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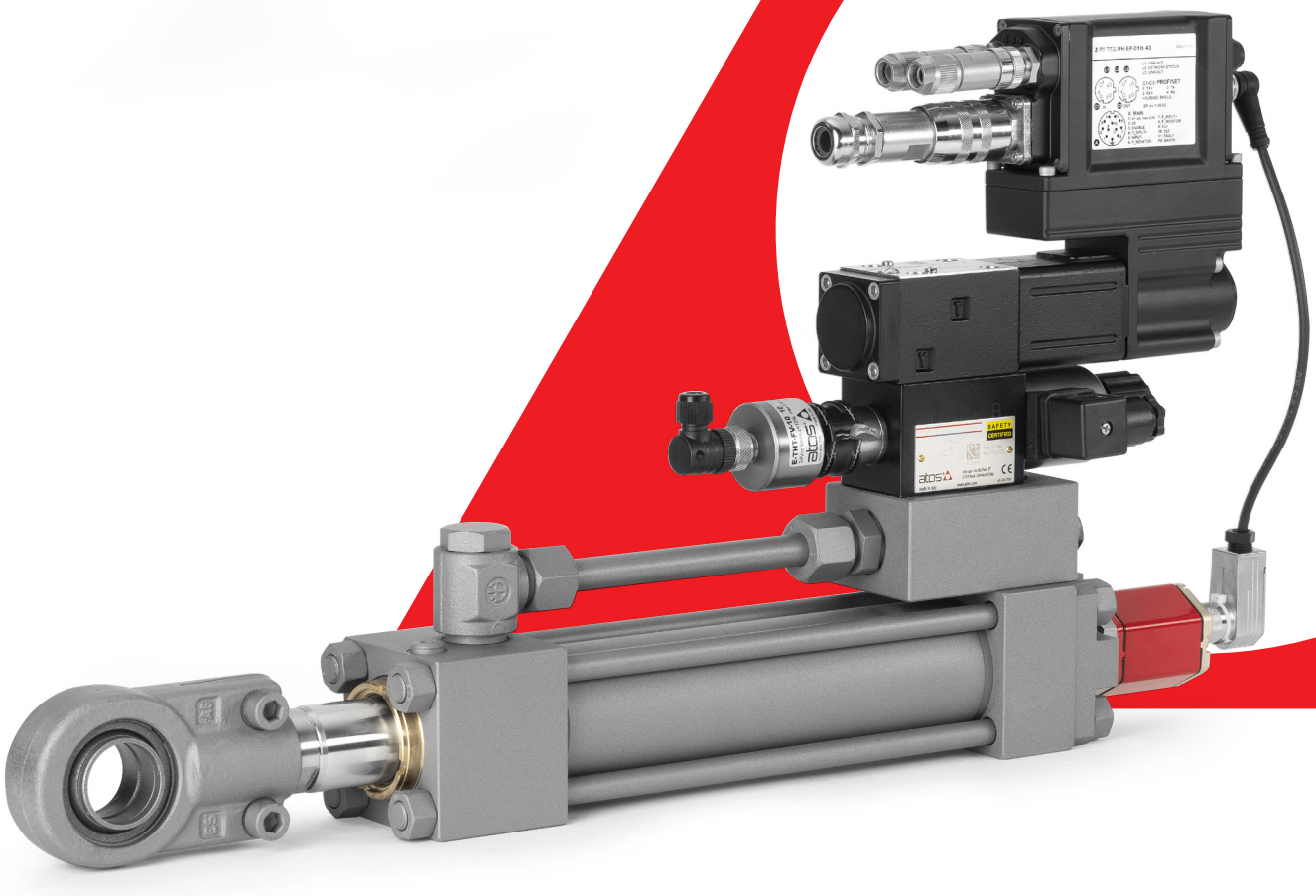
CYLINDERS

CATALOG



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INDEX

CYLINDERS

Supplementary components range available on **www.atos.com**

Sizing criteria for cylinders and servocylinders

1 SWC Cylinders Designer

SWC is a smart software for fast and efficient design of Atos hydraulic Cylinders & Servocylinders, available for download at **www.atos.com** in 4 languages: **English**, **Italian**, **French**, **German**. The codes' assisted selection and the cylinder's sizing module drive the user to identify the best solution for any application. The 3D tool permits then to include the cylinder's model into machines or systems overall mechanical design.

Main SWC features:
- 2D cylinder with overall dimensions in DXF format
- 3D cylinder visualization & file export in IGES, SAT and STEP formats
- Cylinder's sizing module to check the buckling load, the cushioning effects and the cylinder expected working life
- Specific technical documentation and spare parts tables
- Trolley function for offer requests, orders, bill of materials, etc

2 HYDRAULIC FORCES AND DYNAMIC LIMITS

2.1 Hydraulic forces

To ensure the correct cylinder functioning it is necessary to check that the hydraulic force F_p is upper than the algebraic sum of all the counteracting forces acting on the cylinder:

$$F_p \geq m \cdot a + F_f + m \cdot g$$

F_f are the friction forces of the system, m·a the inertial forces and m·g the weight force (only for vertical loads). For gravity acceleration consider g = 9,8 m/s^2.
For F_p values refers to section 3 , otherwise F_p, A_1, A_2 and speed V can be calculated as follow:

Hydraulic force

$$F_p = |p_1 \cdot A_1 - p_2 \cdot A_2| \cdot 10 \quad [N]$$

Pushing area

$$A_1 = \frac{\pi \cdot D^2}{4 \cdot 100} \quad [cm^2]$$

Cylinder speed

$$V = \frac{10 \cdot Q}{A \cdot 60} \quad \left[\frac{m}{sec}\right]$$

Pulling area

$$A_2 = \frac{\pi \cdot (D^2 - d^2)}{4 \cdot 100} \quad [cm^2]$$

2.2 Dynamic limits due to oil elasticity

The calculation of the pulsing value ω_o of the cylinder-mass system allows to define the minimum accleration/deceleration time t_{min}, the max. speed V_{max} and the min. acceleration/deceleration space S_{min} to not affect the functional stability of the system. Calculate ω_o, t_{min}, V_{max} and S_{min} with the below formulas. Flexible piping or long distances between the directional valve and the cylinder may affect the stiffness of the system, thus the calculated values may not be reliable.

$$\omega_0 = \sqrt{\frac{40 \cdot E \cdot A_1}{c \cdot m}} \cdot \frac{1 + \sqrt{\frac{A_2}{A_1}}}{2} \left[\frac{rad}{s}\right] \qquad B137$$

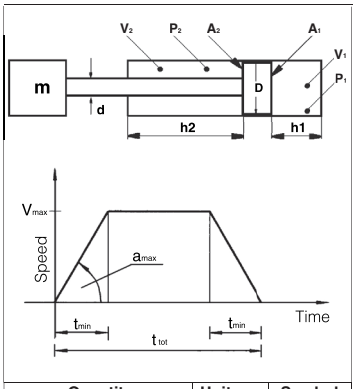
$$t_{min} = \frac{35}{\omega_o} \quad [s]$$

$$V_{max} = \frac{c}{t_{tot} - t_{min}} \quad [mm/s]$$

$$S_{min} = \frac{V_{max} \cdot t_{min}}{2} \quad [mm]$$

Note: for mineral oil consider E = 1,4•10^7 kg/cm·s^2

Symbols



Quantity	Unit	Symbol
Force	N	F_p
Pressure	bar	p
Section	cm^2	A
Bore size	mm	D
Rod diameter	mm	d
Cylinder stroke	mm	c
Flow rate	l/min	Q
Speed	m/s	V
Acceleration	m/s^2	a
Load mass	kg	m
Oil modulus of elasticity	kg/cm·s^2	E
Total time at disposal	s	t_{tot}

3 SIZING

The table below reports the push/pull sections and forces for three different working pressures.

Once the push/pull forces are known, the size of the hydraulic cylinder can be choosen from the table below. The values have been determined using the formulas in section 2.

PULL FORCE [kN]

Bore [mm]		25		32		40			50			63			80			100		
Rod [mm]		12	18	14	22	18	22	28	22	28	36	28	36	45	36	45	56	45	56	70
A_2 Pulling area [cm^2]		3,8	2,4	6,5	4,2	10,0	8,8	6,4	15,8	13,5	9,5	25,0	21,0	15,3	40,1	34,4	25,6	62,6	53,9	40,1
Pull force [kN]	p=100 bar	3,8	2,4	6,5	4,2	10,0	8,8	6,4	15,8	13,5	9,5	25,0	21,0	15,3	40,1	34,4	25,6	62,6	53,9	40,1
	p=160 bar	6,0	3,8	10,4	6,8	16,0	14,0	10,3	25,3	21,6	15,1	40,0	33,6	24,4	64,1	55,0	41,0	100,2	86,3	64,1
	p=250 bar	9,4	5,9	16,3	10,6	25,1	21,9	16	39,6	33,7	23,6	62,5	52,5	38,2	100,2	85,9	64,1	156,6	134,8	100,1

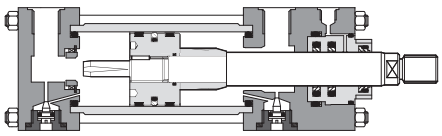
Bore [mm]		125			140	160			180	200			250		320		400	
Rod [mm]		56	70	90	90	70	90	110	110	90	110	140	140	180	180	220	220	280
A_2 Pulling area [cm^2]		98,1	84,2	59,1	90,3	162,6	137,4	106,0	159,4	250,5	219,1	160,2	336,9	236,4	549,8	424,1	876,5	640,9
Pull force [kN]	p=100 bar	98,1	84,2	59,1	90,3	162,6	137,4	106,0	159,4	250,5	219,1	160,2	336,9	236,4	549,8	424,1	876,5	640,9
	p=160 bar	156,9	134,8	94,6	144,5	260,1	219,9	169,6	255,1	400,9	350,6	256,4	539,1	378,2	879,6	678,6	1.402,4	1.025,4
	p=250 bar	245,2	210,6	147,8	225,8	406,4	343,6	265,1	398,6	626,4	547,8	400,6	842,3	591,0	1.374,4	1.060,3	2.191,3	1.602,2

PUSH FORCE [kN]

Bore [mm]		25	32	40	50	63	80	100	125	140	160	180	200	250	320	400
A_1 Pushing area [cm^2]		4,9	8,0	12,6	19,6	31,2	50,3	78,5	122,7	153,9	201,1	254,5	314,2	490,9	804,2	1.256,6
Push force [kN]	p=100 bar	4,9	8,0	12,6	19,6	31,2	50,3	78,5	122,7	153,9	201,1	254,5	314,2	490,9	804,2	1.256,6
	p=160 bar	7,9	12,9	20,1	31,4	49,9	80,4	125,7	196,3	246,3	321,7	407,2	502,7	785,4	1.286,8	2.010,6
	p=250 bar	12,3	20,1	31,4	49,1	77,9	125,7	196,3	306,8	384,8	502,7	636,2	785,4	1.227,2	2.010,6	3.141,6

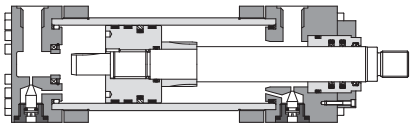
4 CHOICE OF THE CYLINDER SERIES

SERIES CK/CH - tab. B137 - B140 to ISO 6020-2



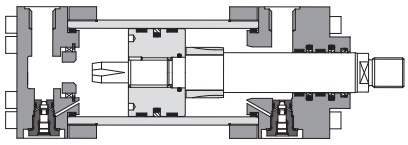
- Nominal pressure **16** MPa (160 bar) - max. **25** MPa (250 bar)
- Bore sizes from **25** to **200** mm
- Rod diameters from **12** to **140** mm

SERIES CH BIG BORE SIZE - tab. B160 to ISO 6020-3



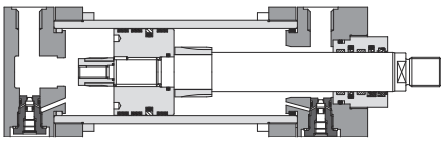
- Nominal pressure **16** MPa (160 bar) - max. **25** MPa (250 bar)
- Bore sizes from **250** to **400** mm
- Rod diameters from **140** to **220** mm

SERIES CN - tab. B180 to ISO 6020-1



- Nominal pressure **16** MPa (160 bar) - max. **25** MPa (250 bar)
- Bore sizes from **50** to **200** mm
- Rod diameters from **28** to **140** mm

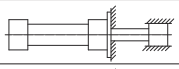
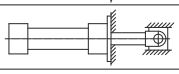
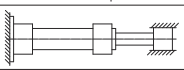
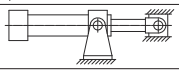
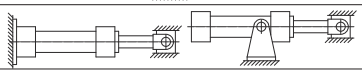
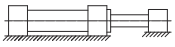
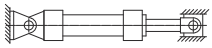
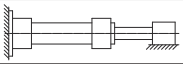
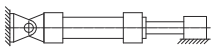
SERIES CC - tab. B241 to ISO 6022



- Nominal pressure **25** MPa (250 bar) - max. **32** MPa (320 bar)
- Bore sizes from **50** to **320** mm
- Rod diameters from **36** to **220** mm

5 CHECK OF THE BUCKLING LOAD

5.1 Calculation of the ideal lenght

Style	Rod end connection	Type of mounting	Fc
A, E, K, N, T, W, Y, Z	Fixed and rigidly guided		0,5
A, E, K, N, T, W, Y, Z	Pivoted and rigidly guided		0,7
B, P, V	Fixed and rigidly guided		1,0
G	Pivoted and rigidly guided		1,0
B, P, V, L	Pivoted and rigidly guided		1,5
A, E, K, N, T, W, Y, Z	Supported but not rigidly guided		2,0
C, D, H, S	Pivoted and rigidly guided		2,0
B, P, V	Supported but not rigidly guided		4,0
C, D, H, S	Supported but not rigidly guided		4,0

For cylinders working with push loads, the buckling load's checking has to be considered before choosing the rod size. This check is performed considering the fully extended cylinder as a bar having the same diameter of the cylinder rod (safety criteria):

1. determine the stroke factor "Fc" depending to the mounting style and to the rod end connection, see table at side

2. calculate the "ideal lenght" from the equation:

ideal length = Fc x stroke [mm]

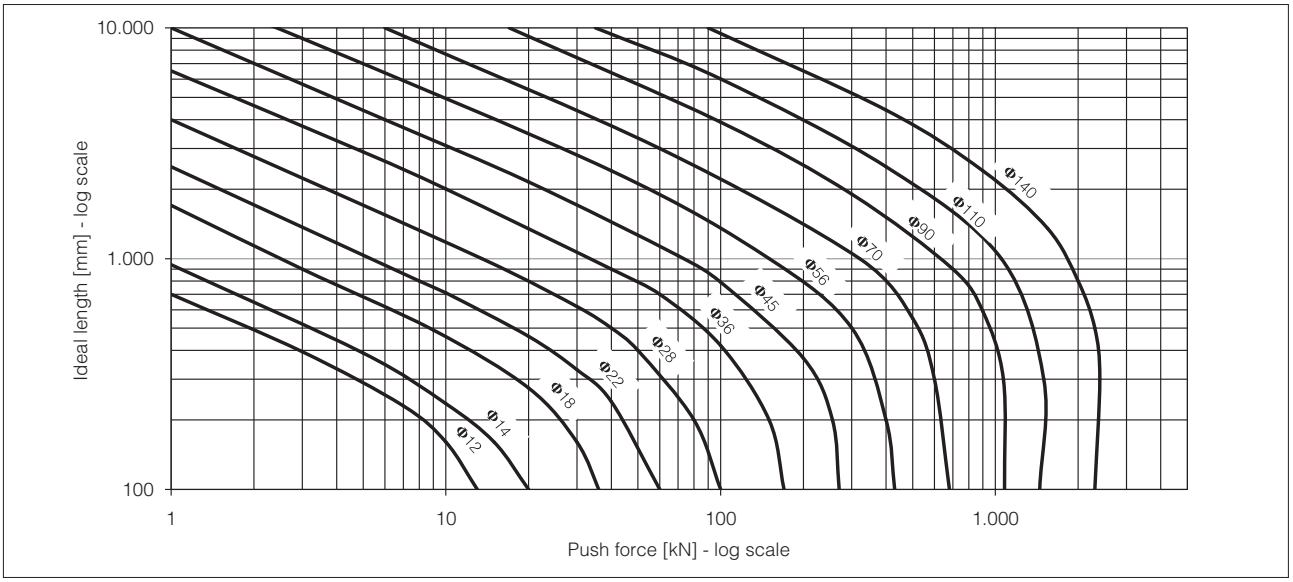
If a spacer has been selected, the spacer's length must be added to the stroke

3. calculate the F_p push force as indicated in section 3 or using the formulae indicated in section 2

4. obtain the point of intersection between the push force and the ideal length using the rod selection chart 5.2

5. obtain the minimum rod diameter from the curved line above the point of intersection

5.2 Rod selection chart



6 PREDICTION OF THE EXPECTED CYLINDER'S MECHANICAL WORKING LIFE

The rod thread is the cylinder's max critical part, thus the expected cylinder's working life can be evaluated by the prediction of the expected rod thread fatigue life. The fatigue rod fractures take place suddenly and without any warning, thus it is always recommended to check if the rod is subject to fatigue stress (not necessary if the cylinder works with push loads) and thus if the expected rod threads fatigue life may become an issue in relation to the required cylinder working life. The charts below do not include the rods which are fatigue-free for working pressures over 250 bar. The curves are referred to ideal working conditions and do not take into account misalignments and transversal loads that could decrease the predicted life cycles. The charts are intended valids for all the cylinders and servocylinders series with standard materials and sizes (section 6.2) or option **K** "Nickel and chrome plating" rods (section 6.3). For the evaluation of the expected fatigue life of stainless steel rods (CNX series), contact our technical office. For double rod executions the mechanical working life calculation does not apply to secondary rods since the thread is weaker than the primary rods.

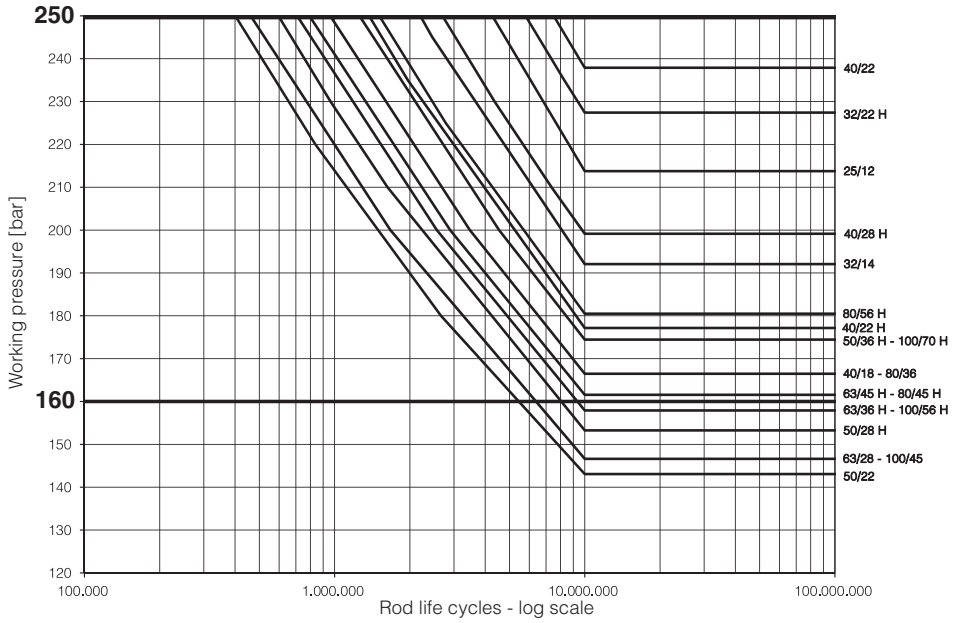
6.1 Mechanical working life calculation procedure

1. Identify the curve of proper rods fatigue life graph according to the selected bore/rod size and rod treatment. Fatigue-free bore/rod couplings are not included in the graphs.

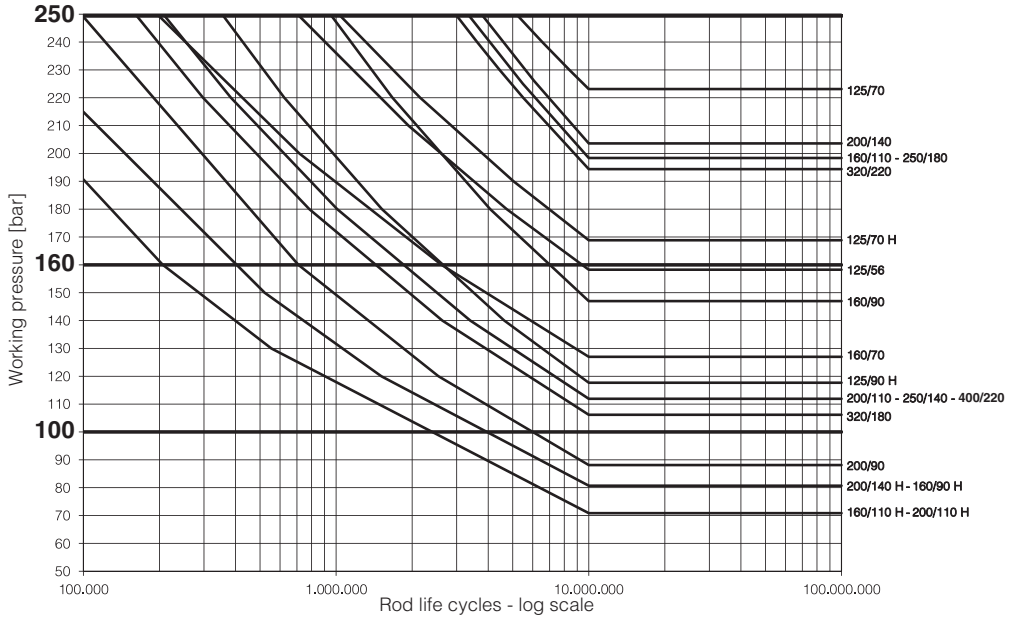
2. Intersect the working pressure with the curve corresponding to the rod under investigation and determine the expected rod life cycles. If the calculated rod fatigue life is lower than 500.000 cycles a careful analysis of our technical office is suggested.

6.2 Rods fatigue life charts for standard rod

Rods fatigue life for bore sizes from 25 to 100 mm



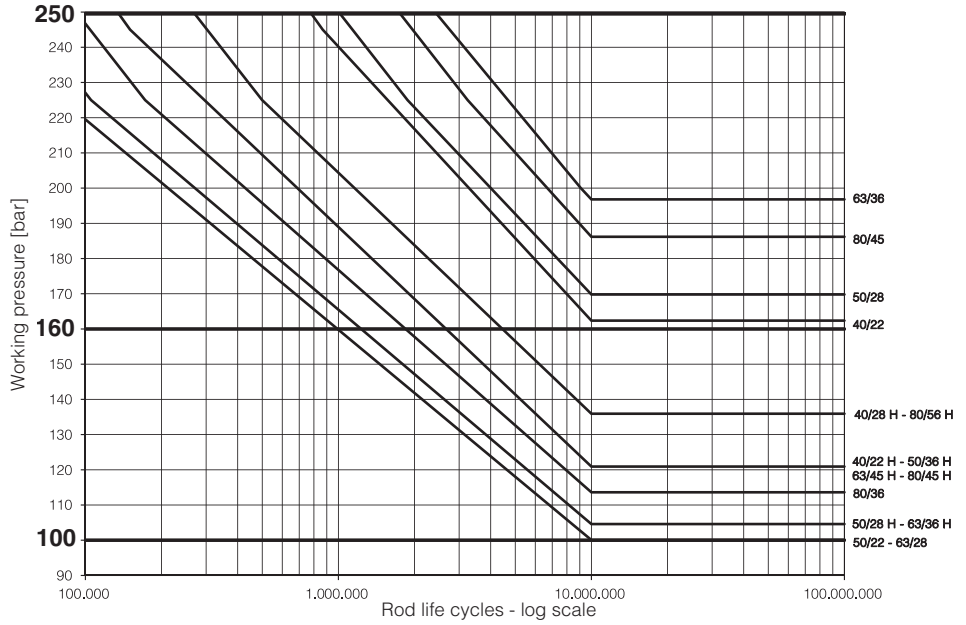
Rods fatigue life for bore sizes from 125 to 400 mm



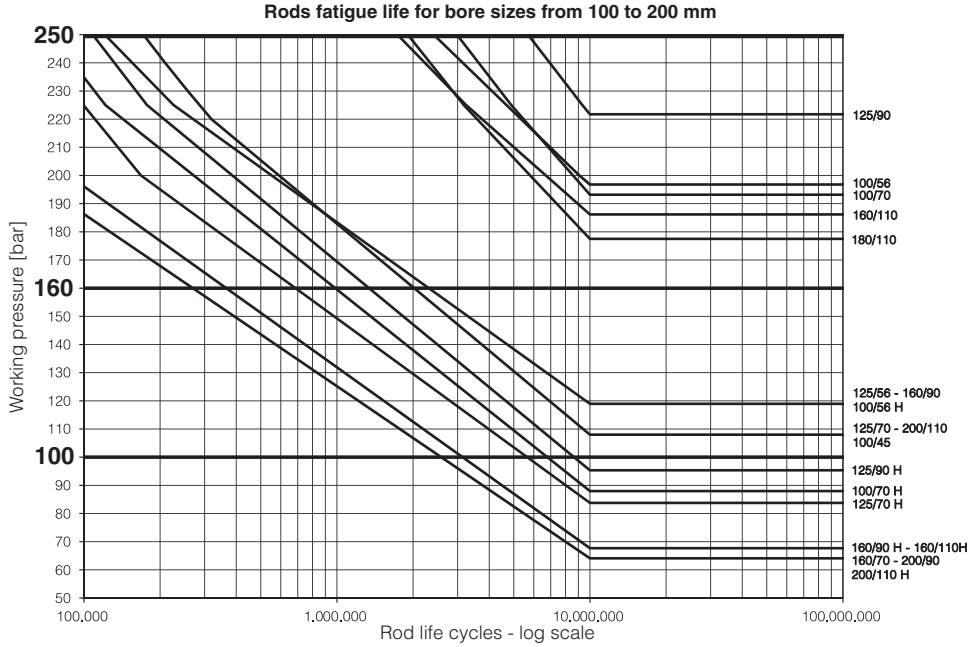
Note: the curves are labelled according to the bore/rod size. The light male thread (option **H)** is indicated by the "H" after the rod
Example: label **125/90 H** means bore = 125 mm, rod = 90 mm and rod with option **H**

6.3 Rods fatigue life charts for Nickel and Chrome plating rod (option K)

Rods fatigue life for bore sizes from 25 to 80 mm



Rods fatigue life for bore sizes from 100 to 200 mm



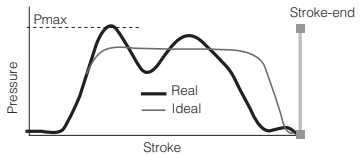
Note: the curves are labelled according to the bore/rod size. The light male thread (option **H)** is indicated by the "H" after the rod
Example: label **125/90 H** means bore = 125 mm, rod = 90 mm and rod with option **H**

7 CHECK OF THE HYDRAULIC CUSHIONING

7.1 Functioning features

Hydraulic cushioning act as "dumpers" to dissipate the energy of a mass connected to the rod and directed towards the cylinder stroke-ends, reducing its velocity before the mechanical contact, thus avoiding mechanical shocks that could reduce the average life of the cylinder and of the entire system.
Cushioning proves to be effective as much as the pressure inside the cushioning chamber gets close to the ideal profile described in the diagram at side. The diagram compares the ideal profile with typical cylinders real pressure profile.

Pressure in the cushioning chamber

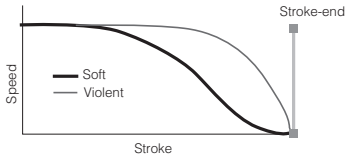


7.2 Application features

The following guidelines refer to CK, CH, CN and CC cylinders: for CH big bore sizes, contact our technical office. In order to optimize the performances of cushioning in different applications, three different cushioning versions have been developed:

- slow version, with cushioning adjustment, for speed $V \leq 0,5 \cdot Vmax$
- fast version, without adjustment, for speed $V > 0,5 \cdot Vmax$
- fast version, with cushioning adjustment, for speed $V > 0,5 \cdot Vmax$

Speed during cushioning



Adjustable cushioning are provided with needle valve to optimize the cushioning performances. The maximum permitted speed value Vmax depends to the cylinder size, see table below.

ø Bore [mm]	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
Vmax [m/s]	1	1	1	1	0,8	0,8	0,6	0,6	0,5	0,5

7.3 Max energy calculation procedure

Check the max energy that can be absorbed by the selected cushioning as follow:

1. calculate the energy to be dissipated **E** by the algrebraic sum of the kinetic energy E_c and the potential energy E_p (for horizontal applications the potential energy is: $E_p = 0$)

$$E = E_c + E_p$$

- E_c (kinetic energy) due to the mass speed

$$E_c = 1/2 \cdot M \cdot V^2 \quad \text{[Joule]}$$

- E_p (potential energy) due to the gravity and related to the cylinder inclination angle α as shown at side

For front cushioning:

$$E_p = -Lf \cdot \frac{M \cdot g \cdot \text{sen}\,\alpha}{1000} \quad \text{[Joule]}$$

For rear cushioning:

$$E_p = +Lf \cdot \frac{M \cdot g \cdot \text{sen}\,\alpha}{1000} \quad \text{[Joule]}$$

2. identify the proper cushioning chart depending to the rod type, the cushioning side (front or rear), and the cylinder series (section 7.4 for CK, CH, CN cylinders or section 7.5 for CC cylinders)

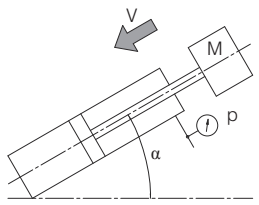
3. intersect the working pressure with the proper bore/rod size curve and extract the corresponding E_{max} value

4. compare the E_{max} value with the energy to be dissipated **E** and verify that:

$$E \leq E_{max}$$

5. for critical applications with high speed and short cushioning strokes an accurate cushioning evaluation is warmly suggested, contact our technical office

Symbols

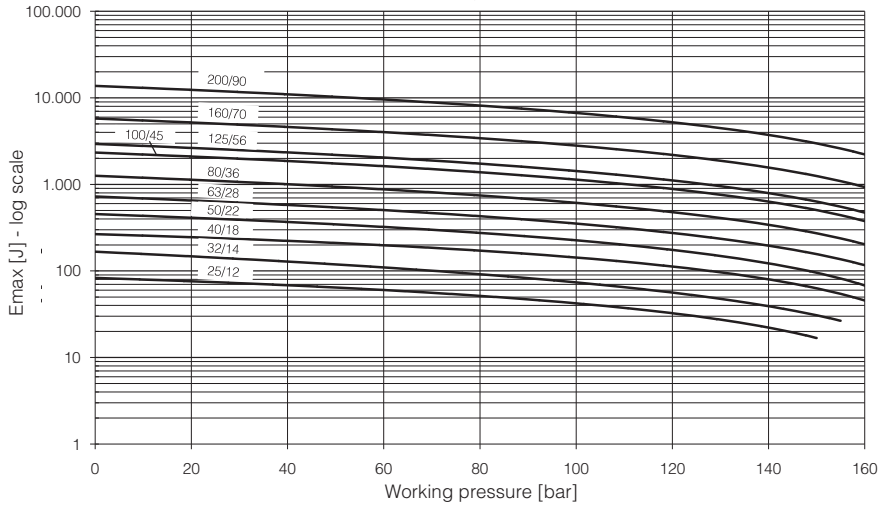


E = energy to be dissipated	[J]
E_{max} = energy max dissipable	[J]
M = mass	[kg]
V = rod speed	[m/s]
Lf = cushioning length (see section 12 of tables B137, B140)	[mm]
g = acceleration of gravity consider g=9,81 m/s²	[m/s²]
α = inclination angle	[°]

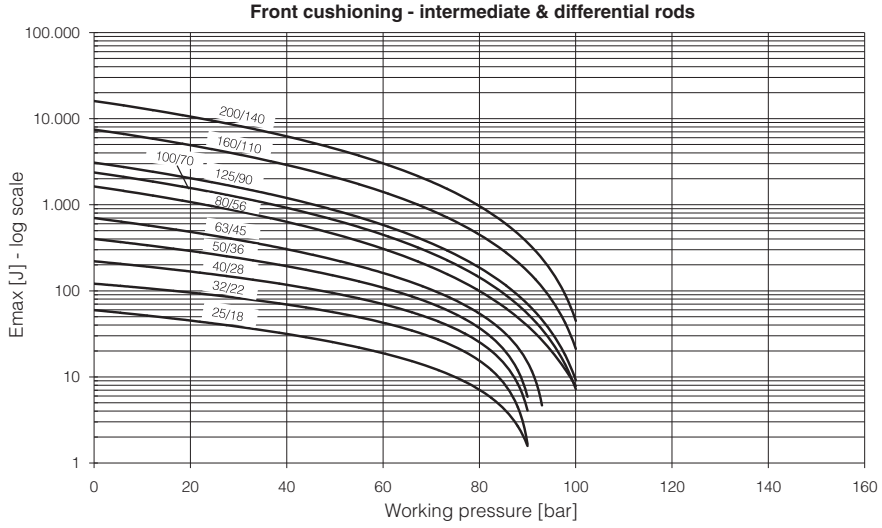
7.4 Cushioning charts for CK - CH - CN cylinders

Notes:
- the front cushioning graphs are labelled according to the bore/rod size, the rear cushioning graph is labelled according to the bore size
- the curves are intended valid for mineral oil ISO 46 and a fluid temperature of 40-50 °C: the use of water or water-based fluids and higher/lower temperatures can affect the cushioning performance because of high viscosity variations respect to standard mineral oil
- for adjustable versions the E_{max} value is referred to cushioning cartridge fully closed, the max energy to be dissipated may be increased opening the cushioning cartridge, thus reducing the max pressure reached in the cushioning chamber
- the cushioning charts have been determined with 250 bar maximum pressure admitted in the cushioning chamber

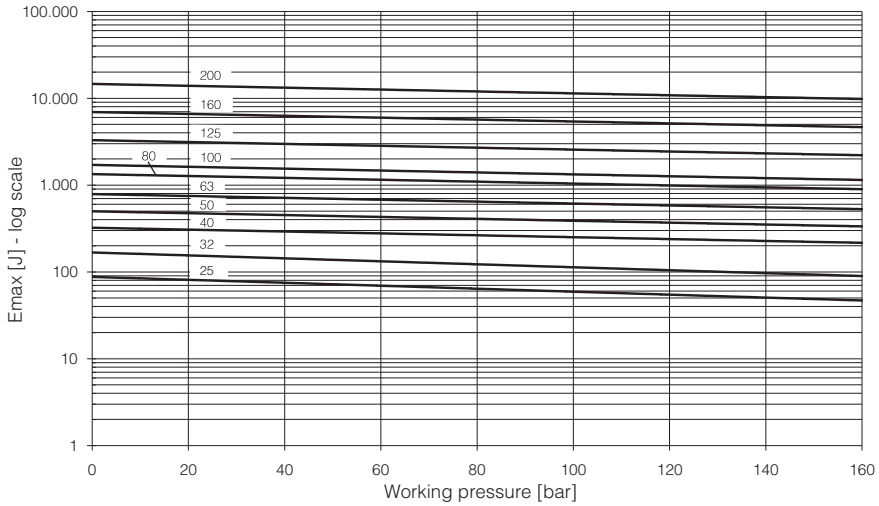
Front cushioning - standard rods



Front cushioning - intermediate & differential rods



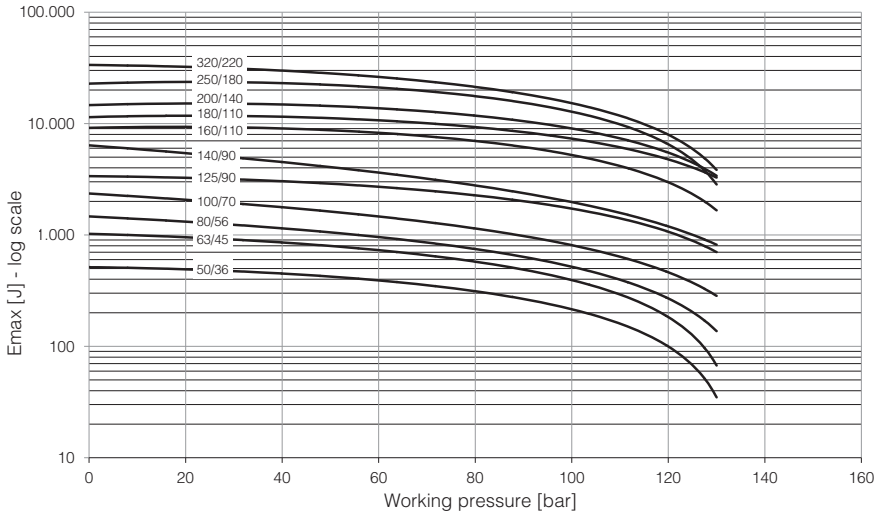
Rear cushioning



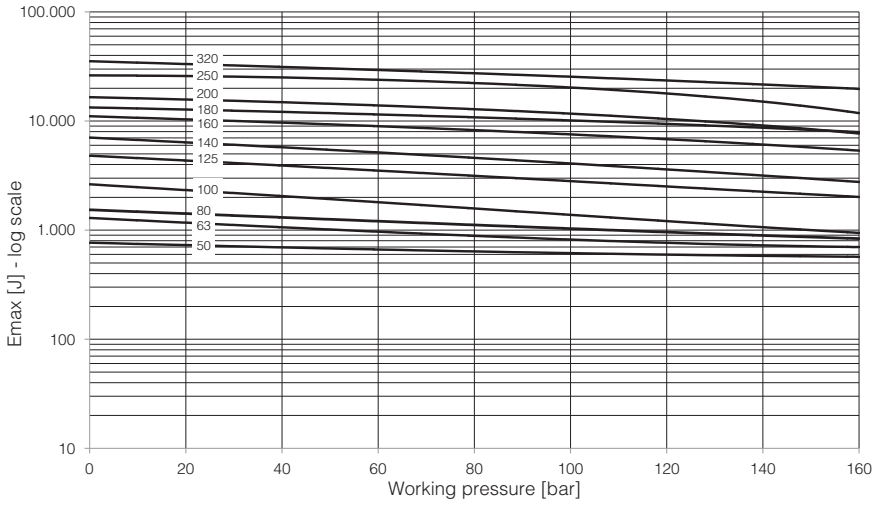
7.5 Cushioning charts for CC cylinders

Notes:
- the front cushioning graphs are labelled according to the bore/rod size, the rear cushioning graph is labelled according to the bore size
- the curves are intended valid for mineral oil ISO 46 and a fluid temperature of 40-50 °C: the use of water or water-based fluids and higher/lower temperatures can affect the cushioning performance because of high viscosity variations respect to standard mineral oil
- for adjustable versions the E_{max} value is referred to cushioning cartridge fully closed, the max energy to be dissipated may be increased opening the cushioning cartridge, thus reducing the max pressure reached in the cushioning chamber
- the cushioning charts have been determined with 320 bar maximum pressure admitted in the cushioning chamber

Front cushioning



Rear cushioning



8 SEALING FRICTION AND IN / OUT SPEED RATIO

Basic sealing performances reported in the cylinders technical tables are not sufficient for a comprehensive evaluation of the sealing system, the following sections report additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction.

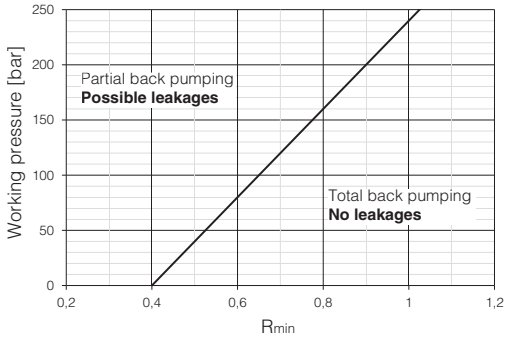
8.1 In / out speed ratio

Applications with low in/out rod speed ratio may involve leakages caused by partial "back pumping" of the oil trapped between the rod seals, thus it is recommended to check the correct back pumping with the diagram reported below.

1. Determine the in/out speed ratio **R** of the cylinder

$$R = \frac{V_{in}}{V_{out}} = \frac{Q_2 \cdot A_1}{A_2 \cdot Q_1}$$

2. Intersect the working pressure with the curve below and extract the corresponding R_{min} value admitted



3. Verify that

R ≥ Rmin

If the equation above is not verified contact our technical office

8.2 Static and dynamic sealing friction

Sealing systems may affect the smooth rod motion, thus the assessment of the sealing friction forces is recommended in several applications like :

- Servoactuators with closed loop control
- Servocylinders where high accuracy in rod positioning is required
- Cylinders with low speeds (<0,05 m/s)
- Low pressure hydraulic systems (<10 bar) where sealing friction forces may have significant influence

The following sections allow to calculate both static and dynamic sealing friction according to the sealing system selected for CK, CH and CK* servocylinders.

8.3 Sealing friction calculation procedure

Calculate the **dynamic** sealing friction as follow:

1. Intersect the speed with the proper curve depending to the sealing system from the chart in section 8.4.

2. Extract the corresponding **C** value

3. Identify the proper diagram according to the sealing system (section 8.5)

4. Intersect the working pressure with the curve depending to the Bore size.

5. Extract the corresponding **A** value

6. F_{sf} = **A** · (D + d) + **C** [N]
considering D= Bore size [mm]; d= Rod size [mm]

Calculate the **static** sealing friction as follow:

1. Extract the **C** value corresponding to speed **V = 0 m/s** in the chart in section 8.4

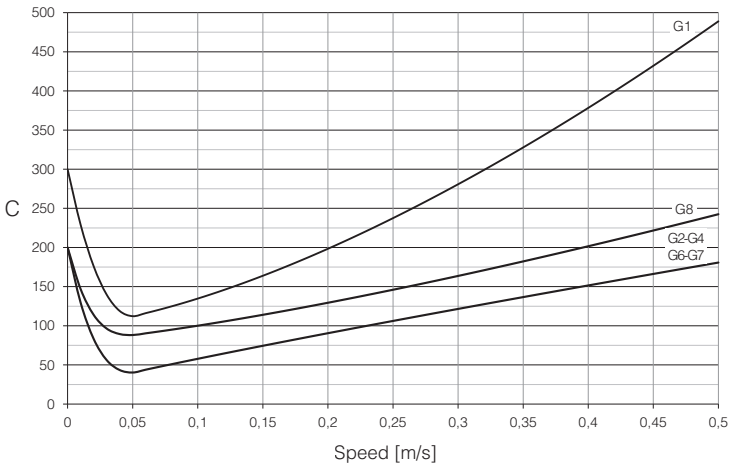
2. Identify the proper diagram according to the sealing system (section 8.5)

3. Intersect the working pressure with the curve depending to the Bore size.

4. Extract the corresponding **A** value

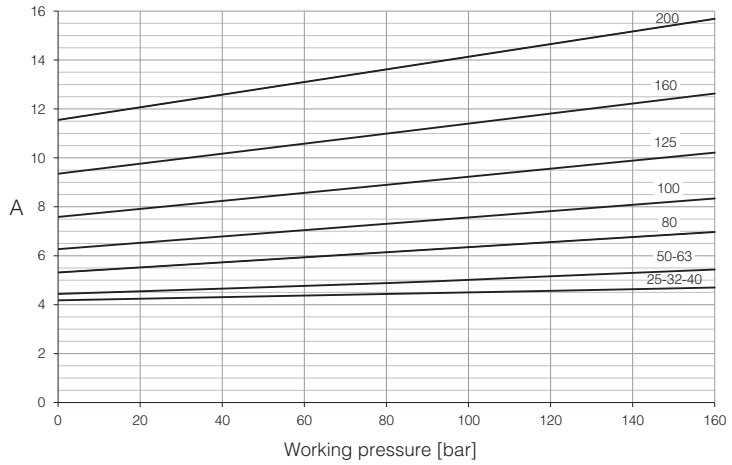
5. F_{sf} = **A** · (D + d) + **C** [N]
considering D= Bore size [mm]; d= Rod size [mm]

8.4 Friction charts - C parameter vs speed

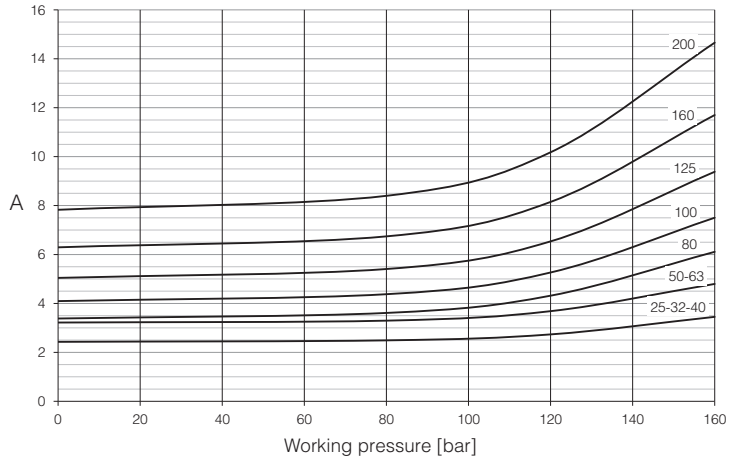


8.5 Friction charts - A parameter vs pressure

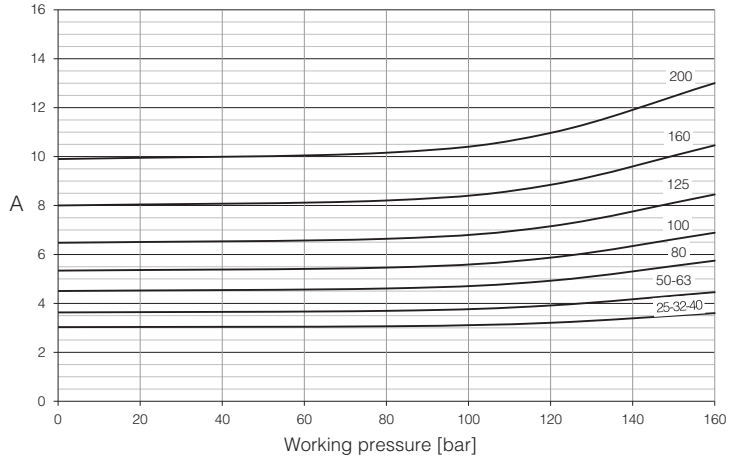
SEALING G1



SEALING G2 - G4 - G6 - G7

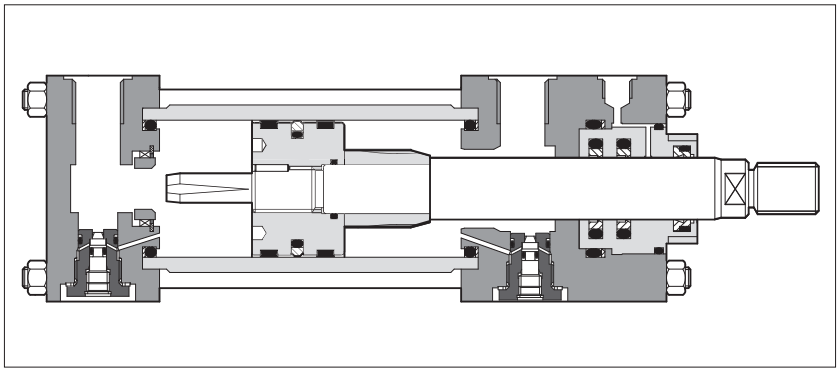


SEALING G8



Hydraulic cylinders type CK - square heads with tie rods

to ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CK cylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.

- Bore sizes from **25** to **200** mm
- Up to **3** rod diameters per bore
- Strokes up to **5000** mm
- Single or double rod
- Rods and tie rods with **rolled threads**
- **15** standard mounting styles
- **6** seals options
- Adjustable or fixed cushioning
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's choice and sizing criteria **see tab. B015**

SWC Cylinders Designer

Software for assisted selection of Atos cylinders & servocylinders codes, including cylinder's sizing, full technical information, 2D & 3D drawings in several CAD formats.

Available for download at www.atos.com

1 MODEL CODE

CK	P	/	10	-	50	/	22	/	22	*	0500	-	S	3	0	1	-	A	-	B1E3X1Z3	**

Cylinder series
CK to ISO 6020 - 2

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Dimensions and performances see tab. B310

Incorporated subplate, see section 15
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size, see section 3
from **25** to **200** mm

Rod diameter, see sections 6 and 9
from **12** to **140** mm

Second rod diameter for double rod, see section 10
from **12** to **140** mm, omit for single rod

Stroke, see section 4
up to **5000** mm
Quick deliveries available for selected strokes

Mounting style, see sections 2 and 3

		REF. ISO
C	= fixed clevis	MP1 **(3)**
D	= fixed eye	MP3 **(3)**
E	= feet	MS2
G	= front trunnion	MT1
H	= rear trunnion	MT2 **(3)**
L	= intermediate trunnion	MT4 **(4)**
N	= front flange	ME5
P	= rear flange	ME6 **(3)**
S	= fixed eye + spherical bearing	MP5 **(3)**
T	= threaded hole+tie rods extended	MX7
V	= rear tie rods extended	MX2
W	= both end tie rods extended	MX1
X	= basic execution	-
Y	= front tie rods extended	MX3
Z	= front threaded holes	MX5

Heads' configuration (2), see section 13
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
* = selected position (1, 2, 3 or 4)

Options (2):
Rod end, see section 6
F = female thread
G = light female thread
H = light male thread
Oversized oil ports, see section 11
D = front oversized oil port
Y = rear oversized oil port
Proximity sensors, see section 18
R = front sensor
S = rear sensor
Rod treatment, see section 9
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds, see section 16
A = front air bleed
W = rear air bleed
Draining, see section 17
L = rod side draining

Sealing system, see section 14
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
6 = (NBR + PTFE) very low friction, single acting - pushing
7 = (NBR + PTFE) very low friction, single acting - pulling
8 = (NBR + PTFE and POLYURETHANE) low friction

Spacer, see section 5
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

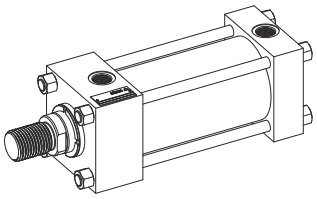
Cushioning, see section 12
0 = none

Fast adjustable	Slow adjustable	Fast fixed
1 = rear only	**4** = rear only	**7** = rear only
2 = front only	**5** = front only	**8** = front only
3 = front and rear	**6** = front and rear	**9** = front and rear

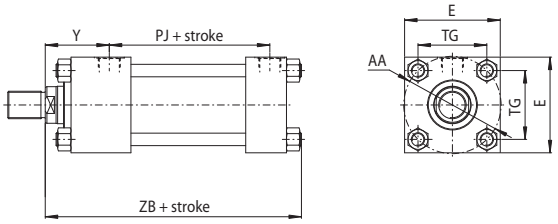
Series number (1)

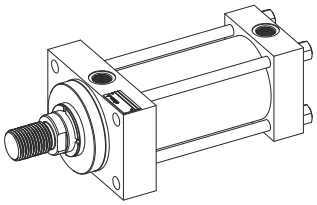
(1) For spare parts request indicate the series number printed on the nameplate only for series < 30
(2) To be entered in alphabetical order **(3)** Not available for double rod **(4)** XV dimension must be indicated in the model code, see section 3

2 MOUNTING STYLE - for dimensions see section 3

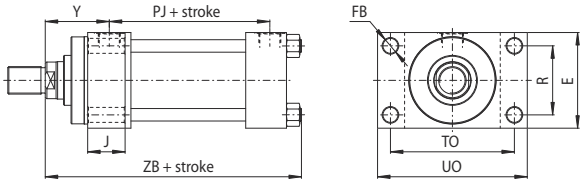


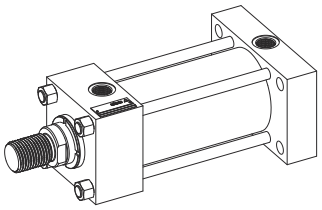
X = basic mounting



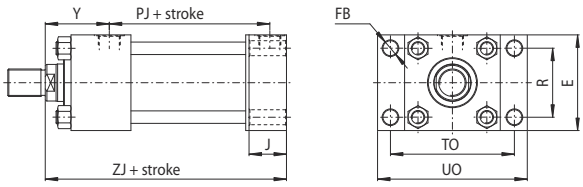


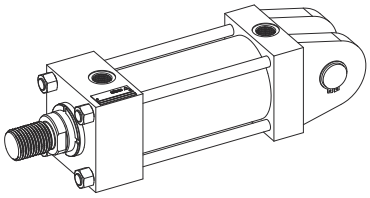
N (ISO ME5) = front flange mounting



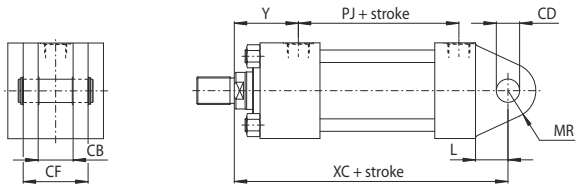


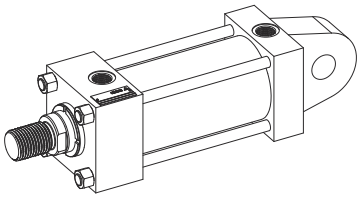
P (ISO ME6) = rear flange mounting



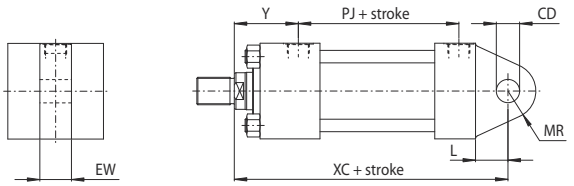


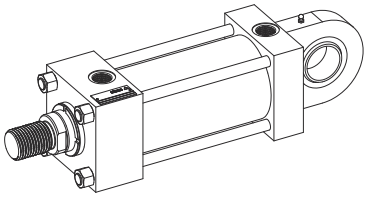
C (ISO MP1) = fixed clevis mounting - supplied with pivot pin C-145



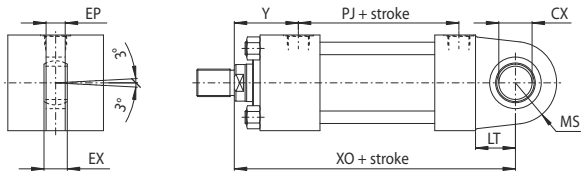


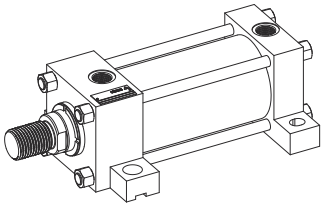
D (ISO MP3) = fixed eye mounting



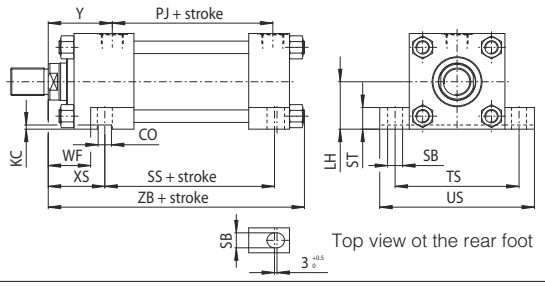


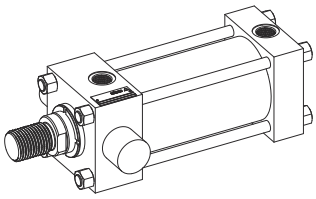
S (ISO MP5) = fixed eye with spherical bearing mounting

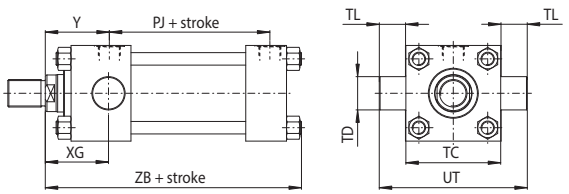




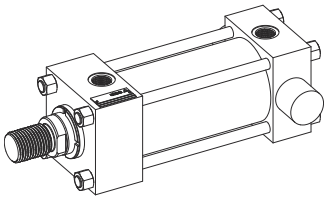
E (ISO MS2) = side feet mounting

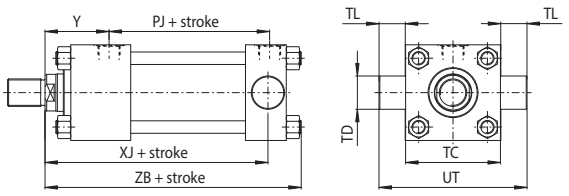




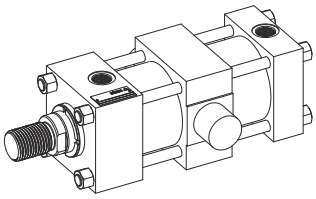


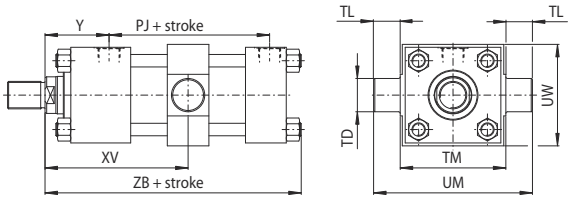
G (ISO MT1) = front trunnion mounting



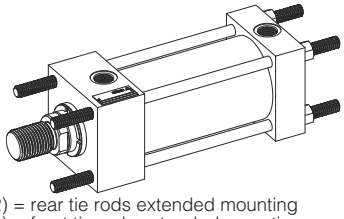


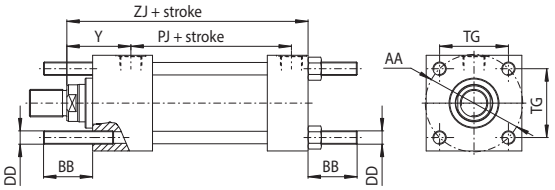
H (ISO MT2) = rear trunnion mounting



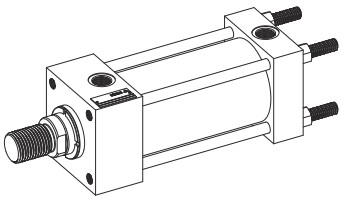


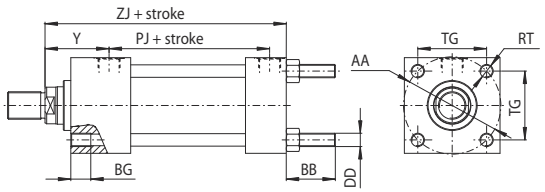
L (ISO MT4) = intermediate trunnion mounting



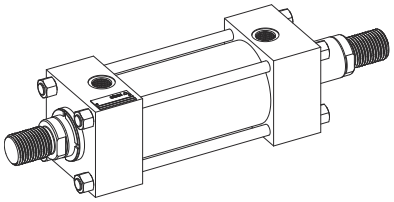


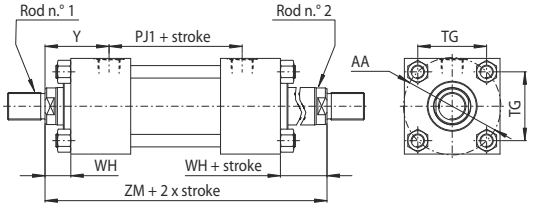
V (ISO MX2) = rear tie rods extended mounting
Y (ISO MX3) = front tie rods extended mounting
W (ISO MX1) = both end tie rods extended mounting (*)
(*) see figure



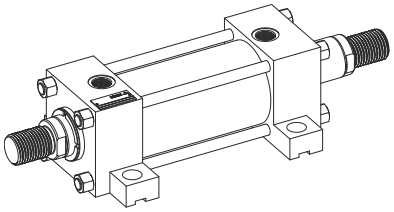


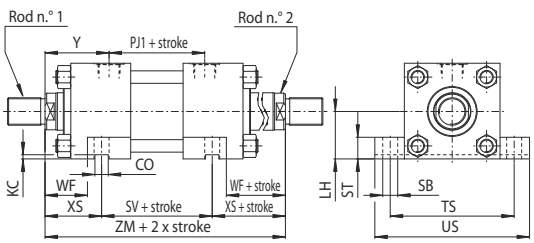
Z (ISO MX5) = front threaded holes mounting
T (ISO MX7) = threaded holes with tie rods extended mounting (*)
(*) see figure





X = basic mounting for double rod





E = feet mounting for double rod

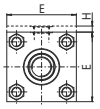
3 INSTALLATION DIMENSIONS [mm] - see figures in section 2

Ø Bore		25	32	40	50	63	80	100	125	160	200
Ø Rod	standard	12	14	18	22	28	36	45	56	70	90
	intermediate	NA	NA	22	28	36	45	56	70	90	110
	differential	18	22	28	36	45	56	70	90	110	140
AA		40	47	59	74	91	117	137	178	219	269
BB +3 / 0		19	24	35	46	46	59	59	81	92	115
BG min		8	9	12	18	18	24	24	27	32	40
CB A13		12	16	20	30	30	40	50	60	70	80
CD H9		10	12	14	20	20	28	36	45	56	70
CF max		25	34	42	62	62	83	103	123	143	163
CO N9		NA	NA	12	12	16	16	16	20	30	40
CX	value	12	16	20	25	30	40	50	60	80	100
	tolerance	0 -0,008		0 -0,012					0 -0,015		0 -0,02
DD 6g		M5x0,8	M6x1	M8x1	M12x1,25	M12x1,25	M16x1,5	M16x1,5	M22x1,5	M27x2	M30x2
E (1)		40±1,5	45±1,5	63±1,5	75±1,5	90±1,5	115±1,5	130±2	165±2	205±2	245±2
EP max		8	11	13	17	19	23	30	38	47	57
EW h14		12	16	20	30	30	40	50	60	70	80
EX		10 0/-0,12	14 0/-0,12	16 0/-0,12	20 0/-0,12	22 0/-0,12	28 0/-0,12	35 0/-0,12	44 0/-0,15	55 0/-0,15	70 0/-0,2
FB H13		5,5	6,6	11	14	14	18	18	22	26	33
H (2) max		5	5	NA	NA	NA	NA	NA	NA	NA	NA
J ref		25	25	38	38	38	45	45	58	58	76
L min		13	19	19	32	32	39	54	57	63	82
LH h10		19	22	31	37	44	57	63	82	101	122
LT min		16	20	25	31	38	48	58	72	92	116
KC min		NA	NA	4	4,5	4,5	5	6	6	8	8
M (3)		1000	1200	1500	1800	2300	3000	3500	3500	3500	3500
MR max		12	17	17	29	29	34	50	53	59	78
MS max		20	22,5	29	33	40	50	62	80	100	120
PJ (4) ±1,5 (6)		53	56	73	74	80	93	101	117	130	165
PJ1 ±1,5 (6)		54	58	71	73	81	92	101	117	130	160
PJ2 (4) ±1,5 (6)		53	57	73	76	80	93	99	121	143	167
R js13		27	33	41	52	65	83	97	126	155	190
RT		M5x0,8	M6x1	M8x1,25	M12x1,75	M12x1,75	M16x2	M16x2	M22x2,5	M27x3	M30x3,5
SB H13		6,6	9	11	14	18	18	26	26	33	39
SS ±1,25 (6)		72	72	97	91	85	104	101	130	129	171
ST js13		8,5	12,5	12,5	19	26	26	32	32	38	44
SV ±1,25 (6)		88	88	105	99	93	110	107	131	130	172
TC h14		38	44	63	76	89	114	127	165	203	241
TD f8		12	16	20	25	32	40	50	63	80	100
TG js13		28,3	33,2	41,7	52,3	64,3	82,7	96,9	125,9	154,9	190,2
TL js13		10	12	16	20	25	32	40	50	63	80
TM h14		48	55	76	89	100	127	140	178	215	279
TO js13		51	58	87	105	117	149	162	208	253	300
TS js13		54	63	83	102	124	149	172	210	260	311
UM ref		68	79	108	129	150	191	220	278	341	439
UO max		65	70	110	130	145	180	200	250	300	360
US max		72	84	103	127	161	186	216	254	318	381
UT ref		58	68	95	116	139	178	207	265	329	401
UW max		45	50	70	88	98	127	141	168	205	269
XC ±1,5 (6)		127	147	172	191	200	229	257	289	308	381
XG ±2 (6)		44	54	57	64	70	76	71	75	75	85
XJ ±1,5 (6)		101	115	134	140	149	168	187	209	230	276
XO ±1,5 (6)		130	148	178	190	206	238	261	304	337	415
XS ±2 (6)		33	45	45	54	65	68	79	79	86	92
XV (5) ±2 (6)	style L minimum stroke	5	5	5	15	20	20	35	35	35	35
	min	77	90	100	109	120	129	148	155	161	195
	max	75+stroke	86+stroke	99+stroke	98+stroke	100+stroke	115+stroke	117+stroke	134+stroke	141+stroke	166+stroke
Y (4) ±2 (6)		50	60	62	67	71	77	82	86	86	98
Y1 (4) ±2 (6)		49,5	59,5	63	65,5	70	75,5	83	84	79,5	97
ZB max		121	137	166	176	185	212	225	260	279	336
ZJ ±1 (6)		114	128	153	159	168	190	203	232	245	299
ZM ±2 (6)		154	178	195	207	223	246	265	289	302	356

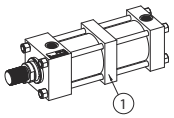
NOTES TO TABLE 3

(1) **E** - If not otherwise specified in the figures in section 2, this value is the front and rear square heads dimension for all the mounting styles (see figure below)

(2) **H** - This additional dimension has to be considered only for bores 25 and 32



(3) **M** - For strokes longer than M, one or more intermediate tie rods supports ① are fitted on the cylinder housing to maintain the radial tension on the tie rods, thus keeping them rigidly fixed to the cylinder housing. The support has the same overall dimensions of the square heads as indicated in note (1)



(4) When oversized oil ports are selected (see section 11 and 13 for dimensions and position) dimensions **PJ** and **Y** are respectively modified into **PJ2** and **Y1**

(5) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.
The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CK - 50 / 22 * 0500 - L301 - D - B1E3X1Z3
XV = 200

(6) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is given by the max stroke tolerance in section 4

4 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end.

Standard strokes to ISO 4393

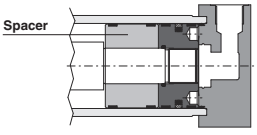
25	50	80	100	125	160	200	250
320	400	500	630	800	1000	1250	

Maximum stroke:
- 2600 mm for bores up to 40 mm
- 5000 mm for other bores

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

5 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 3.



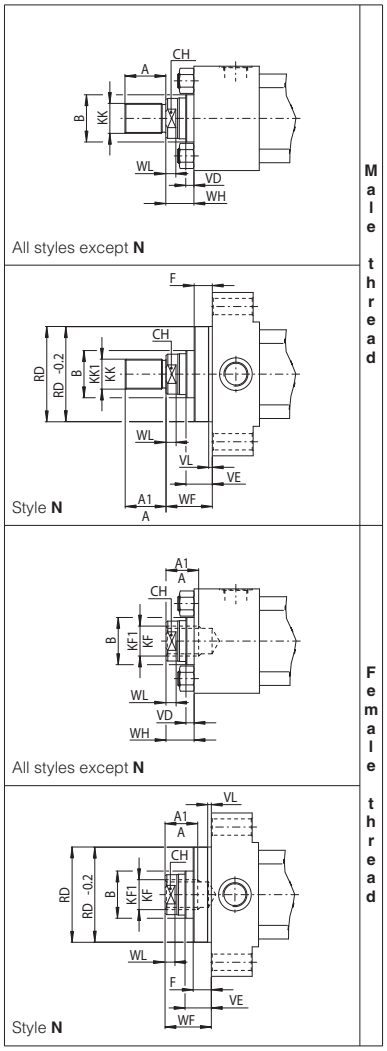
RECOMMENDED SPACERS [mm]

Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

6 ROD END DIMENSIONS [mm]

Ø Bore	Ø Rod	Male thread		Female thread		A (KK or KF) (1)	A1 (KK1 or KF1) (1)	B	CH	F	RD	VD	VE	VL	WF	WH	WL
		KK	KK1 (option **H**)	KF (option **F**)	KF1 (option **G**)												
		6g	6g	6H	6H			f9	h14	max	f8		max	min	±2	±2	min
25	**12**	M10x1,25	NA	M8x1	NA	14	NA	24	10	10	38	6	16	3	25	15	5
	18	M14x1,5	M10x1,25	M12x1,25	M8x1	18	14	30	15	10	38	6	16	3	25	15	5
32	**14**	M12x1,25	NA	M10x1,25	NA	16	NA	26	12	10	42	12	22	3	35	25	5
	22	M16x1,5	M12x1,25	M16x1,5	M10x1,25	22	16	34	19	10	42	9	19	3	35	25	5
40	**18**	M14x1,5	NA	M12x1,25	NA	18	NA	30	15	10	62	6	16	3	35	25	5
	22	M16x1,5	M14x1,5	M16x1,5	NA	22	18	34	19	10	62	12	22	3	35	25	5
	28	M20x1,5	M14x1,5	M20x1,5	M12x1,25	28	18	42	22	10	62	12	22	3	35	25	7
50	**22**	M16x1,5	NA	M16x1,5	NA	22	NA	34	19	16	74	9	25	4	41	25	5
	28	M20x1,5	M16x1,5	M20x1,5	NA	28	22	42	22	16	74	9	25	4	41	25	7
	36	M27x2	M16x1,5	M27x2	M16x1,5	36	22	50	30	16	74	9	25	4	41	25	8
63	**28**	M20x1,5	NA	M20x1,5	NA	28	NA	42	22	16	75	13	29	4	48	32	7
	36	M27x2	M20x1,5	M27x2	NA	36	28	50	30	16	88	13	29	4	48	32	8
	45	M33x2	M20x1,5	M33x2	M20x1,5	45	28	60	39	16	88	13	29	4	48	32	10
80	**36**	M27x2	NA	M27x2	NA	36	NA	50	30	20	82	9	29	4	51	31	8
	45	M33x2	M27x2	M33x2	NA	45	36	60	39	20	105	9	29	4	51	31	10
	56	M42x2	M27x2	M42x2	M27x2	56	36	72	48	20	105	9	29	4	51	31	10
100	**45**	M33x2	NA	M33x2	NA	45	NA	60	39	22	92	10	32	5	57	35	10
	56	M42x2	M33x2	M42x2	NA	56	45	72	48	22	125	10	32	5	57	35	10
	70	M48x2	M33x2	M48x2	M33x2	63	45	88	62	22	125	10	32	5	57	35	10
125	**56**	M42x2	NA	M42x2	NA	56	NA	72	48	22	105	10	32	5	57	35	10
	70	M48x2	M42x2	M48x2	NA	63	56	88	62	22	150	7	29	5	57	35	10
	90	M64x3	M42x2	M64x3	M42x2	85	56	108	80	22	150	7	29	5	57	35	15
160	**70**	M48x2	NA	M48x2	NA	63	NA	88	62	25	125	7	32	5	57	32	10
	90	M64x3	M48x2	M64x3	NA	85	63	108	80	25	170	7	32	5	57	32	15
	110	M80x3	M48x2	M80x3	M48x2	95	63	133	100	25	170	7	32	5	57	32	15
200	**90**	M64x3	NA	M64x3	NA	85	NA	108	80	25	150	7	32	5	57	32	15
	110	M80x3	M64x3	M80x3	NA	95	85	133	100	25	210	7	32	5	57	32	15
	140	M100x3	M64x3	M100x3	M64x3	112	85	163	128	25	210	7	32	5	57	32	15

Notes: (1) Dimensions **A** and **A1** are according to ISO 4395 short type.
Tolerances: max for male thread; min for female thread



7 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "cold drawn and stressed steel"; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

8 TIE RODS FEATURES

The cylinder's tie rods are made in "normalized automatic steel"; end-threads are rolled to improve the fatigue working life. They are screwed to the heads or mounted by means of nuts with a prefixed tightening torque MT, see the table at side.

TIE RODS TIGHTENING TORQUES

Ø Bore	**25**	**32**	**40**	**50**	**63**
MT [Nm]	5	9	20	70	70
Wrench	8	10	13	19	19
Ø Bore	**80**	**100**	**125**	**160**	**200**
MT [Nm]	160	160	460	820	1160
Wrench	24	24	32	41	46

9 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure. The rod surface is chrome plated: diameter tolerances f7; roughness Ra ≤ 0,25 µm. Corrosion resistance of 200 h in neutral spray to ISO 9227 NSS

ø Rod	Material	Rs min [N/mm²]	Chrome	
			min thickness [mm]	hardness [HV]
12÷90	hardened and tempered alloy-steel	700	0,020	850-1150
110÷140	alloy steel	450		

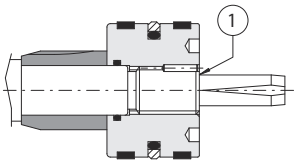
Rod diameters from 12 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life. The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 6. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing. **Contact our technical office** in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):
K = Nickel and chrome-plating (for rods from 22 to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

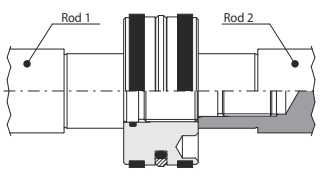
T = Induction surface hardening and chrome plating
- 56-60 HRC (613-697 HV) hardness

ROD-PISTON COUPLING

Single rod



Double rod



10 DOUBLE ROD

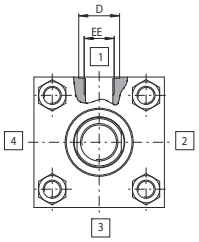
Double rod cylinders ensure the same pushing and pulling areas, thus the same speeds and forces. Rod2 (see figure at side) is screwed into the male thread of Rod1, consequently the Rod2 is weaker than the other and it is strongly recommended to use this one only to compensate the areas; the stronger rod is identified by the number '1' stamped on its end. For double rod cylinders, rod end dimensions indicated in section 6 are valid for both the rods.

11 OIL PORTS AND ROD SPEEDS

The fluid speed in pipings connected to the cylinder oil ports should not exceed 6 m/s in order to minimize the turbolence flow, the pressure drop and water hammer. The table below shows the max recommended rod speed relative to 6 m/s flow velocity.
In high dynamic systems the rod can reach even higher speeds (after a careful check of dampable masses, **see tab. B015**): in these cases it is recommended to use piping's diameters larger than the cylinder oil ports and to introduce proper reductions just near the cylinder oil ports.

Ø Bore	Standard oil ports				Oversized oil ports **D**, **Y** options			
	D [mm]	**EE** 6g	Internal pipe Ø[mm] min	Rod speed V [m/s]	**D** [mm]	**EE** 6g	Internal pipe Ø[mm] min	Rod speed V [m/s]
25	21	G 1/4	7,5	0,54	25	G 3/8	9	0,77
32	21	G 1/4	7,5	0,33	25	G 3/8	9	0,47
40	25	G 3/8	9	0,30	29	G 1/2	14	0,73
50	29	G 1/2	14	0,47	36	G 3/4	16	0,61
63	29	G 1/2	14	0,30	36	G 3/4	16	0,39
80	36	G 3/4	16	0,18	42	G 1	20	0,37
100	36	G 3/4	16	0,15	42	G 1	20	0,24
125	42	G 1	20	0,15	52	G 1 1/4	30	0,34
160	42	G 1	20	0,09	52 (1)	G 1 1/4 (1)	30	0,21
200	52	G 1 1/4	30	0,13	58	G 1 1/2	40	0,24

Oil ports features are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D type N (narrow).
Oil ports with SAE 3000 flanges are available on request, **contact our technical office.**



Note to table:
(1) For mounting styles C, D, E, N, P, S the dimension **PJ2** reported in section 3 is modified, contact our technical office.

12 CUSHIONING

Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessaty to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically desigined to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). Two types of cushioning are available depending to the rod speed V:

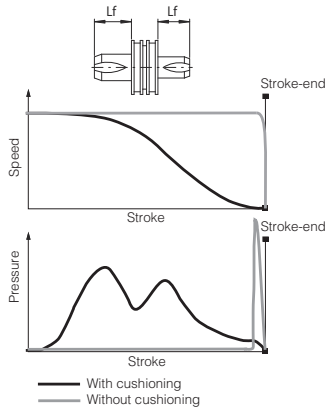
Slow version for $V \leq 0.5 \cdot V_{max}$

Fast version for $V > 0.5 \cdot V_{max}$

See the table below for V_{max} values and **tab. B015** for the max damping energy.
When fast or slow adjustable versions are selected, the cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

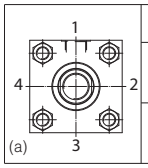
Ø Bore		**25**		**32**		**40**		**50**		**63**		**80**		**100**		**125**		**160**		**200**	
Ø Rod		**12**	**18**	**14**	**22**	**18**	**22 28**	**22**	**28 36**	**28**	**36 45**	**36**	**45 56**	**45**	**56 70**	**56**	**70 90**	**70**	**90 110**	**90 140**	**110**
Cushioning length [mm]	Lf front	21	17	23	17	26	25	28	27	28	27	27	29	35	27	28	25	34	34	49	34
	Lf rear	13		15		27		28		30		32		32		32		41		56	
Vmax [m/s]		1		1		1		1		0,8		0,8		0,6		0,6		0,5		0,5	

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.



13 POSITION COMBINATION FOR OIL PORTS AND CUSHIONING ADJUSTMENTS

FRONT HEAD: **B*** = oil port position; **E*** = cushioning adjustment position REAR HEAD: **X*** = oil port position; **Z*** = cushioning adjustment position
The table below shows all the available configurations for the oil port and cushioning adjustment positions. Bolt characters identify the standard positions. Each configuration for the front head can be variously combined with any one of the rear head. Cushioning adjustment positions **E***, **Z*** have to be entered only if adjustable cushioning are selected.
Example of model code: CK-50/22 *0100-S301 - A - **B2E3X1Z4**

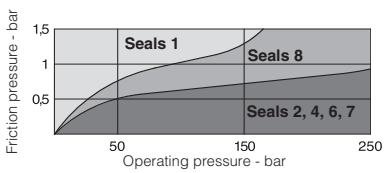


Mounting style			**C, D, S, L**							**E**		**G**		**H**		**N, P**			**T, V, W, X, Y, Z**			
FRONT HEAD	Oil port side	**B**	**1**	1	2	1	2	4	3	**1**	1	**1**		**1**	2	**1**	1	2●	**1**	1	2	3
	Cushioning adjustment side	**E**	**3**	2	3	4	4	3	1	**2**	4	**3**		**3**	4	**3**	2●	3	**3**	4	3	1
REAR HEAD	Oil port side	**X**	**1**	1	2	1	2	4	3	**1**	1	**1**	2	**1**		**1**	1	2●	**1**	1	2	3
	Cushioning adjustment side	**Z**	**3**	2	3	4	4	3	1	**2**	4	**3**	4	**3**		**3**	2●	3	**3**	4	3	1

● Not available for bores 25 and 32. Dimensions **PJ, PJ2, Y** and **Y1** change compared to the values in section 3, contact our technical office
(a) Front view rod side (rod n°1 for double rods)
Contact our technical office for combinations not included in the table.

14 SEALING SYSTEM FEATURES

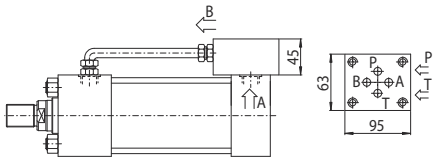
The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**.
When single acting seals are selected (types **6** and **7**), the not pressurized cylinder's chamber must be connected to the tank. Special sealing system for low temperatures, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 22. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition. See section 19 for fluid requirements.



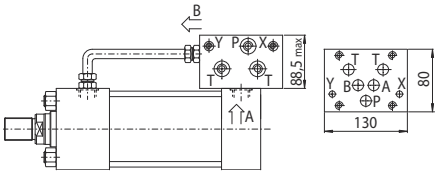
Sealing system	**Material**	**Features**	**Max speed [m/s]**	**Fluid temperature range**	**Fluids compatibility**	**ISO Standards for seals**	
						Piston	**Rod**
1	NBR + POLYURETHANE	**high static and dynamic sealing**	0.5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%), HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
6 - 7	NBR + PTFE	**very low friction single acting - pushing/pulling**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
8	PTFE + NBR + POLYURETHANE	**low friction**	0,5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 7425/2

15 INCORPORATED SUBPLATE

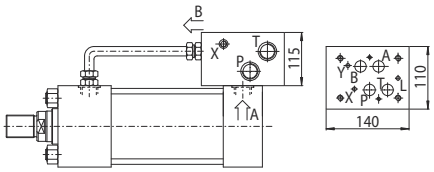
CK cylinders with oil ports positions 1 can be supplied with ISO (size 06, 10, 16 and 25) incorporated subplates for mounting of valves directly on the cylinder.



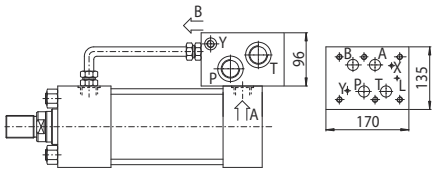
10 = subplate with mounting surface 4401-03-02-0-05 (size 06)
Oil ports P and T = G 3/8
For bores from 40 to 200 and strokes longer than 100 mm
For shorter strokes, the cylinder must be provided with suitable spacer



20 = subplate with mounting surface 4401-05-05-0-05 (size 10)
Oil ports P and T = G 3/4; X and Y = G 1/4
For bores from 40 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer



30 = subplate with mounting surface 4401-07-07-0-05 (size 16)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 80 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer

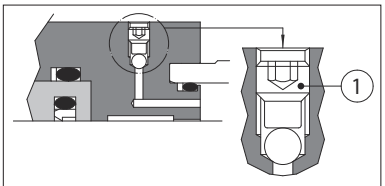


40 = subplate with mounting surface 4401-08-08-0-05 (size 25)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 125 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer

Note: for the choice of suitable spacer see section 5. The addition of spacer length and working stroke must be at least equal or upper than the minimum stroke indicated above, see the following example:
Subplate **20**; working stroke = **70** mm; min. stroke = **150** mm ⟶ select spacer **4** (lenght = **100**mm)

16 AIR BLEEDS

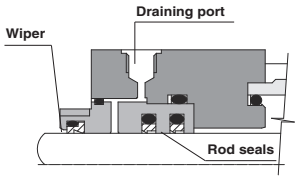
CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely. Air bleeds are usually positioned on the opposite side of the oil port except for front heads of mounting styles **N**, **G** (on side 3), rear heads of mounting styles **C**, **D**, **S**, **H**, **P** (on side 3) and for heads of mounting style **E** (on side 2), see section 13. For cylinders with adjustable cushioning the air bleeds are positioned on the same side of the cushioning adjustment screw. For Servocylinders, cylinders with incorporated subplates or proximity sensors, air bleeds are supplied as standard and they must not be entered in the model code. For cylinders with proximity sensors, air bleeds A, W or AW are supplied respectively depending on the selected sensors R, S or RS. For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
25 - 40	M5 x 4	8 Nm
50 - 200	M8 x 10	20 Nm

17 DRAINING

CODE: **L** = rod side draining
The rod side draining reduces the seals friction and increases their reliability; it is mandatory for cylinders with strokes longer than 2000 mm, with rod side chamber constantly pressurized and for servocylinders.The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side) and it can be supplied only with sealing system: **1**, **2**, **4**, **7** and **8**. It is recommended to connect the draining port to the tank without backpressure.
Draining port is G1/8.

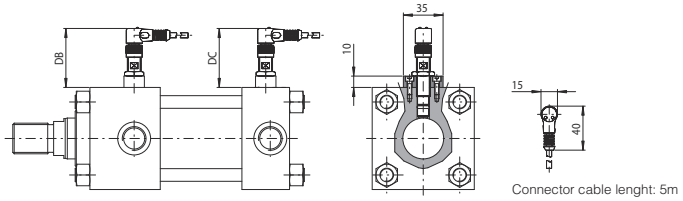


18 PROXIMITY SENSORS

CODES: **R** = front sensor; **S** = rear sensor
Proximity sensors functioning is based on the variation of the magnetic field, generated by the sensor itself, when the cushioning piston enters on its influence area, causing a change of state (on/off) of the sensors. The distance from the mechanical stroke-end of the cylinder, at which occurs the switching of the sensor's electrical contact, can be adjusted between 1 and 3 mm. For their regulation, it is necessary to position the rod where it is desired to obtain the contact switching and rotate the sensor until its LED switch-on (commutation occurred). The sensors tightening torque must be lower than 40 N/m to avoid damages. The sensors must always be coupled with fast adjustable cushioning, see section 12, to avoid pressure peaks on stroke-end. They are positioned on side 4 and they can be coupled with the standard oil ports and cushioning adjustments positions in bolt characters, see section 13. The coupling of the proximity sensors with the stroke-end cushioning imposes particular executions with limitation of the damping masses and/or speeds compared to the executions with standard cushioning.

Limitations
R, **S** options not available for cylinders with bores smaller then 40 mm.
R option not available for G and N mounting styles; **S** option not available for P and H mounting styles.

Ø Bore	40	50	63	80	100	125	160	200
DB max	60	58	71	71	71	68	68	63
DC	50	67	62	67	62	64	63	63



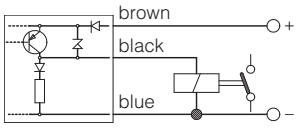
Connector cable lenght: 5m

SENSORS TECHNICAL DATA

The proximity sensors are inductive type, they supply a "NO" (Normally Open) output signal which status corresponds to the rod position:

- **R, S** = close contact = 24 Volt at output contacts = rod positioned at stroke ends
- **R**, **S** = open contact = 0 Volt at output contacts = rod not positioned at stroke ends

Ambient temperature	-20 +70°C
Nominal voltage	24 VDC
Operating voltage	10…30 VDC
Max load	200 mA
Version	PNP
Output type	NO
Repeatability	<5%
Hysteresis	<15%
Protection	IP68
Max pressure	25 MPa (250 bar)



19 FLUID REQUIREMENTS

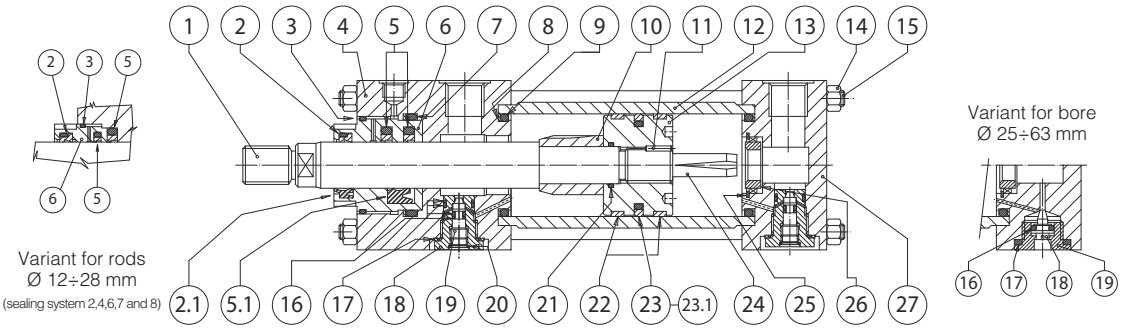
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm²/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

20 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLES X, Z Single rod		MASS FOR STYLES X, Z Double rod		ADDITIONAL MASSES according to mounting styles and options										
Ø Bore [mm]	**Ø Rod** [mm]	Stroke 100 mm	Each added 100 mm	Stroke 100 mm	Each added 100 mm	Style **C**	Style **D**	Style **E**	Style **G**	Style **L**	Style **N**	Style **P**	Style **S**	Style **V Y**	Style **W**	Each cushio-ning	Each 50 mm spacer
25	**12**	1,65	0,47	1,95	0,56	0,08	0,068	0,22	-0,02	0,19	0,18	0,18	0,08	0,01	0,02	0,03	0,38
	18	1,80	0,58	2,40	0,78												
32	**14**	2,23	0,49	2,69	0,61	0,17	0,15	0,24	0,02	0,29	0,18	0,18	0,14	0,02	0,04	0,04	0,50
	22	2,51	0,67	3,21	0,97												
40	**18**	4,90	0,79	6,78	0,99	0,27	0,22	0,256	0,08	0,78	0,76	0,76	0,57	0,06	0,12	0,07	0,79
	22	5,15	0,89	7,19	1,19												
	28	5,40	1,07	7,60	1,55												
50	**22**	6,40	1,18	7,85	1,48	0,84	0,74	0,52	0,28	1,46	1,10	1,10	0,31	0,16	0,32	0,13	1,15
	28	6,59	1,37	8,23	1,85												
	36	7,20	1,68	9,45	2,48												
63	**28**	8,70	1,62	11,08	2,10	0,52	0,41	1,54	0,26	2,17	1,34	1,34	0,46	0,16	0,32	0,25	1,68
	36	9,13	1,93	11,94	2,73												
	45	9,80	2,39	13,64	3,64												
80	**36**	17,00	2,96	20,45	3,76	1,25	0,79	1,23	1,63	3,67	2,39	2,39	0,86	0,34	0,68	0,40	2,85
	45	17,76	3,46	21,97	4,71												
	56	18,10	4,09	23,90	6,02												
100	**45**	23,80	3,90	29,85	5,15	3,05	2,31	1,63	1,00	5,46	2,94	2,94	1,77	0,34	0,68	0,60	4,15
	56	24,70	4,60	32,01	6,53												
	70	26,00	5,68	35,20	8,70												
125	**56**	43,60	6,15	53,60	8,08	3,95	2,87	4,60	1,50	8,60	5,65	5,65	4,65	0,90	1,80	1,15	6,61
	70	45,24	7,25	58,55	10,27												
	90	49,62	9,21	72,88	14,20												
160	**70**	74,55	8,75	85,96	11,77	8,33	7,63	7,56	4,66	16,58	7,97	7,97	8,21	1,50	3,00	1,85	10,75
	90	79,31	10,72	96,08	15,71												
	110	83,90	13,18	106,20	20,64												
200	**90**	123,60	12,50	136,52	17,49	10,00	13,82	14,6	9,86	37,00	16,78	16,82	14,80	2,50	5,00	2,50	15,86
	110	130,39	14,52	142,65	21,98												
	140	137,19	19,14	148,78	31,22												

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

21 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	Chrome plated steel	9	O-ring	NBR / FKM	19	Cushioning adjustment screw	Steel
2	Wiper	NBR / FKM and PTFE	10	Front cushioning piston	Steel	20	Seeger	Steel
2.1	Wiper (G1)	Polyurethane	11	Screw stop pin	Steel	21	O-ring	NBR / FKM
3	O-ring	NBR / FKM	12	Cylinder housing	Steel	22	Piston guide ring	PTFE or phenolic resin
4	Front head	Steel / cast iron	13	Piston	Steel	23	Piston seal	NBR / FKM and PTFE
5	Rod seal	NBR / FKM and PTFE	14	Nut	Steel	23.1	Piston seal (G1)	NBR and Polyurethane
5.1	Rod seal (type G1)	Polyurethane	15	Tie rod	Steel	24	Rear cushioning piston	Steel
6	Rod bearing	Bronze	16	O-ring and anti-extrusion ring	FKM and PTFE	25	Toroidal ring	Steel
7	O-ring and anti-extrusion ring	NBR / FKM and PTFE	17	Seal	FKM	26	Rear cushioning sleeve	Bronze
8	Anti-extrusion ring	PTFE	18	Cushioning adjustment plug	Steel	27	Rear head	Steel / cast iron

22 SPARE PARTS - SEE TABLE SP-B137

Example for seals spare parts code

G 8	-	C K	-	50	/	22	/	22

Sealing system

Cylinder series

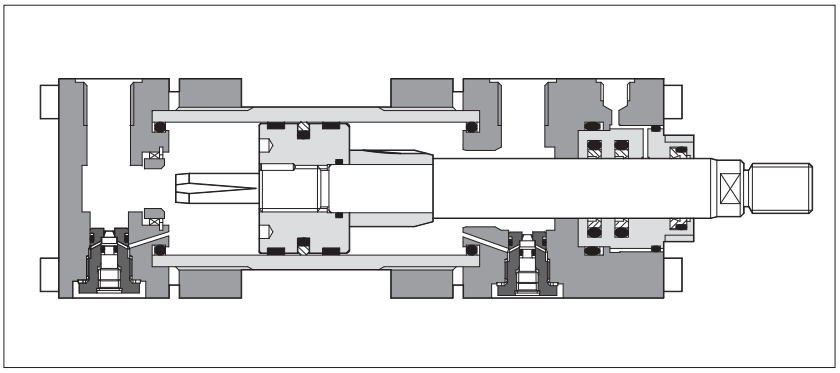
Bore size [mm]

Rod diameter [mm]

Second rod diameter for double rod [mm] Omit if not requested

Hydraulic cylinders type CH - square heads with counterflanges

to ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



SWC Cylinders Designer

Software for assisted selection of Atos cylinders & servocylinders codes, including cylinder's sizing, full technical information, 2D & 3D drawings in several CAD formats.

Available for download at www.atos.com

CH cylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.

- Bore sizes from **63** to **200** mm
- **3** rod diameters per bore
- Strokes up to **5000** mm
- Single or double rod
- Rods with **rolled threads**
- **9** standard mounting styles
- **6** seals options
- Adjustable or fixed cushioning
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's choice and sizing criteria **see tab. B015**

1 MODEL CODE

CH	P	/	10	-	63	/	28	/	28	*	0500	-	S	3	0	1	-	A	-	B1E3X1Z3	**

Cylinder series
CH to ISO 6020 - 2

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Incorporated subplate, see section 15
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size, see section 3
from **63** to **200** mm

Rod diameter, see sections 7 and 9
from **28** to **140** mm

Second rod diameter for double rod, see section 10
from **28** to **140** mm, omit for single rod

Stroke, see section 5
up to **5000** mm

Mounting style, see sections 2 and 3	**REF. ISO**
D = fixed eye	MP3 **(3)**
E = feet	MS2
G = front trunnion	MT1
H = rear trunnion	MT2 **(3)**
N = front flange	ME5
P = rear flange	ME6 **(3)**
S = fixed eye + spherical bearing	MP5 **(3)**
X = basic execution	-

Series number **(1)**

Heads' configuration (2), see section 13
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
* = selected position (1, 2, 3 or 4)

Options (2):
Rod end, see section 7
F = female thread
G = light female thread
H = light male thread
Oversized oil ports, see section 11
D = front oversized oil port
Y = rear oversized oil port
Proximity sensors, see section 18
R = front sensor
S = rear sensor
Rod treatment, see section 9
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds, see section 16
A = front air bleed
W = rear air bleed
Draining, see section 17
L = rod side draining

Sealing system, see section 14
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
6 = (NBR + PTFE) very low friction, single acting - pushing
7 = (NBR + PTFE) very low friction, single acting - pulling
8 = (NBR + PTFE and POLYURETHANE) low friction

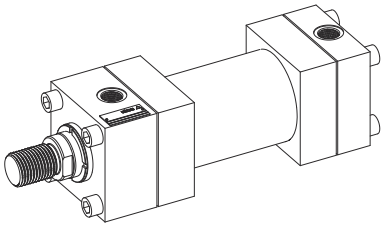
Spacer, see section 6
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

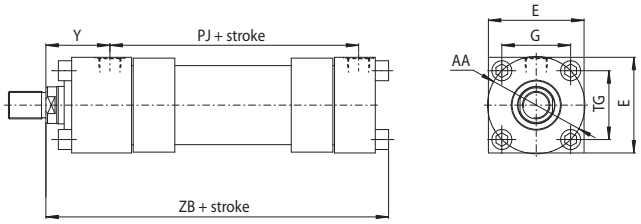
Cushioning, see section 12
0 = none

Fast adjustable	**Slow adjustable**	**Fast fixed**
1 = rear only	**4** = rear only	**7** = rear only
2 = front only	**5** = front only	**8** = front only
3 = front and rear	**6** = front and rear	**9** = front and rear

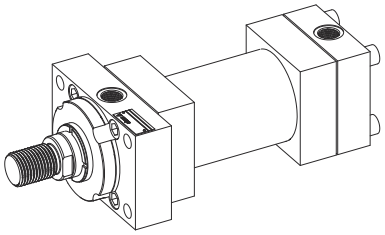
(1) For spare parts request indicate the series number printed on the nameplate only for series < 30
(2) To be entered in alphabetical order **(3)** Not available for double rod

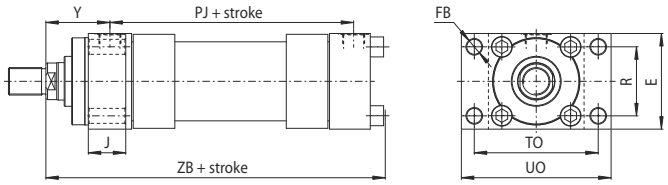
2 **MOUNTING STYLE** - for dimensions see section 3



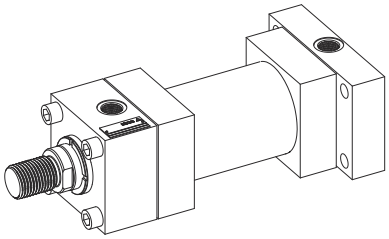


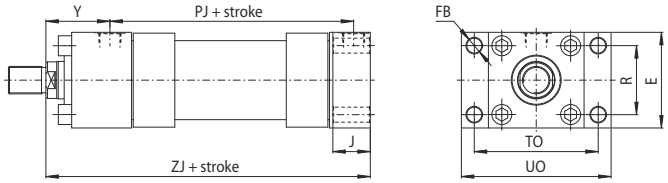
X = basic mounting



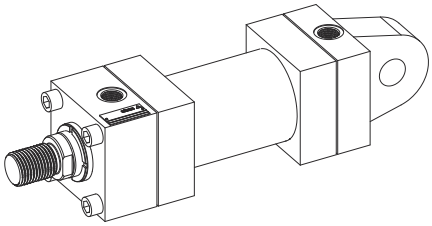


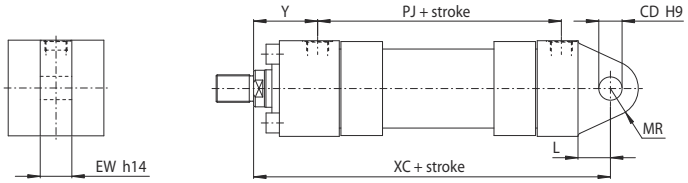
N (ISO ME5) = front flange mounting



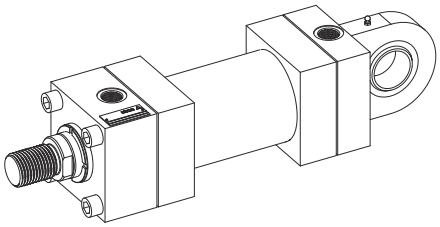


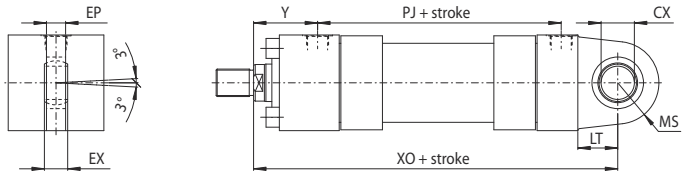
P (ISO ME6) = rear flange mounting



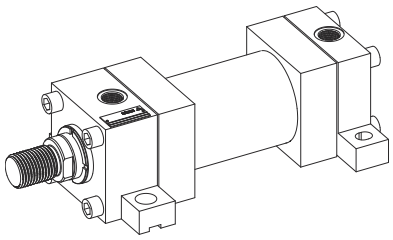


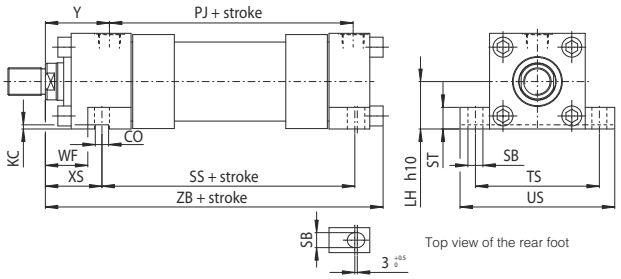
D (ISO MP3) = fixed eye mounting



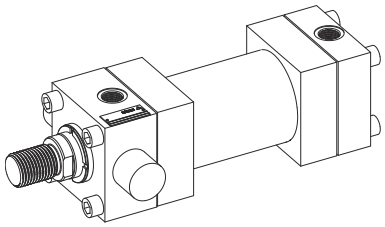


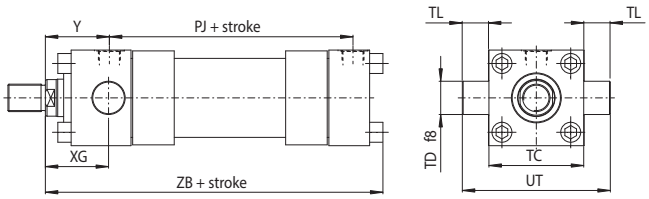
S (ISO MP5) = fixed eye with spherical bearing mounting



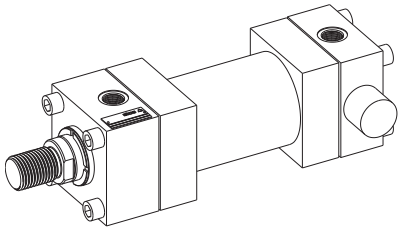


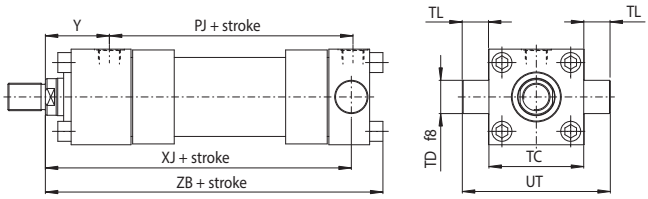
E (ISO MS2) = side feet mounting



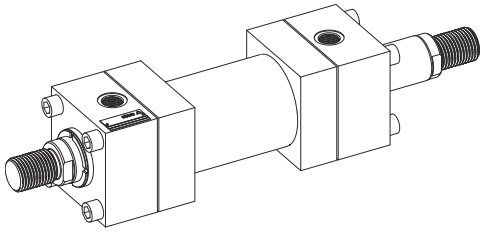


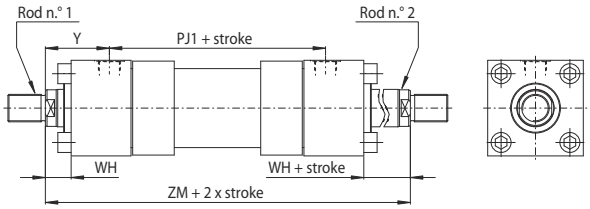
G (ISO MT1) = front trunnion mounting



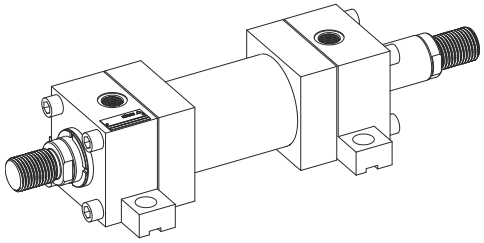


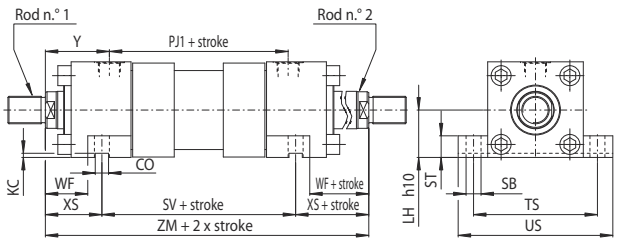
H (ISO MT2) = rear trunnion mounting





X = basic mounting for double rod





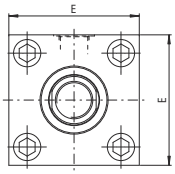
E = feet mounting for double rod

3 INSTALLATION DIMENSION [mm] - see figures in section 2

Ø Bore		63	80	100	125	160	200
Ø Rod	standard	28	36	45	56	70	90
	intermediate	36	45	56	70	90	110
	differential	45	56	70	90	110	140
AA		91	117	137	178	219	269
CD H9		20	28	36	45	56	70
CO N9		16	16	16	20	30	40
CX	value	30	40	50	60	80	100
	tolerance	0 -0,012			0 -0,015		0 -0,02
E (1)		90±1,5	115±1,5	130±2	165±2	205±2	245±2
EP max		19	23	30	38	47	57
EW h14		30	40	50	60	70	80
EX		22 0/-0,12	28 0/-0,12	35 0/-0,12	44 0/-0,15	55 0/-0,15	70 0/-0,2
FB H13		14	18	18	22	26	33
J ref		38	45	45	58	58	76
L min		32	39	54	57	63	82
LH h10		44	57	63	82	101	122
LT min		38	48	58	72	92	116
KC min		4,5	5	6	6	8	8
MR max		29	34	50	53	59	78
MS max		40	50	62	80	100	120
PJ (2) ±1,5 (3)		80	93	101	117	130	165
PJ1 ±1,5 (3)		81	92	101	117	130	160
PJ2 (2) ±1,5 (3)		80	93	99	121	143	167
R js13		65	83	97	126	155	190
SB H13		18	18	26	26	33	39
SS ±1,25 (3)		85	104	101	130	129	171
ST js13		26	26	32	32	38	44
SV ±1,25 (3)		93	110	107	131	130	172
TC h14		89	114	127	165	203	241
TD f8		32	40	50	63	80	100
TG js13		64,3	82,7	96,9	125,9	154,9	190,2
TL js13		25	32	40	50	63	80
TO js13		117	149	162	208	253	300
TS js13		124	149	172	210	260	311
UO max		145	180	200	250	300	360
US max		161	186	216	254	318	381
UT ref		139	178	207	265	329	401
XC ±1,5 (3)		200	229	257	289	308	381
XG ±2 (3)		70	76	71	75	75	85
XJ ±1,5 (3)		149	168	187	209	230	276
XO ±1,5 (3)		206	238	261	304	337	415
XS ±2 (3)		65	68	79	79	86	92
Y (2) ±2 (3)		71	77	82	86	86	98
Y1 (2) ±2 (3)		70	75,5	83	84	79,5	97
ZB max		185	212	225	260	279	336
ZJ ±1 (3)		168	190	203	232	245	299
ZM ±2 (3)		223	246	265	289	302	356

NOTES TO TABLE 3

(1) **E** - If not otherwise specified in the figures in section 2 this value is the front and rear square heads dimension for all the mounting styles (see figure below)



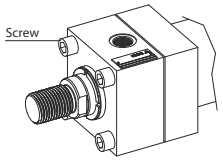
(2) When oversized oil ports are selected (see section 11 and 13 for dimensions and positions) dimensions **PJ** and **Y** are respectively modified into **PJ2** and **Y1**

(3) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is given by the max stroke tolerance in section 5

4 SCREWS TIGHTENING TORQUES

Mounting screws must be to a minimum strength of ISO 898/2 grade 12.9.

Ø Bore	63	80	100	125	160	200
MT [Nm]	70	160	160	460	820	1160
Screw	M12	M16	M16	M22	M27	M30



5 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end.
The table below shows the minimum stroke depending to the bore.

Minimum stroke [mm]

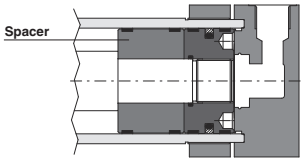
Ø Bore	63	80	100	125	160	200
Minimum stroke	55	70	70	75	70	85

Maximum stroke:
- 5000 mm

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

6 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 3.



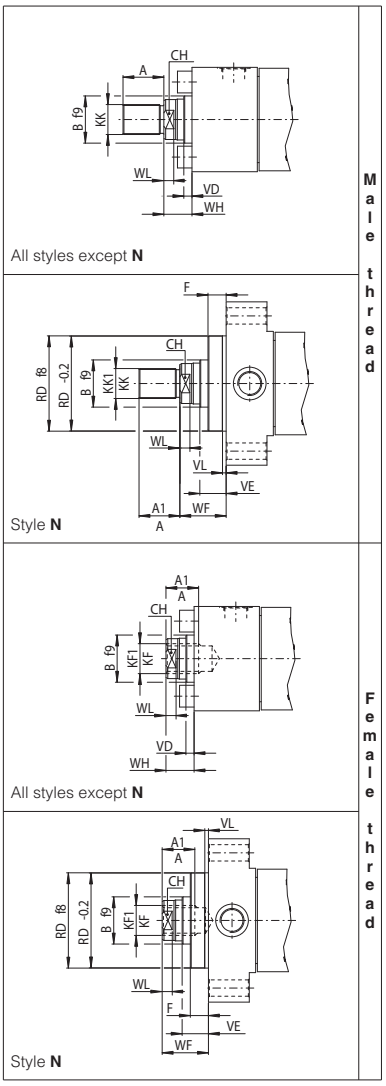
RECOMMENDED SPACERS [mm]

Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

7 ROD END DIMENSIONS [mm]

Ø Bore	Ø Rod	Male thread		Female thread		A (KK or KF) (1)	A1 (KK1 or KF1) (1)	B	CH	F	RD	VD	VE	VL	WF	WH	WL
		KK	KK1 (option H)	KF (option F)	KF1 (option G)												
		6g	6g	6H	6H			f9	h14	max	f8		max	min	±2	±2	min
	28	M20x1,5	NA	M20x1,5	NA	28	NA	42	22	16	75	13	29	4	48	32	7
63	36	M27x2	M20x1,5	M27x2	NA	36	NA	50	30	16	88	13	29	4	48	32	8
	45	M33x2	M20x1,5	M33x2	M20x1,5	45	28	60	39	16	88	13	29	4	48	32	10
	36	M27x2	NA	M27x2	NA	36	NA	50	30	20	82	9	29	4	51	31	8
80	45	M33x2	M27x2	M33x2	NA	45	NA	60	39	20	105	9	29	4	51	31	10
	56	M42x2	M27x2	M42x2	M27x2	56	36	72	48	20	105	9	29	4	51	31	10
	45	M33x2	NA	M33x2	NA	45	NA	60	39	22	92	10	32	5	57	35	10
100	56	M42x2	M33x2	M42x2	NA	56	NA	72	48	22	125	10	32	5	57	35	10
	70	M48x2	M33x2	M48x2	M33x2	63	45	88	62	22	125	10	32	5	57	35	10
	56	M42x2	NA	M42x2	NA	56	NA	72	48	22	105	10	32	5	57	35	10
125	70	M48x2	M42x2	M48x2	NA	63	NA	88	62	22	150	7	29	5	57	35	10
	90	M64x3	M42x2	M64x3	M42x2	85	56	108	80	22	150	7	29	5	57	35	15
	70	M48x2	NA	M48x2	NA	63	NA	88	62	25	125	7	32	5	57	32	10
160	90	M64x3	M48x2	M64x3	NA	85	NA	108	80	25	170	7	32	5	57	32	15
	110	M80x3	M48x2	M80x3	M48x2	95	63	133	100	25	170	7	32	5	57	32	15
	90	M64x3	NA	M64x3	NA	85	NA	108	80	25	150	7	32	5	57	32	15
200	110	M80x3	M64x3	M80x3	NA	95	NA	133	100	25	210	7	32	5	57	32	15
	140	M100x3	M64x3	M100x3	M64x3	112	85	163	128	25	210	7	32	5	57	32	15

Notes: (1) Dimensions **A** and **A1** are according to ISO 4395 short type.
Tolerances: max for male thread; min for female thread



8 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "cold drawn and stressed steel"; the internal surfaces are lapped; diameter tolerance H8, roughness Ra ≤ 0,25 µm.

9 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure. The rod surface is chrome plated: diameter tolerance f7, roughness Ra ≤ 0,25 µm. Corrosion resistance of 200h in neutral spray to ISO 9227 NSS.

ø Rod	Material	Rs min [N/mm²]	Chrome	
			min thickness [mm]	hardness [HV]
28÷90	hardened and tempered alloy-steel	700	0,020	850-1150
110÷140	alloy steel	450		

Rod diameters from 28 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life. The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 7. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing. **Contact our technical office** in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):
K = Nickel and chrome-plating (for rods up to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

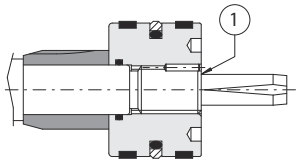
T = Induction surface hardening and chrome plating
- 56-60 HRC (613-697 HV) hardness

10 DOUBLE ROD

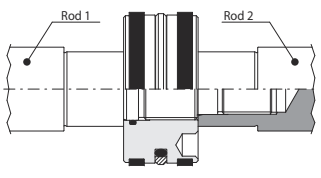
Double rod cylinders ensure the same pushing and pulling areas, thus the same speeds and forces. Rod2 (see figure at side) is screwed into the male thread of Rod1, consequently the Rod2 is weaker than the other and it is strongly recommended to use this one only to compensate the areas; the stronger rod is identified by the number '1' stamped on its end. For double rod cylinders, rod end dimensions indicated in section 7 are valid for both the rods.

ROD-PISTON COUPLING

Single rod



Double rod

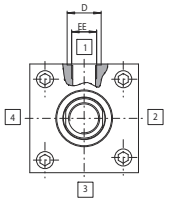


11 OIL PORTS AND ROD SPEEDS

The fluid speed in pipings connected to the cylinder oil ports should not exceed 6 m/s in order to minimize the turbolence flow, the pressure drop and water hammer. The table below shows the max recommended rod speed relative to 6 m/s flow velocity.
In high dynamic systems the rod can reach even higher speeds (after a careful check of dampable masses, **see tab. B015**): in these cases it is recommended to use piping's diameters larger than the cylinder oil ports and to introduce proper reductions just near the cylinder oil ports.

Ø Bore	Standard oil ports				Oversized oil ports **D**, **Y** options			
	D [mm]	**EE** 6g	Internal pipe Ø[mm] min	Rod speed V [m/s]	**D** [mm]	**EE** 6g	Internal pipe Ø[mm] min	Rod speed V [m/s]
63	29	G 1/2	14	0,30	36	G 3/4	16	0,39
80	36	G 3/4	16	0,18	42	G 1	20	0,37
100	36	G 3/4	16	0,15	42	G 1	20	0,24
125	42	G 1	20	0,15	52	G 1 1/4	30	0,34
160	42	G 1	20	0,09	52 (1)	G 1 1/4	30	0,21
200	52	G 1 1/4	30	0,13	58	G 1 1/2	40	0,24

Oil ports features are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D type N (narrow).
Oil ports with SAE 3000 flanges are available on request, **contact our technical office.**



Note to table:
(1) For mounting styles D, E, N, P, S the dimension **PJ2** reported in section 3 is modified, contact our technical office.

12 CUSHIONING

Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessary to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). Two types of cushioning are available depending to the rod speed V:

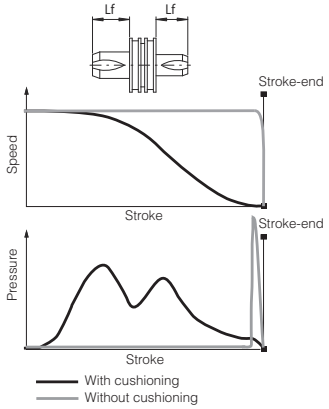
Slow version for $V \leq 0.5 \cdot V_{max}$

Fast version for $V > 0.5 \cdot V_{max}$

See the table below for V_{max} values and **tab. B015** for the max damping energy.
When fast or slow adjustable versions are selected, the cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

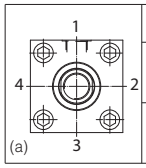
Ø Bore		**63**		**80**		**100**		**125**		**160**		**200**	
Ø Rod		**28**	**36 45**	**36**	**45 56**	**45**	**56 70**	**56**	**70 90**	**70**	**90 110**	**90 140**	**110**
Cushioning length [mm]	Lf front	28	27	27	29	35	27	28	25	34	34	49	34
	Lf rear	30		32		32		32		41		50	
Vmax [m/s]		0,8		0,8		0,6		0,6		0,5		0,5	

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.



13 POSITION COMBINATION FOR OIL PORTS AND CUSHIONING ADJUSTMENTS

FRONT HEAD: **B*** = oil port position; **E*** = cushioning adjustment position REAR HEAD: **X*** = oil port position; **Z*** = cushioning adjustment position
The table below shows all the available configurations for the oil port and cushioning adjustment positions. Bolt characters identify the standard positions. Each configuration for the front head can be variously combined with any one of the rear head. Cushioning adjustment positions **E***, **Z*** have to be entered only if adjustable cushioning are selected.
Example of model code: CH-63/28 *0100-S301 - A - **B2E3X1Z4**

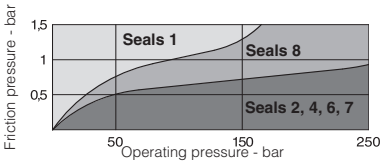


Mounting style			**D, S**							**E**		**G**		**H**		**N, P**			**X**			
FRONT HEAD	Oil port side	**B**	**1**	1	2	1	2	4	3	**1**	1	**1**		**1**	2	**1**	1	2 ●	**1**	1	2	3
	Cushioning adjustment side	**E**	**3**	2	3	4	4	3	1	**2**	4	**3**		**3**	4	**3**	2	3	**3**	4	3	1
REAR HEAD	Oil port side	**X**	**1**	1	2	1	2	4	3	**1**	1	**1**	2	**1**		**1**	1	2 ●	**1**	1	2	3
	Cushioning adjustment side	**Z**	**3**	2	3	4	4	3	1	**2**	4	**3**	4	**3**		**3**	2	3	**3**	4	3	1

● Dimensions **PJ, PJ2, Y** and **Y1** change compared to the values in section 3, contact our technical office
(a) Front view rod side (rod n°1 for double rods)
Contact our technical office for combinations not included in the table.

14 SEALING SYSTEM FEATURES

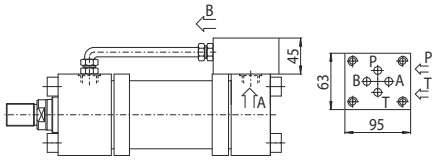
The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature.Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**.
When single acting seals are selected (types **6** and **7**), the not pressurized cylinder's chamber must be connected to the tank. Special sealing system for low temperatures, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 22. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition. See section 19 for fluid requirements.



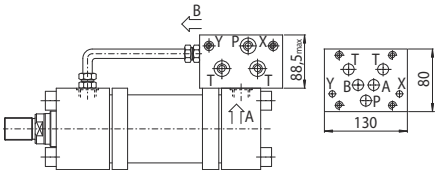
Sealing system	**Material**	**Features**	**Max speed [m/s]**	**Fluid temperature range**	**Fluids compatibility**	**ISO Standards for seals**	
						Piston	**Rod**
1	NBR + POLYURETHANE	**high static and dynamic sealing**	0.5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%), HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
6 - 7	NBR + PTFE	**very low friction single acting - pushing/pulling**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
8	PTFE + NBR + POLYURETHANE	**low friction**	0,5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 7425/2

15 INCORPORATED SUBPLATE

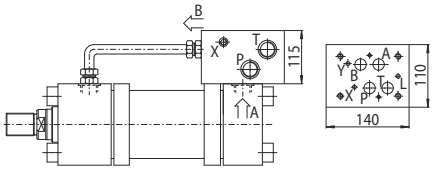
CH cylinders with oil ports positions 1 can be supplied with ISO (size 06, 10, 16 and 25) incorporated subplates for mounting of valves directly on the cylinder.



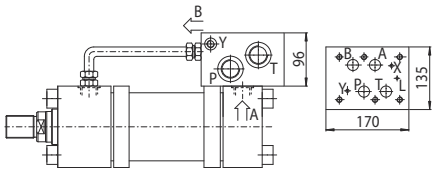
10 = subplate with mounting surface 4401-03-02-0-05 (size 06)
Oil ports P and T = G 3/8
For bores from 63 to 200 and strokes longer than 100 mm
For shorter strokes, the cylinder must be provided with suitable spacer



20 = subplate with mounting surface 4401-05-05-0-05 (size 10)
Oil ports P and T = G 3/4; X and Y = G 1/4
For bores from 63 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer



30 = subplate with mounting surface 4401-07-07-0-05 (size 16)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 80 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer

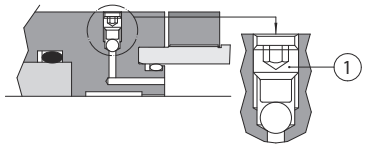


40 = subplate with mounting surface 4401-08-08-0-05 (size 25)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 125 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinder must be provided with suitable spacer

Note: for the choice of suitable spacer see section 6. The addition of spacer length and working stroke must be at least equal or upper than the minimum stroke indicated above, see the following example:
Subplate **20** ; working stroke = **70** mm; min. stroke = **150** mm ⟶ select spacer **4** (lenght = **100**mm)

16 AIR BLEEDS

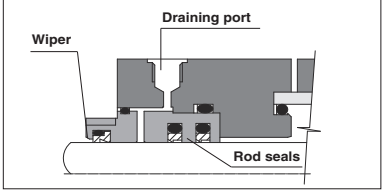
CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely. Air bleeds are usually positioned on the opposite side of the oil port except for front heads of mounting styles **N**, **G** (on side 3), rear heads of mounting styles **D**, **S**, **H**, **P** (on side 3) and for heads of mounting style **E** (on side 2), see section 13. For cylinders with adjustable cushioning the air bleeds are positioned on the same side of the cushioning adjustment screw. For Servocylinders, cylinders with incorporated subplates or proximity sensors, air bleeds are supplied as standard and they must not be entered in the model code. For cylinders with proximity sensors, air bleeds A, W or AW are supplied respectively depending on the selected sensors R, S or RS. For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
63 - 200	M8 x 10	20 Nm

17 DRAINING

CODE: **L** = rod side draining
The rod side draining reduces the seals friction and increases their reliability; it is mandatory for cylinders with strokes longer than 2000 mm, with rod side chamber constantly pressurized and for servocylinder.
The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side) and it can be supplied only with sealing system: **1**, **2**, **4**, **7** and **8**. It is recommended to connect the draining port to the tank without backpressure.
Draining port is G1/8.

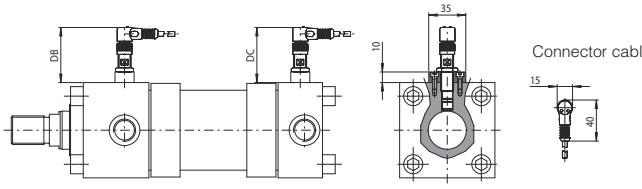


18 PROXIMITY SENSORS

CODES: **R** = front sensor; **S** = rear sensor
Proximity sensors functioning is based on the variation of the magnetic field, generated by the sensor itself, when the cushioning piston enters on its influence area, causing a change of state (on/off) of the sensors. The distance from the mechanical stroke-end of the cylinder, at which occurs the switching of the sensor's electrical contact, can be adjusted between 1 and 3 mm. For their regulation, it is necessary to position the rod where it is desired to obtain the contact switching and rotate the sensor until its LED switch-on (commutation occurred). The sensors tightening torque must be lower than 40 N/m to avoid damages. The sensors must always be coupled with fast adjustable cushioning, see section 12, to avoid pressure peaks on stroke-end. They are positioned on side 4 and they can be coupled with the standard oil ports and cushioning adjustaments positions in bolt characters, see section 13. The coupling of the proximity sensors with the stroke-end cushioning imposes particular executions with limitation of the damping masses and/or speeds compared to the executions with standard cushioning.

Limitations
R option not available for G and N mounting styles; **S** option not available for P and H mounting styles.

Ø Bore	63	80	100	125	160	200
DB max	71	71	71	68	68	63
DC	62	67	62	64	63	63



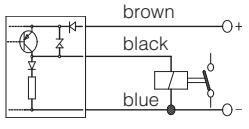
Connector cable lenght: 5m

SENSORS TECHNICAL DATA

The proximity sensors are inductive type, they supply a "NO" (Normally Open) output signal which status corresponds to the rod position:

- **R**, **S** = close contact = 24 Volt at output contacts = rod positioned at stroke ends
- **R**, **S** = open contact = 0 Volt at output contacts = rod not positioned at stroke ends

Ambient temperature	-20 +70°C
Nominal voltage	24 VDC
Operating voltage	10…30 VDC
Max load	200 mA
Version	PNP
Output type	NO
Repeatability	<5%
Hysteresis	<15%
Protection	IP68
Max pressure	25 MPa (250 bar)



19 FLUID REQUIREMENTS

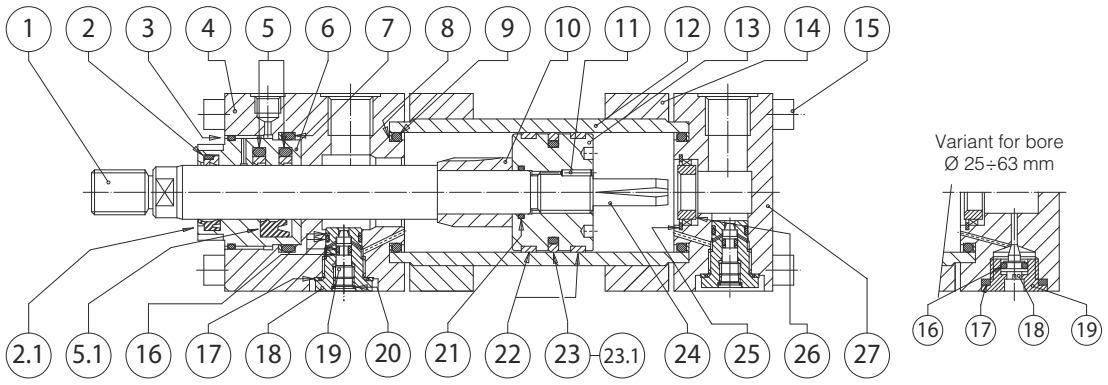
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm²/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

20 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLES X, Z Single rod		MASS FOR STYLES X, Z Double rod		ADDITIONAL MASSES according to mounting styles and options							
Ø Bore [mm]	**Ø Rod** [mm]	Stroke 100 mm	Each added 100 mm	Stroke 100 mm	Each added 100 mm	Style **D**	Style **E**	Style **G**	Style **N**	Style **P**	Style **S**	Each cushioning	Each 50 mm spacer
63	**28**	9,65	1,54	12,03	2,03	0,41	1,54	0,26	1,34	1,34	0,46	0,25	1,68
	36	10,17	1,85	12,98	2,65								
	45	10,84	2,31	14,68	3,56								
80	**36**	19,24	2,82	22,69	3,62	0,79	1,23	1,63	2,39	2,39	0,86	0,40	2,85
	45	20,00	3,32	24,21	4,57								
	56	20,34	3,95	26,14	5,88								
100	**45**	25,89	3,76	31,94	5,01	2,31	1,63	1,00	2,94	2,94	1,77	0,60	4,15
	56	26,79	4,46	34,10	6,39								
	70	28,09	5,54	37,29	8,56								
125	**56**	48,38	5,88	58,38	7,81	2,87	4,60	1,50	5,65	5,65	4,65	1,15	6,61
	70	50,02	6,98	63,33	10,00								
	90	54,40	8,94	77,66	13,93								
160	**70**	80,74	8,34	92,15	11,36	7,63	7,56	4,66	7,97	7,97	8,21	1,85	10,75
	90	85,50	10,31	102,27	15,31								
	110	90,09	12,77	112,39	20,23								
200	**90**	135,62	12,00	148,54	17,00	13,82	14,60	9,86	16,78	16,82	14,80	2,50	15,86
	110	142,41	14,01	154,67	21,47								
	140	149,21	18,63	160,80	30,72								

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

21 CYLINDER SECTION



PART	DESCRIPTION	MATERIAL	PART	DESCRIPTION	MATERIAL	PART	DESCRIPTION	MATERIAL
1	Rod	Chromeplated steel	9	O-ring	NBR / FKM	19	Cushioning adjustment screw	Steel
2	Wiper	NBR / FKM and PTFE	10	Front cushioning piston	Steel	20	Seeger	Steel
2.1	Wiper (G1)	Polyurethane	11	Screw stop pin	Steel	21	O-ring	NBR / FKM
3	O-ring	NBR / FKM	12	Cylinder housing	Steel	22	Piston guide ring	PTFE or phenolic resin
4	Front head	Steel / Cast iron	13	Piston	Steel	23	Piston seal	NBR / FKM and PTFE
5	Rod seal	NBR / FKM and PTFE	14	Counterflange	Steel	23.1	Piston seal (G1)	NBR and polyurethane
5.1	Rod seal (type G1)	Polyurethane	15	Screw	Steel (grade12.9)	24	Rear cushioning piston	Steel
6	Rod bearing	Bronze	16	O-ring and anti-extrusion ring	FKM and PTFE	25	Toroidal ring	Steel
7	O-ring and anti-extrusion ring	NBR / FKM and PTFE	17	Seal	FKM	26	Rear cushioning sleeve	Bronze
8	Anti-extrusion ring	PTFE	18	Cushioning adjustment plug	Steel	27	Rear head	Steel / Cast iron

22 SPARE PARTS - SEE TABLE SP-B140

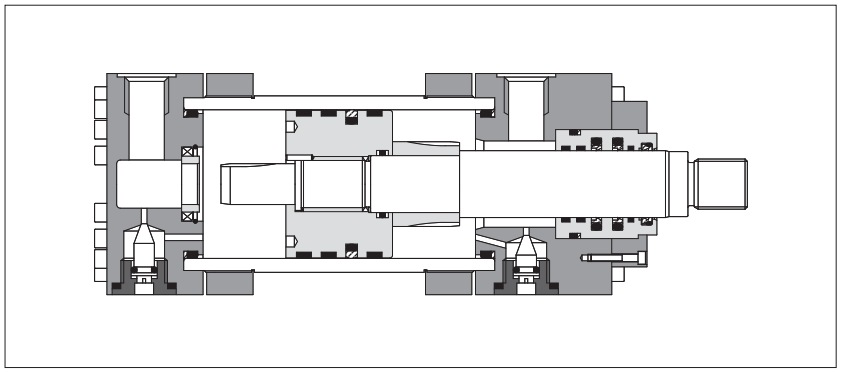
Example for seals spare parts code

G 8 - **C K** - **63** / **28** / **28**

- **G 8** — Sealing system
- **C K** — Cylinder series
- **63** — Bore size [mm]
- **28** — Rod diameter [mm]
- **28** — Second rod diameter for double rod [mm] Omit if not requested

Hydraulic cylinders type CH - big bore sizes

to ISO 6020-3 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CH big bore cylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.

- Bore sizes from **250** to **400** mm
- Strokes up to **5000** mm
- **7** standard mounting styles
- **2** seals options
- **3** piston guides for overload
- Adjustable cushioning
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's choice and sizing criteria **see tab. B015**

SWC Cylinders Designer

Software for assisted selection of Atos cylinders & servocylinders codes, including cylinder's sizing, full technical information, 2D & 3D drawings in several CAD formats.

Available for download at www.atos.com

1 MODEL CODE

CH	F	-	250	/	140	*	0500	-	S	3	0	8	-	A	-	B1E3X1Z3	**

Cylinder series
CH to ISO 6020 - 3

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Bore size, see section 3
from **250** to **400** mm

Rod diameter, see sections 7
from **140** to **220** mm

Stroke, see section 4
up to **5000** mm

Mounting style, see sections 2 and 3

		REF. ISO
C	= fixed clevis	MP1
G	= front trunnion	MT1
L	= intermediate trunnion	MT4 **(3)**
N	= front flange	ME5
P	= rear flange	ME6
S	= fixed eye + spherical bearing	MX5
X	= basic execution	-

Cushioning, see section 10
0 = none
Slow adjustable
1 = rear only
2 = front only
3 = front and rear

Spacer, see section 5
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Sealing system, see section 12
2 = (FKM + PTFE) very low friction and high temperatures
8 = (NBR + PTFE) low friction

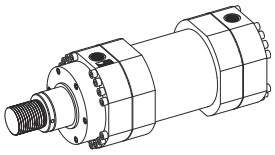
Options (2):
Rod treatment, see section 9
T = induction surface hardening and chrome plating
Air bleeds, see section 13
A = front air bleed
W = rear air bleed
Draining, see section 14
L = rod side draining
Flange oil ports, see section 6
M = front and rear SAE 6000 flange oil ports

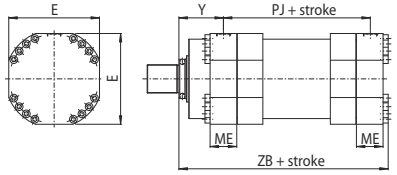
Heads' configuration (2), see section 11
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions
E3 = front head
Z3 = rear head

Series number **(1)**

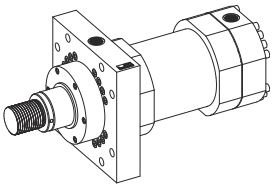
(1) For spare parts request indicate the series number printed on the nameplate only for series < 20
(2) To be entered in alphabetical order
(3) XV dimension must be indicated in the model code, see section 3

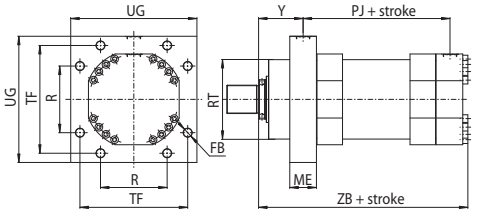
2 **MOUNTING STYLE** - for dimensions see section 3



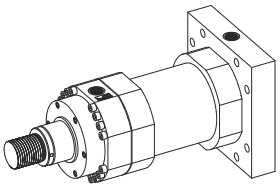


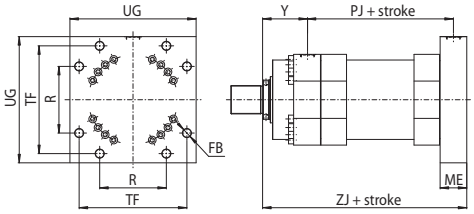
X = basic mounting



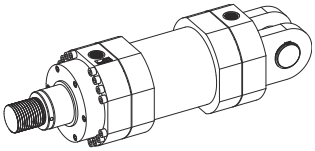


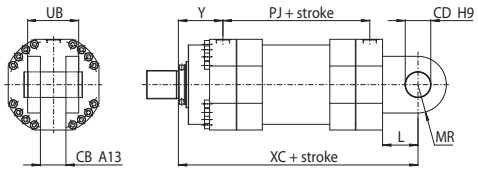
N (ISO MF5) = front flange mounting



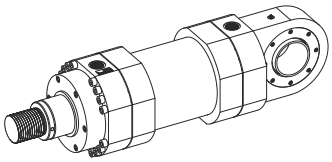


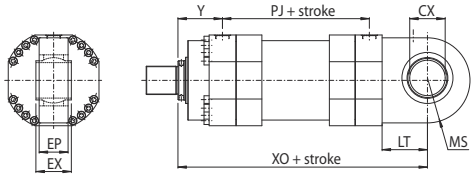
P (ISO MF6) = rear flange mounting



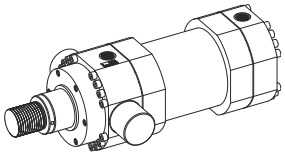


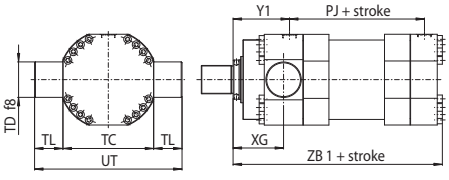
C (ISO MP1) = fixed clevis mounting - supplied with pivot pin C-145



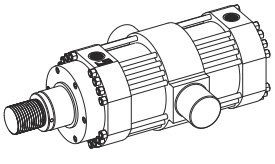


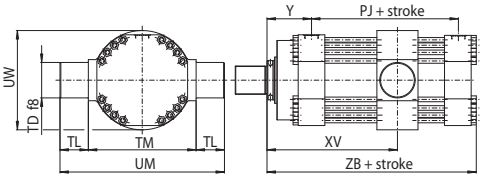
S (ISO MP5) = fixed eye with spherical bearing mounting





G (ISO MT1) = front trunnion mounting





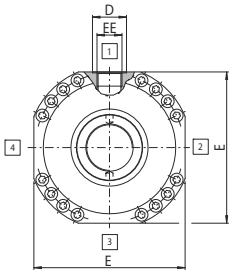
L (ISO MT4) = intermediate trunnion mounting

3 INSTALLATION DIMENSIONS [mm] - see figures in section 2

Ø Bore		250	320	400
Ø Rod		140	180	220
B f9 **(4)**		163	205	245
CB A13		90	110	140
CD H9		90	110	140
CX H7		125	160	200
D (1)		58	58	69
E (2) max		320	400	500
EE (1)		G 1 1/2	G 1 1/2	G 2
EP		102	130	162
EX		125	160	200
F max **(4)**		75	75	75
FB		30	36	45
L min		125	152	195
LT min		160	200	250
ME ref		94	114	140
MR max		100	120	160
MS max		160	200	250
MT (3) [Nm]		350	680	1060
PJ ±1,5 **(6)**		218	252	320
R js13		235	283	340
RD f8 **(4)**		280	325	380
TC h14		320	400	500
TD f8		125	160	200
TF		380	472	588
TL js13		100	125	160
TM h14		380	485	605
UB		180	220	280
UG max		445	549	683
UM ref		580	735	925
UT ref		520	650	820
UW max		480	600	750
VD (4)		8	8	8
VE max **(4)**		83	83	83
WF ±2		110	110	110
XC ±1,5 **(6)**		545	627	775
XG ±2 **(6)**		178	195	215
XO ±1,5 **(6)**		580	675	830
XV (5) ±2 **(6)**	**style L minimun stroke**	20	35	26
	min	275	312	358
	max	255+stroke	273+stroke	332+stroke
Y ±2 **(6)**		157	167	180
Y1 ±2 **(6)**		199	223	260
ZB max **(6)**		460	520	625
ZB1 max **(6)**		505	580	685
ZJ ±1 **(6)**		420	475	580

NOTES TO TABLE 3

(1) **D, EE** - Oil ports and drain are threaded according to GAS standard with counterbore dimension **D** according to ISO 1179-1 (see figure below)



(2) **E** - If not otherwise specified in the figures in section 2, this value is the front and rear round heads dimension for all the mounting styles (see figure above)

(3) **MT** - Screws tightening torque. Mounting screws must be to a minimum strength of ISO 898/2 grade 12.9

(4) See figures in section 7

(5) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CH - 250 / 140 * 0500 - L308 - A - B1E3X1Z3
XV = 300

(6) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is given by the max stroke tolerance in section 4

4 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end. The table below shows the minimum stroke depending to the bore.

Minimum stroke [mm]

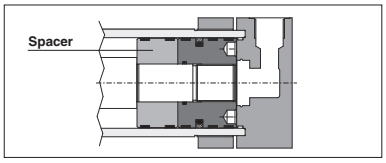
Ø Bore	250	320	400
Minimum stroke	65	70	40

Maximum stroke:
- 5000 mm

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

5 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 3.

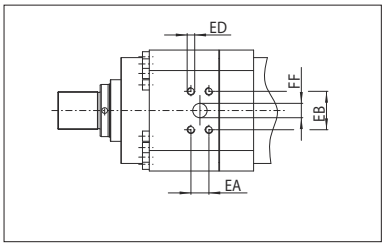


RECOMMENDED SPACERS [mm]

Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

6 SAE 6000 FLANGE OIL PORTS - DIMENSIONS TO ISO 6162-2 [mm]

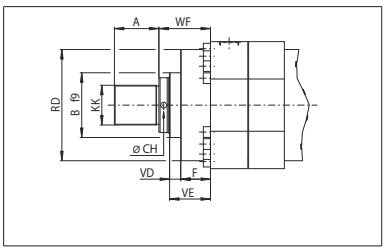
Ø Bore	DN	EA ±0,25	EB ±0,25	ED 6g	FF 0 / -1,5
250	38	36,5	79,3	M16	38
320					
400	51	44,5	96,8	M20	51



7 ROD END DIMENSIONS [mm]

Ø Bore	250	320	400
Ø Rod	140	180	220
A	112	125	160
CH (*)	15	15	15
KK	M100x3	M125x4	M160x4

(*) n°2 holes per key
Note: for B, F, RD, VD, VE and WF dimensions see section 3



8 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "hot rolled steel"; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

9 RODS FEATURES and options

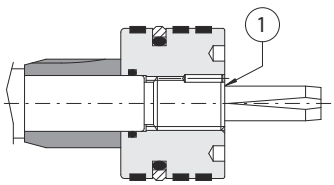
The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure. The rod surface is chrome plated: diameter tolerances f7; roughness Ra ≤ 0,25 µm. Corrosion resistance of 200h in neutral spray to ISO 9227 NSS.

ø Rod	Material	Rs min [N/mm²]	Chrome	
			min thickness [mm]	hardness [HV]
140	alloy-steel	450	0,020	850-1150
180÷220	carbon steel	360	0,045	

The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 7. See **tab. B015** for the calculation of the expected rod fatigue life. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing. **Contact our technical office** in case of heavy duty applications.

Rod hardness can be improved selecting the option **T**:
T = Induction surface hardening and chrome plating (only for rod 140)
• 56-60 HRC (613-697 HV) hardness

ROD-PISTON COUPLING

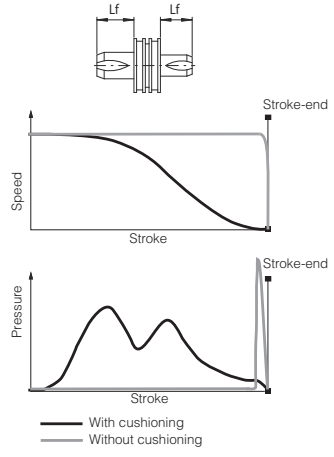


10 CUSHIONING

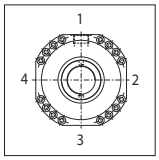
Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessary to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side).
The cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect). In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

Ø Bore		250	320	400
Ø Rod		140	180	220
Cushioning length [mm]	Lf front	50	60	70
	Lf rear	56	64	64

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.



11 POSITION OF THE OIL PORTS AND CUSHIONING ADJUSTMENTS

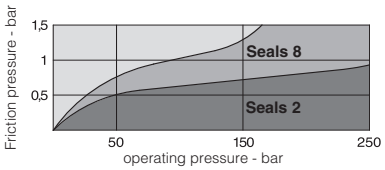


FRONT HEAD: **B1** = oil port position; **E3** = cushioning adjustment position
REAR HEAD: **X1** = oil port position; **Z3** = cushioning adjustment position.
The oil ports and cushioning adjustment positions are only available, respectively, on sides 1 and 3 (see the figure at side).

Example of model code: CH-250/140 *0100-S301 - A - **B1E3X1Z3**

12 SEALING SYSTEM FEATURES

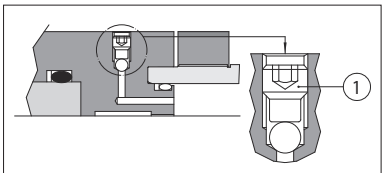
The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed is warmly suggested, see **tab. B015**.
Special sealing system for low temperatures, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 18. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition. See section 15 for fluid requirements.



Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%), HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
8	PTFE + NBR	**low friction**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2

13 AIR BLEEDS

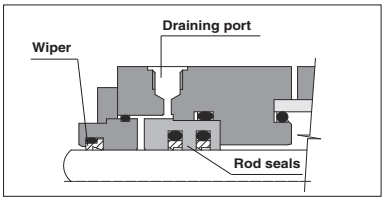
CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely.
Air bleeds are positioned on side 3, see section 11.
For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
250	M8 x 10	20 Nm
320 - 400	M12 x 20	30 Nm

14 DRAINING

CODE: **L** = rod side draining
The rod side draining reduces the seals friction and increases their reliability; it is mandatory for cylinders with strokes longer than 2000 mm, with rod side chamber constantly pressurized and for servocylinders.
The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side). It is recommended to connect the draining port to the tank without backpressure. Draining port is G1/8.



15 FLUID REQUIREMENTS

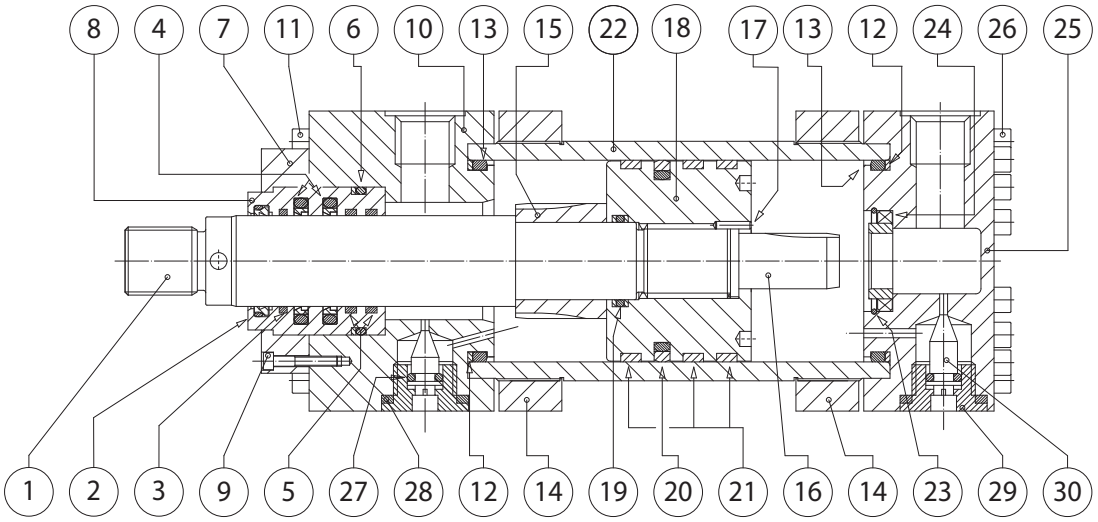
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm²/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

16 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLE X single rod		ADDITIONAL MASSES according to mounting styles and options						
Ø Bore [mm]	**Ø Rod** [mm]	Stroke 100 mm	Each 100 mm more	Styles **C, S**	Style **G**	Style **L**	Styles **N, P**	Front cushioning	Rear cushioning	Each 50 mm spacer
250	**140**	324	27	55	9	110	83	8,5	19	28
320	**180**	485	41	82	16	160	142	11	27	44
400	**220**	902	71	155	34	360	275	17	45	72,4

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

17 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	Chrome plated steel	11	Screw	Steel (grade 12.9)	21	Piston guide ring	PTFE
2	Wiper	NBR / FKM + PTFE	12	Anti-extrusion ring	PTFE	22	Cylinder housing	Steel
3	Rod guide ring	PTFE	13	O-ring	NBR + PTFE	23	Toroidal ring	Steel
4	Rod seal	NBR + PTFE	14	Counterflange	Steel	24	Rear cushioning sleeve	Bronze
5	Rod guide ring	PTFE	15	Front cushioning piston	Steel	25	Rear head	Steel
6	O-Ring + Anti-extrusion ring	NBR / FKM + PTFE	16	Rear cushioning piston	Steel	26	Screw	Steel (grade 12.9)
7	Flange	Steel	17	Screw stop pin	Steel	27	O-Ring + Anti-extrusion ring	NBR / FKM + PTFE
8	Rod bearing	Steel	18	Piston	Steel	28	Seal	FKM
9	Screw	Steel (grade 12.9)	19	O-Ring + Anti-extrusion ring	NBR / FKM + PTFE	29	Cushioning adjustment plug	Steel
10	Front head	Steel	20	Piston seal	NBR / FKM + PTFE	30	Cushioning adjustment screw	Steel

18 SPARE PARTS - SEE TABLE SP-B160

Example for seals spare parts code

G 8	-	C H	-	250	/	140

Sealing system

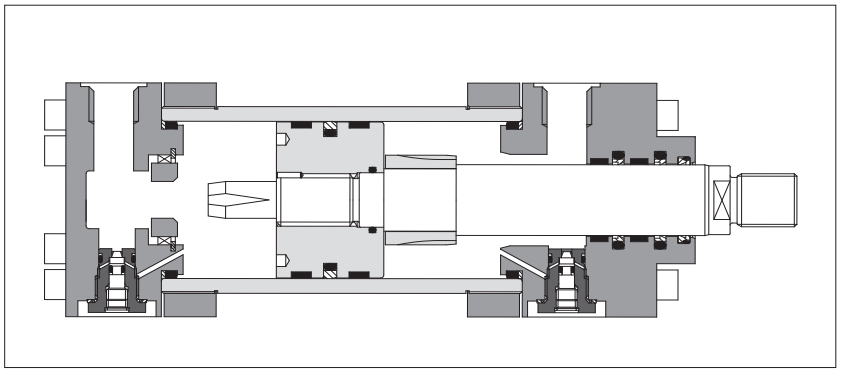
Cylinder series

Bore size [mm]

Rod diameter [mm]

Hydraulic cylinders type CN - round heads with counterflanges

to ISO 6020-1 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



SWC Cylinders Designer
Software for assisted selection of Atos cylinders & servocylinders codes, including cylinder's sizing, full technical information, 2D & 3D drawings in several CAD formats.

Available for download at www.atos.com

CN cylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.

- Bore sizes from **40** to **200** mm
- **2** rod diameters per bore
- Strokes up to **5000** mm
- Rods with **rolled threads**
- **9** standard mounting styles
- **3** seals options
- Rod guide rings for low wear
- Adjustable or fixed cushioning
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's choice and sizing criteria **see tab. B015**

1 MODEL CODE

CN	F	-	50	/	28	*	0500	-	S	3	0	8	-	A	-	B1E3X1Z3	**

Series number

Cylinder series
CN to ISO 6020 - 1

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Bore size, see section 4
from **40** to **200** mm

Rod diameter, see sections 7 and 9
from **22** to **140** mm

Stroke, see section 5
up to **5000** mm

Mounting style, see sections 2 and 4

	REF. ISO
A = front round flange	MF3
B = rear round flange	MF4
D = fixed eye	MP3
E = feet	MS2
L = intermediate trunnion	MT4 **(2)**
N = front square flange	MF1
P = rear square flange	MF2
S = fixed eye + spherical bearing	MP5
X = basic execution	-

Cushioning, see section 10
0 = none

Slow adjustable	Slow fixed
1 = rear only	**7** = rear only
2 = front only	**8** = front only
3 = front and rear	**9** = front and rear

Spacer, see section 6
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

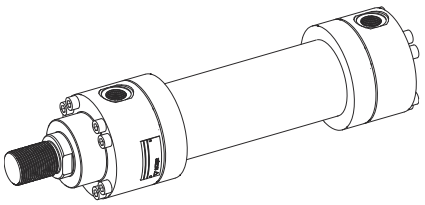
Sealing system, see section 12
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
8 = (NBR + PTFE and POLYURETHANE) low friction

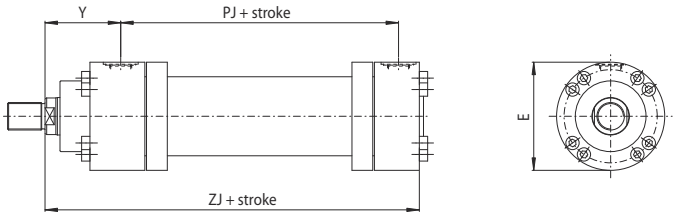
Options (1):
Oversized oil ports, see section 4
D = front oversized oil port
Y = rear oversized oil port
Rod treatment, see section 9
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds, see section 13
A = front air bleed
W = rear air bleed
Flange oil ports, see section 3
M = front and rear SAE 6000 flange oil ports

Heads' configuration (1), see section 11
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E3 = front head*
Z3 = rear head*
* = enter E2 and Z2 for mounting style E

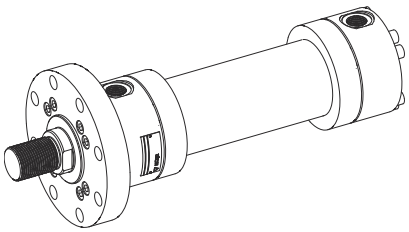
(1) To be entered in alphabetical order
(2) XV dimension must be indicated in the model code, see section 4

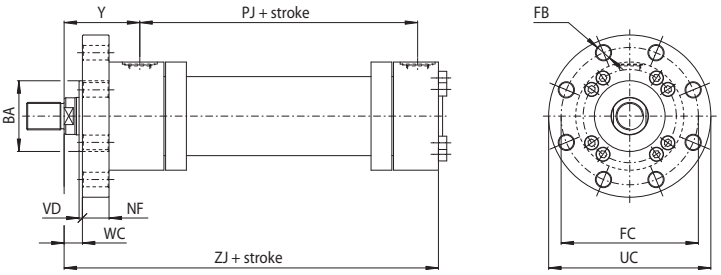
2 **MOUNTING STYLE** - for dimensions see section 4



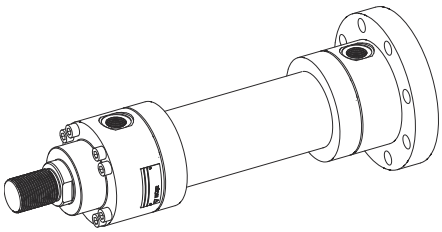


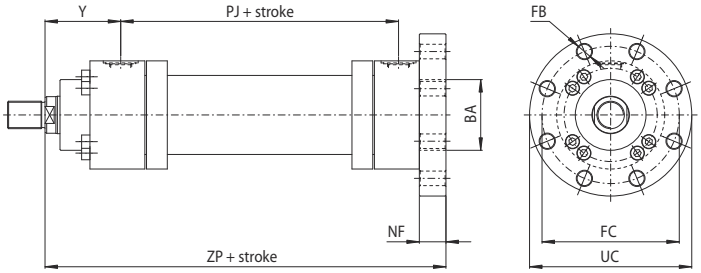
X = basic mounting



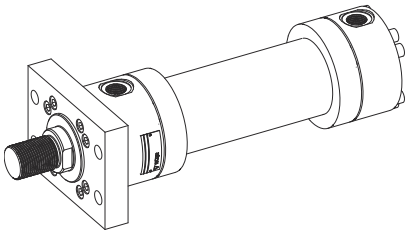


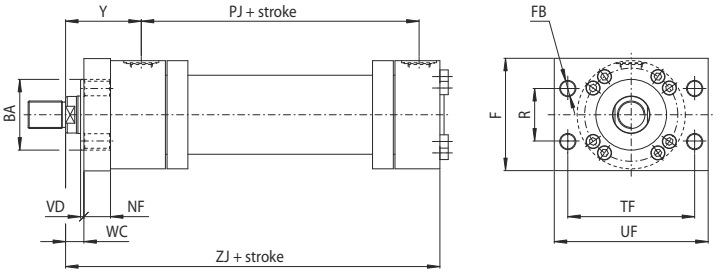
A (ISO MF3) = front round flange mounting



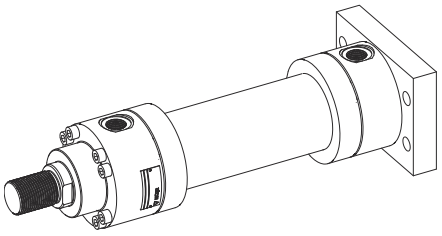


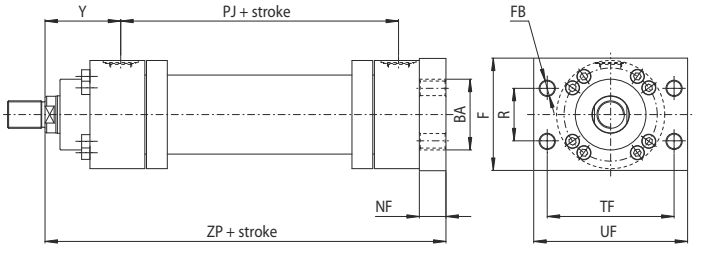
B (ISO MF4) = rear round flange mounting



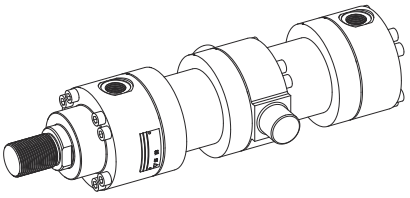


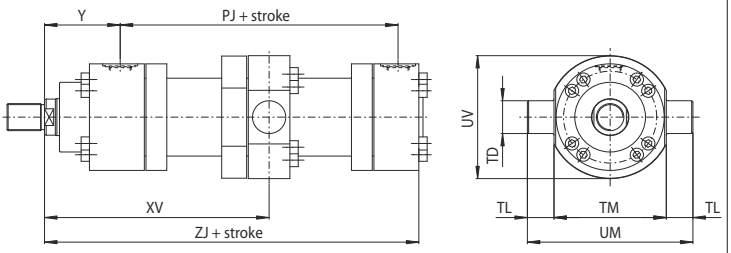
N (ISO MF1) = front square flange mounting (not for bores 160 - 200)



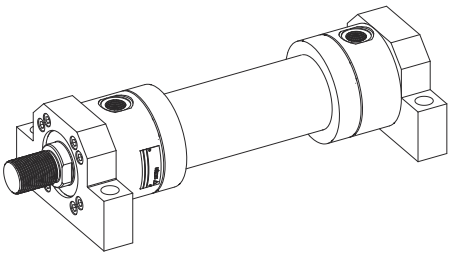


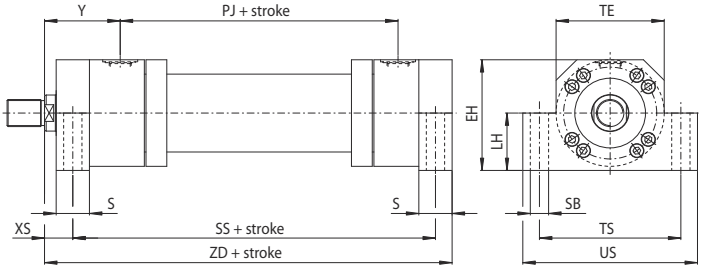
P (ISO MF2) = rear square flange mounting (not for bores 160 - 200)



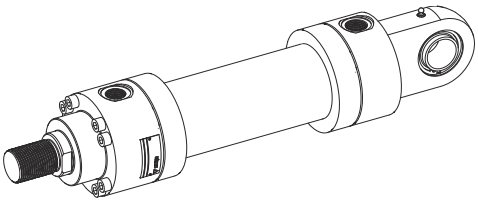


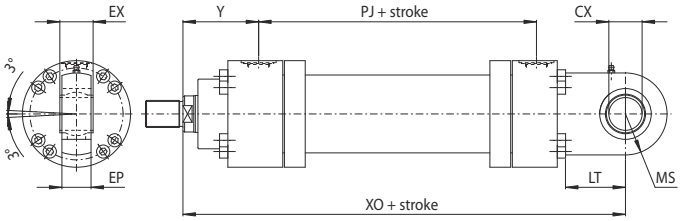
L (ISO MT4) = intermediate trunnion mounting



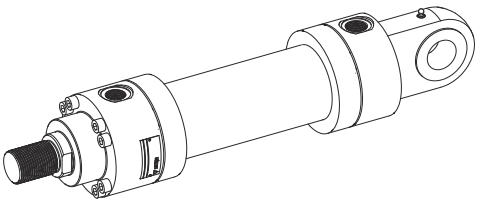


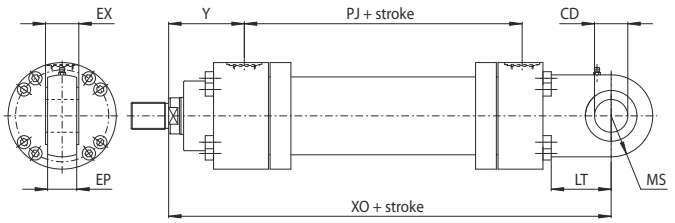
E (ISO MS2) = side feet mounting





S (ISO MP5) = fixed eye with spherical bearing mounting

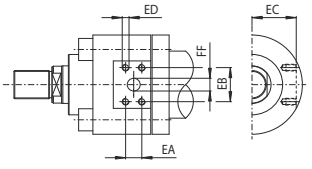




D (ISO MP3) = fixed eye mounting

3 SAE 3000 FLANGE OIL PORTS - DIMENSIONS TO ISO 6162-1 [mm]

Ø Bore	DN	EC	EA ±0,25	EB ±0,25	ED 6g	FF 0 / -1,5
63	13	50	17.5	38.1	M8x1.25	13
80		58				
100	19	71	22.3	47.6	M10x1.5	19
125		89				
160	25	113	26.2	52.4	M10x1.5	25
200		137				



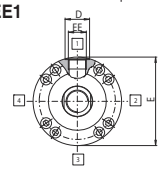
SAE 3000 flange not available for bores 40 and 50

4 INSTALLATION DIMENSIONS [mm] - see figures in section 2

Ø Bore		40	50	63	80	100	125	160	200
Ø Rod	Standard	22	28	36	45	56	70	90	110
	Differential	28	36	45	56	70	90	110	140
B / BA f8/H8		50	60	70	85	106	132	160	200
CD / CX H9/H7		20	25	32	40	50	63	80	100
D (1) min		29	29	36	36	42	42	52	52
D1 (1) min		36	36	42	42	52	52	58	58
E (2) max		78	95	116	130	158	192	238	285
EE (1)		G 1/2	G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4	G 1 1/4
EE1 (1)		G 3/4	G 3/4	G 1	G 1	G 1 1/4	G 1 1/4	G 1 1/2	G 1 1/2
EH max		82	100	120	135	161	196	238	288
EP		18	22	27	35	40	52	66	84
EX h12		20	25	32	40	50	63	80	100
F max		80	100	120	135	160	195	NA	NA
FB H13		9	11	13.5	17.5	22	22	22	26
FC js13		106	126	145	165	200	235	280	340
LH h10		43	52	62	70	82	100	119	145
LT min		25	32	40	50	63	71	90	112
MS max		25	32	40	50	63	71	90	112
MT [Nm] (3)		40	78	137	78	137	226	471	471
NF js13		16	20	25	32	32	32	36	40
PJ (5)		97	111	117	134	162	174	191	224
R js13		40.6	48.2	55.5	63.1	76.5	90.2	NA	NA
S js13		25	32	32	40	50	56	60	72
SB H13		11	14	18	22	26	33	33	39
SS (5)		183	199	211	236	293	321	364	447
TD f8		20	25	32	40	50	63	80	100
TE js13		78	95	116	130	158	192	238	285
TF js13		98	116.4	134	152.5	184.8	217.1	NA	NA
TL js13		16	20	25	32	40	50	63	80
TM h12		90	105	120	135	160	195	240	295
TS js13		100	120	150	170	205	245	295	350
UC max		125	148	170	195	238	272	316	385
UF max		115	140	160	185	225	255	NA	NA
UM		122	145	170	199	240	295	366	455
US max		120	145	180	210	250	300	350	415
UV		90	108	124	150	180	219	280	333
VD		3	4	4	4	5	5	5	5
WC (5)		16	18	20	22	25	28	30	35
XO (5)		231	257	289	332	395	428	505	615
XS (5)		19.5	22	29	34	32	32	36	39
XV (4) (5)	minimum stroke for style L	55	55	85	90	110	135	170	190
	min	155	160	190	215	255	290	340	420
	max	100+stroke	105+stroke	105+stroke	125+stroke	145+stroke	155+stroke	170+stroke	230+stroke
Y (5)		71	72	82	91	108	121	143	190
ZD		215	237	256	290	350	381	430	522
ZP (5)		206	225	249	282	332	357	406	490
ZJ (5)		190	205	224	250	300	325	370	450

NOTES TO TABLE 4

(1) **D, EE** - Oil ports are threaded according to GAS standard with counterbore dimension **D** according to ISO 1179-1 (see figure below). When oversized oil ports are selected (**D** = front oversized oil ports, **Y** = rear oversized oil ports) dimensions **D** and **EE** are respectively modified into **D1** and **EE1**



(2) **E** - If not otherwise specified in the figures in section 2, this value is the front and rear round heads dimension for all the mounting styles (see figure above)

(3) **MT** - Screws tightening torque. Mounting screws must be to a minimum strength of ISO 898/2 grade 12.9

(4) **XV** - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table. The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CN - 50 / 28 * 0500 - L308 - A - B1E3X1Z3
XV = 200

(5) The tolerance is according to the table below

Mounting dimensions	ZJ, ZP, XO, SS, PJ	WF, WC, XV, XS, Y
stroke < 1250	±1,5	±2
1250 > stroke < 3150	±3	±4
stroke > 3150	±5	±8

5 STROKE SELECTION

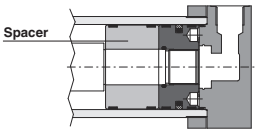
Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end.

Maximum stroke:
- 5000 mm

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

6 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 4.

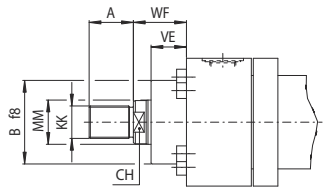


RECOMMENDED SPACERS [mm]

Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

7 ROD END DIMENSIONS [mm]

Ø Bore	40	50	63	80	100	125	160	200
VE max	19	24	29	36	37	37	41	45
WF	32	38	45	54	57	60	66	75
Ø Rod Standard	**22**	**28**	**36**	**45**	**56**	**70**	**90**	**110**
A max	22	28	36	45	56	63	85	95
CH	19	22	30	39	48	62	80	100
KK 6g	M16x1,5	M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x3	M80x3
Ø Rod Differential	**28**	**36**	**45**	**56**	**70**	**90**	**110**	**140**
A max	28	36	45	56	63	85	95	112
CH	22	30	39	48	62	80	100	128
KK 6g	M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x3	M80x3	M100x3



8 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "cold drawn and stressed steel"; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

9 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure.
The rod surface is chrome plated: diameter tolerances f7, roughness Ra ≤ 0,25 µm. Corrosion resistance of 200 h in neutral spray to ISO 9227 NSS.

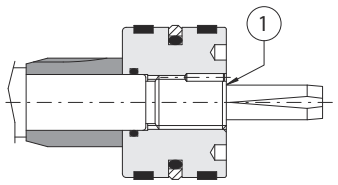
ø Rod	Material	Rs min [N/mm²]	Chrome	
			min thickness [mm]	hardness [HV]
22÷90	hardened and tempered alloy-steel	700	0,020	850-1150
110÷140	alloy steel	450		

Rod diameters from 22 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life. **Contact our technical office** in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):
K = Nickel and chrome-plating (for rods from 22 to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

T = Induction surface hardening and chrome plating
- 56-60 HRC (613-697 HV) hardness

ROD-PISTON COUPLING



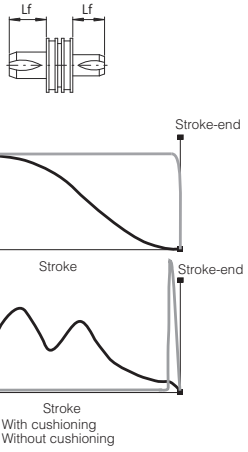
The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 7. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing.

10 CUSHIONING

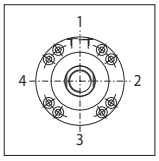
Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessary to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). See the **tab. B015** for the max damping energy.
When fast adjustable versions are selected, the cylinder is provided with needle valve to optimize cushioning peformances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

Ø Bore		40		50		63		80		100		125		160		200	
Ø Rod		22	28	28	36	36	45	45	56	56	70	70	90	90	110	110	140
Cushioning length [mm]	Lf front	25	25	29	29	29	29	27	27	26	26	27	27	34	34	34	49
	Lf rear	30		30		32		32		32		41		56		56	

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.



11 POSITION OF THE OIL PORTS AND CUSHIONING ADJUSTMENTS



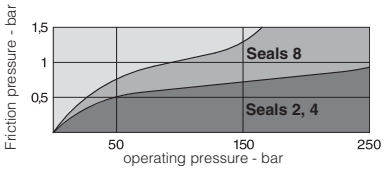
FRONT HEAD: **B1** = oil port position; **E*** = cushioning adjustment position
REAR HEAD: **X1** = oil port position; **Z*** = cushioning adjustment position.
The oil ports and cushioning adjustments positions are available , respectively, on sides 1 and 3 for all styles except E (see the figure at side): the style E has the cushioning adjustments on side 2. Cushioning adjustment positions **E***, **Z*** have to be entered only if adjustable cushioning are selected.

Example of model code: CN-50/28 *0500-S308 - A - **B1E3X1Z3**

12 SEALING SYSTEM FEATURES

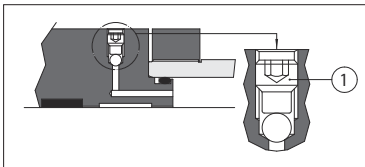
Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%) HFD-U, HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
8	NBR + PTFE + POLYURETHANE	**low friction**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 7425/2

The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed is warmly suggested, see **tab. B015**.
Special sealing system for low temperature, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 17. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition.
See section 14 for fluid requirements.



13 AIR BLEEDS

CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely.
Air bleeds are positioned on side 3 for all styles except E: the style E has the air bleeds on side 2, see section 11.
For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
40 - 200	M8 x 10	20 Nm

14 FLUID REQUIREMENTS

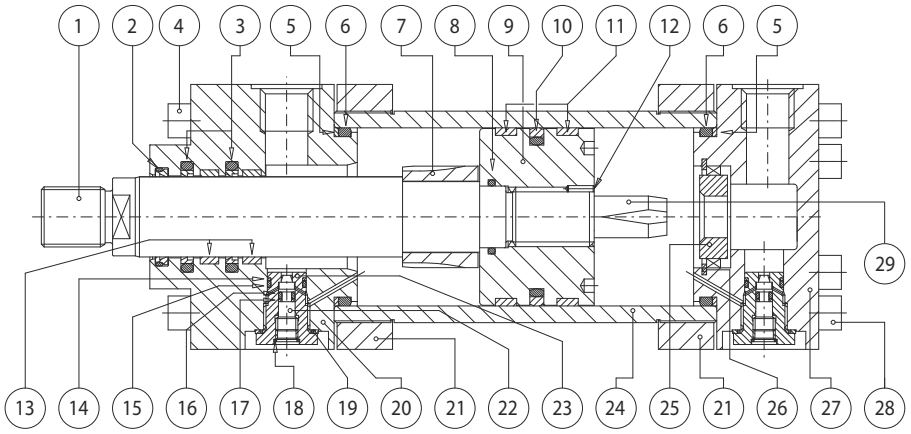
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm²/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

15 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLE X		ADDITIONAL MASSES according to mounting styles and options							
Ø Bore [mm]	**Ø Rod** [mm]	Stroke 100 mm	Each 100 mm more	Styles **A, B**	Style **E**	Style **L**	Styles **N, P**	Styles **D, S**	Front cushioning	Rear cushioning	Each 50 mm spacer
40	**22**	7,36	1,18	1,16	1,16	1,58	0,82	0,29	0,09	0,50	0,93
	28	7,60	1,36								
50	**28**	12	1,55	2	3,80	2,87	1,54	0,64	0,20	0,80	1,30
	36	12,50	1,86								
63	**36**	19,50	2,30	3,28	5,80	4,54	2,70	1,32	0,30	1	1,97
	45	20	2,75								
80	**45**	28	2,87	5,26	9,04	6,79	4,30	2,36	0,50	1	2,78
	56	28,50	3,55								
100	**56**	48,50	4,65	7,76	15,72	10,36	5,96	4,76	0,80	1,50	4,43
	70	49,50	5,73								
125	**70**	76,50	7,26	9,76	24,68	18,14	8,08	7,28	1,20	2	6,93
	90	78,50	9,23								
160	**90**	126	11,47	14,54	38,16	35	NA	15,64	1,70	3	11,13
	110	128,50	13,93								
200	**110**	233,50	18,31	22,66	63,36	58,88	NA	32,20	2,50	5	17,75
	140	238	22,94								

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

16 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	Chrome plated steel	11	Piston guide rings	PTFE	21	Counterflange	Steel
2	Wiper	NBR / FKM and PTFE	12	Screw stop pin	Steel	22	Cushioning adjustment screw	Steel
3	Rod seal	NBR / FKM and PTFE	13	Rod guide rings	Phenolic resin	23	Cushioning adjustment plug	Steel
4	Screw	Steel class 12.9	14	Anti-extrusion ring	PTFE	24	Cylinder housing	Steel
5	Anti-extrusion ring	PTFE	15	O-ring	FKM	25	Rear cushioning sleeve	Bronze
6	O-ring	NBR / FKM	16	O-ring	FKM	26	Toroidal ring	Steel
7	Front cushioning piston	Steel	17	Anti-extrusion ring	PTFE	27	Rear head	Steel / Cast iron
8	O-ring	NBR / FKM	18	Seeger	Steel	28	Screw	Steel class 12.9
9	Piston	Steel	19	Seal	FKM	29	Rear cushioning piston	Steel
10	Piston seal	NBR / FKM and PTFE	20	Front head	Steel / Cast iron			

17 SPARE PARTS - SEE TABLE SP-B180

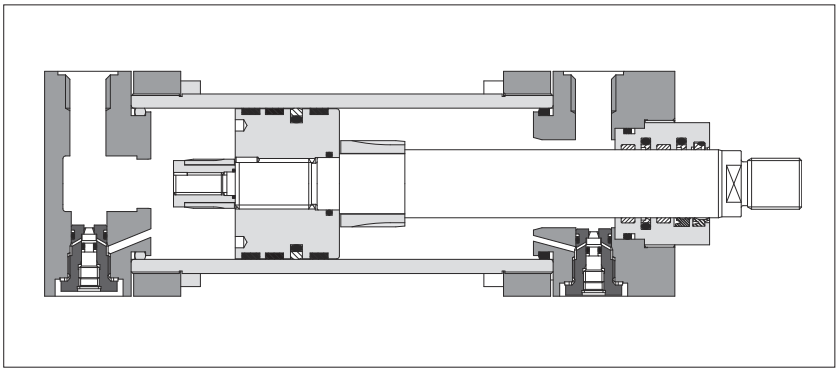
Example for seals spare parts code

G 8 - **C N** - **50** / **28**

- **G 8** — Sealing system
- **C N** — Cylinder series
- **50** — Bore size [mm]
- **28** — Rod diameter [mm]

Hydraulic cylinders type CC - round heads with counterflanges

to ISO 6022 - nominal pressure 25 MPa (250 bar) - max 32 MPa (320 bar)



CC cylinders have engineered double acting construction, designed to suit the requirements of industrial heavy duty applications: top reliability, high performances and long working life.

- Bore sizes from **50** to **320** mm
- Rods with **rolled threads**
- **6** standard mounting styles
- **3** seals options
- Adjustable cushioning
- Rod guide rings for low wear
- Optional built-in position transducer, **see tab. B310**
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's choice and sizing criteria **see tab. B015**

SWC Cylinders Designer
Software for assisted selection of Atos cylinders & servocylinders codes, including cylinder's sizing, full technical information, 2D & 3D drawings in several CAD formats.

Available for download at www.atos.com

1 MODEL CODE

CC	P	-	50	/	36	*	0500	-	S	3	0	1	-	A	-	B1E3X1Z3	**

Cylinder series
CC to ISO 6022

Rod position transducer
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Bore size, see section 3
from **50** to **320** mm

Rod diameter, see sections 7 and 9
from **36** to **220** mm

Stroke, see section 4
up to **5000** mm

Mounting style, see sections 2 and 3

		REF. ISO
A	=front flange	MF3
B	=rear flange	MF4
L	=intermediate trunnion	MT4 **(3)**
S	=fixed eye with spherical bearing	MP5
X	=basic execution	-
Z	=front threaded holes	MX5

Cushioning, see section 10
0 = none
Slow adjustable
1 = rear only
2 = front only
3 = front and rear

Spacer, see section 5
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Sealing system, see section 12
1 = (NBR + PTFE + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds

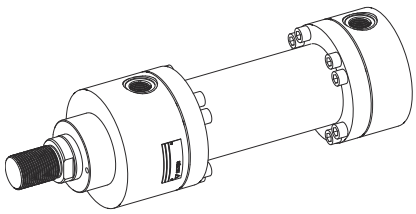
Options (2):
Oversized oil ports, see section 3
D = front oversized oil port
Y = rear oversized oil port
Flange oil ports, see section 6
M = front and rear SAE 6000 flange oil ports
Rod treatment, see section 9
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds, see section 13
A = front air bleed
W = rear air bleed
Draining, see section 14
L= rod side draining

Heads' configuration (2), see section 11
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions
E3 = front head
Z3 = rear head

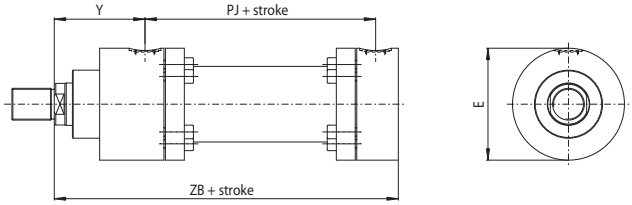
Series number **(1)**

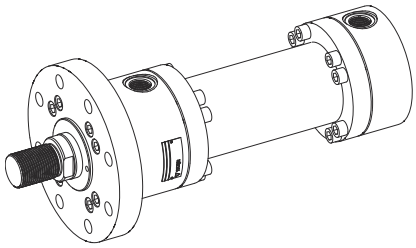
(1) For spare parts request indicate the series number printed on the nameplate only for series < 20
(2) To be entered in alphabetical order
(3) XV dimension must be indicated in the model code, see section 3

2 **MOUNTING STYLE** - for dimensions see section 3

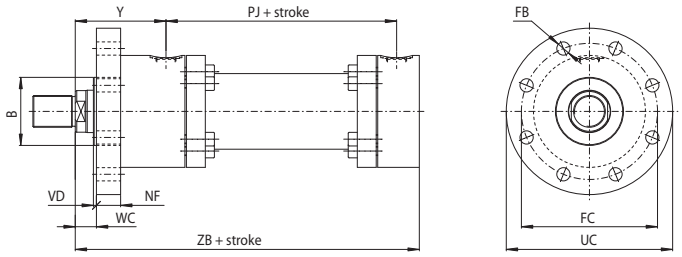


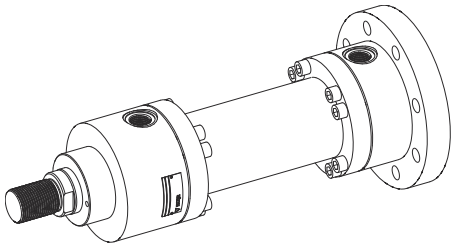
X = basic mounting



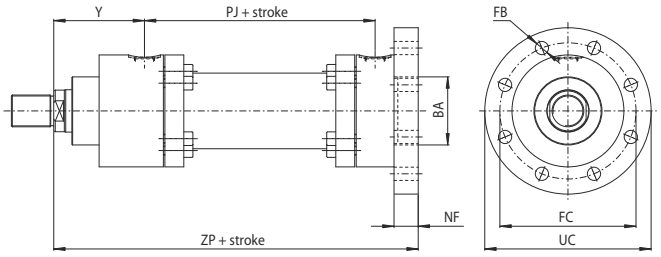


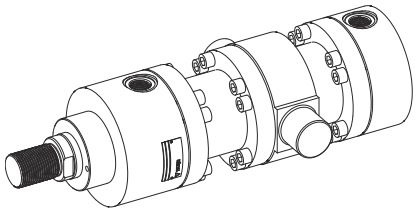
A (ISO MF3) = front flange mounting



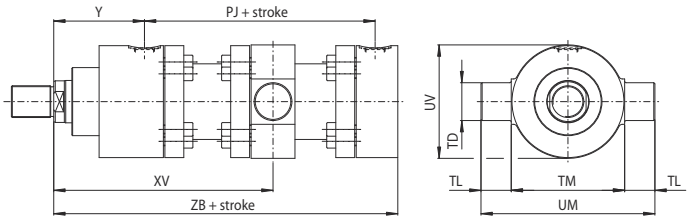


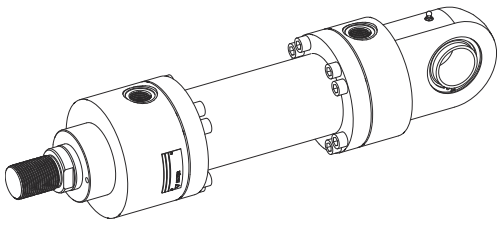
B (ISO MF4) = rear flange mounting



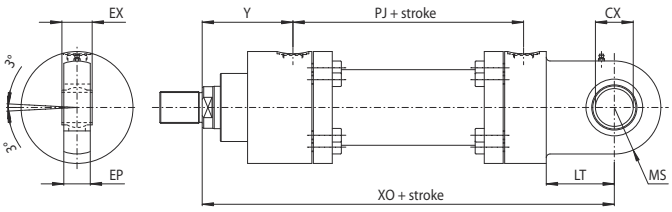


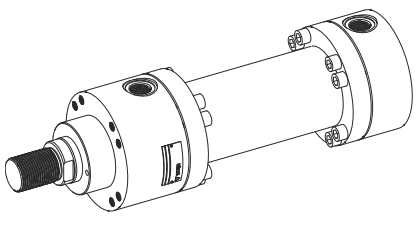
L (ISO MT4) = intermediate trunnion mounting



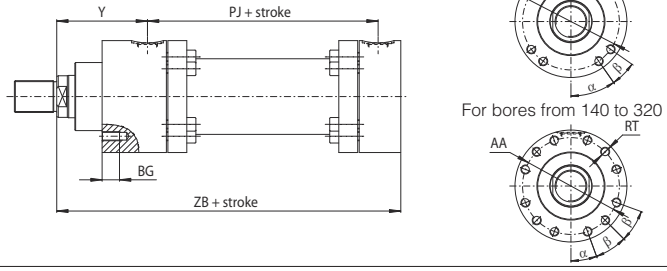


S (ISO MP5) = fixed eye with spherical bearing mounting





Z = front threaded holes mounting

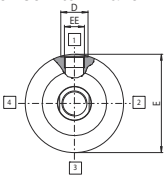


3 INSTALLATION DIMENSIONS [mm] - see figures in section 2

Ø Bore		50	63	80	100	125	140	160	180	200	250	320
Ø Rod		36	45	56	70	90	90	110	110	140	180	220
α, β		32,5°, 25°	32°, 26°	35°, 20°	35°, 20°	35°, 20°	27,5°, 17,5°	25°, 20°	25°, 20°	25°, 20°	27°, 18°	25°, 20°
AA		90	105	128	152	188	215	241	275	295	365	458
B / BA f8/H8 **(4)**		63	75	90	110	132	145	160	185	200	250	320
BG min		20	23	23	30	33	33	43	40	40	58	70
CX H7		32	40	50	63	80	90	100	110	125	160	200
D (1)		29	36	36	42	42	52	52	52	52	58	58
D1 (1)		36	42	42	52	52	58	58	58	58	69	69
E max **(2)**		108	124	148	175	214	255	270	315	330	412	510
EE (1) 6g		G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4	G 1 1/4	G 1 1/4	G 1 1/4	G 1 1/2	G 1 1/2
EE1 (1) 6g		G 3/4	G1	G 1	G 1 1/4	G 1 1/4	G 1 1/2	G 1 1/2	G 1 1/2	G 1 1/2	G 2	G 2
EP		27	35	40	52	66	65	84	88	102	130	162
EX h12		32	40	50	63	80	90	100	110	125	160	200
FB H13		13,5	13,5	17,5	22	22	26	26	33	33	39	45
FC js13		132	150	180	212	250	300 **(7)**	315	365 **(7)**	385	475	600
LT min		40	50	63	71	90	113	112	135	160	200	250
MS max		40	50	63	71	90	113	112	118	160	200	250
MT [Nm] **(3)**		30	50	85	152	255	255	304	370	490	950	1750
NF js13		25	28	32	36	40	40	45	50	56	63	80
PJ (6)		120	133	155	171	205	208	235	250	278	325	350
RT		n°8 holes M8	n°8 holes M10	n°8 holes M12	n°8 holes M14	n°8 holes M16	n°12 holes M16	n°12 holes M18	n°12 holes M20	n°12 holes M22	n°12 holes M27	n°12 holes M33
TD f8		32	40	50	63	80	90	100	110	125	160	200
TL js13		25	32	40	50	63	70	80	90	100	125	160
TM h12		112	125	150	180	224	265	280	320	335	425	530
UC max		160	180	215	260	300	340	370	425	455	545	680
UM		162	189	230	280	350	405	440	500	535	675	850
UV max		108	124	150	180	219	260	280	315	333	412	510
VD		4	4	4	5	5	5	5	5	5	8	8
VE max **(4)**		29	32	36	41	45	45	50	55	61	71	88
WC (6)		22	25	28	32	36	36	40	45	45	50	56
WF (4) (6)		47	53	60	68	76	76	85	95	101	113	136
XO (6)		305	348	395	442	520	580	617	690	756	903	1080
XV (5) (6)	**minimum stroke for style L**	175	185	150	160	245	250	260	350	390	460	560
	min	260	285	290	320	410	440	465	540	590	690	820
	max	85 + stroke	100 + stroke	140 + stroke	160 + stroke	165 + stroke	190 + stroke	205 + stroke	190 + stroke	200 + stroke	230 + stroke	260 + stroke
Y ±2		98	112	120	134	153	181	185	205	220	260	310
ZB max		244	274	305	340	396	430	467	505	550	652	764
ZP (6)		265	298	332	371	430	465	505	550	596	703	830

NOTES TO TABLE 3

(1) D, EE - Oil ports and drain are threaded according to GAS standard with counterbore dimension **D** according to ISO 1179-1 (see figure below).
When oversized oil ports are selected (**D** = front oversized oil ports, **Y** = rear oversized oil ports) dimensions **D** and **EE** are respectively modified into **D1** and **EE1**



(2) E - If not otherwise specified in the figures in section 2 this value is the front and rear round heads dimension for all the mounting styles (see figure above)

(3) MT - Screws tightening torque. Mounting screws must be to a minimum strength of ISO 898/2 grade 12.9

(4) B, VE, WF - See figure in section 7

(5) XV - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.
The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CC - 50 / 36 * 0500 - L308 - A -B1E3X1Z3
XV = 300

(6) The tolerance is according to the table below

Mounting dimensions	PJ, ZP, XO	WF, WC, XV
stroke < 1250	±1,5	±2
1250 > stroke < 3150	±3	±4
stroke > 3150	±5	±8

(7) The dimension is not according to ISO 6022

4 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end. The table below shows the minimum stroke depending to the bore.

Minimum stroke [mm]

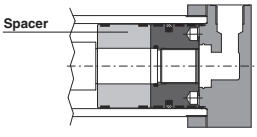
Ø Bore	50	63	80	100	125	140
Minimum stroke	70	70	20	25	50	50
Ø Bore	**160**	**180**	**200**	**250**	**320**	
Minimum stroke	50	70	70	80	120	

Maximum stroke:
- 5000 mm

Stroke tolerances:
- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

5 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in section 3.



RECOMMENDED SPACERS [mm]

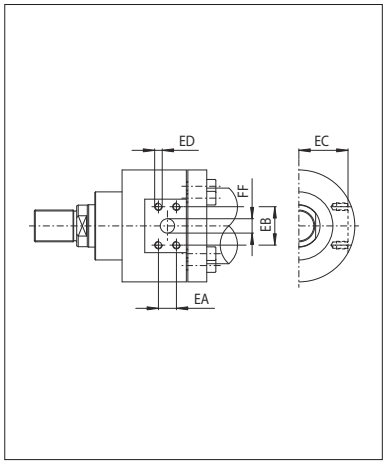
Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 5000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

6 SAE 6000 FLANGE OIL PORTS - DIMENSIONS TO ISO 6162-2 [mm]

Ø Bore	DN	EC	EA ±0,25	EB ±0,25	ED 6g	FF 0 / -1,5
50 (*)	13	46	18,2	40,5	M8x1,25	13
63 (*)	19	51	23,8	50,8	M10x1,5	19
80		65				
100	25	77	27,8	57,2	M12x1,75	25
125		99				
140	32	118	31,6	66,6	M14x2 (**)	32
160		126				
180		150				
200		158				
250	38	195	36,7	79,3	M16x2	38
320	51	245	44,5	96,8	M20x2,5	51

(*) SAE flange not available for style B (ISO MF4)
(**) Not compliance to ISO 6162-2

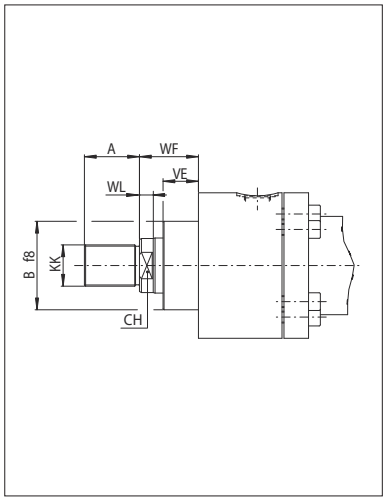
CODE: **M** = Front and rear SAE 6000 flange oil ports
Flange oil port allows an easy cylinder's connection to the piping system and it can work up to the maximum pressure 32 MPa (320 bar).



7 ROD END DIMENSIONS [mm]

Ø Bore	50	63	80	100	125	140	160	180	200	250	320
Ø Rod	**36**	**45**	**56**	**70**	**90**	**90**	**110**	**110**	**140**	**180**	**220**
A max	36	45	56	63	85	90	95	105	112	125	160
CH	30	39	48	62	80	75	100	100	128	15 (*)	20 (*)
KK 6g	M27x2	M33x2	M42x2	M48x2	M64x3	M72x3	M80x3	M90x3	M100x3	M125x4	M160x4
WL min	8	10	10	10	15	15	15	15	15	-	-

(*) n° 2 holes per key



8 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in different materials depending to the bore; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

ø Bore	Material	Rs min [N/mm²]
50÷200	Cold drawn and stressed steel	450
250-320	Hot rolled steel	355

9 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure.
The rod surface is chrome plated: diameter tolerances f7, roughness Ra ≤ 0,25 µm. Corrosion resistance of 200h in neutral spray to ISO 9227 NSS.

ø Rod	Material	Rs min [N/mm²]	Chrome	
			min thickness [mm]	hardness [HV]
36÷110	Hardened and tempered alloy-steel	700	0,020	850-1150
140	Alloy steel	450		
180÷220	Carbon steel	360	0,045	850-1150

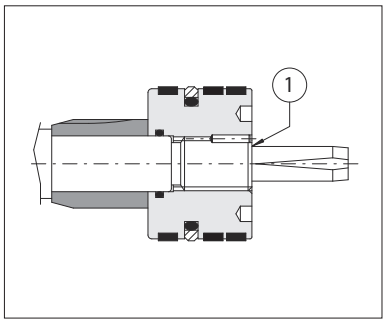
Rod diameters from 36 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life.
Contact our technical office in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):

K = Nickel and chrome-plating (for rods from 36 to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

T = Induction surface hardening and chrome plating (for rods up to 140 mm)
- 56-60 HRC (613-697 HV) hardness

ROD-PISTON COUPLING



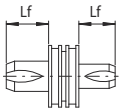
The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the table 7. The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing.

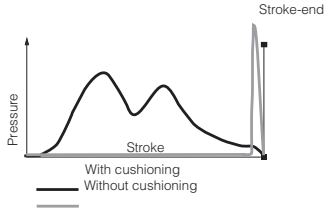
10 CUSHIONING

Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is necessary to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). See the **tab. B015** for the max damping energy.
The cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

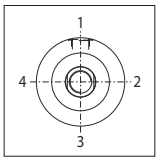
Ø Bore		**50**	**63**	**80**	**100**	**125**	**140**	**160**	**180**	**200**	**250**	**320**
Ø Rod		**36**	**45**	**56**	**70**	**90**	**90**	**110**	**110**	**140**	**180**	**220**
Cushioning length [mm]	Lf front	29	40	45	50	60	60	64	64	64	80	100
	Lf rear	35	38	45	50	60	60	64	64	64	64	64

Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.





11 POSITION OF THE OIL PORTS AND CUSHIONING ADJUSTMENTS

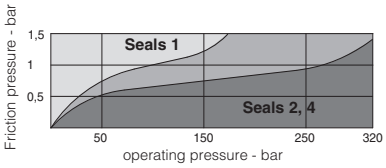


FRONT HEAD: **B1** = oil port position; **E3** = cushioning adjustment position
REAR HEAD: **X1** = oil port position; **Z3** = cushioning adjustment position.
The oil ports and cushioning adjustment positions are only available, respectively, on sides 1 and 3 (see figure at side).

Example of model code: CC-200/140 *0100-S301 - A - **B1E3X1Z3**

12 SEALING SYSTEM FEATURES

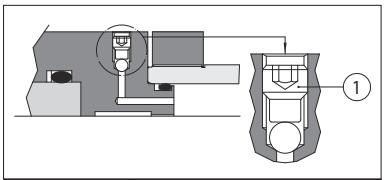
The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed is warmly suggested, see **tab. B015**.
Special sealing system for low temperature, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see section 18. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition. See section 15 for fluid requirements.



Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
1	NBR + PTFE + POLYURETHANE	**high static and dynamic sealing**	0,5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%), HFD-U, HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2

13 AIR BLEEDS

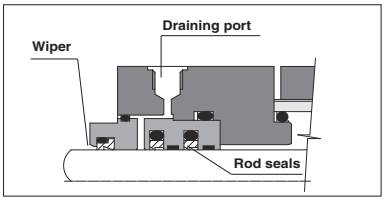
CODES: **A** = front air bleed; **W** = rear air bleed
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves are recommended to realize this operation easily and safely.
Air bleeds are positioned on side 3, see section 11.
For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
50÷200	M8 x 10	20 Nm
250÷320	M12 x 20	30 Nm

14 DRAINING

CODE: **L** = rod side draining
The rod side draining reduces the seals friction and increases their reliability; it is mandatory for cylinders with strokes longer than 2000 mm, with rod side chamber constantly pressurized and for servocylinders.
The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side). It is recommended to connect the draining port to the tank without backpressure.
Draining port is G1/8.



15 FLUID REQUIREMENTS

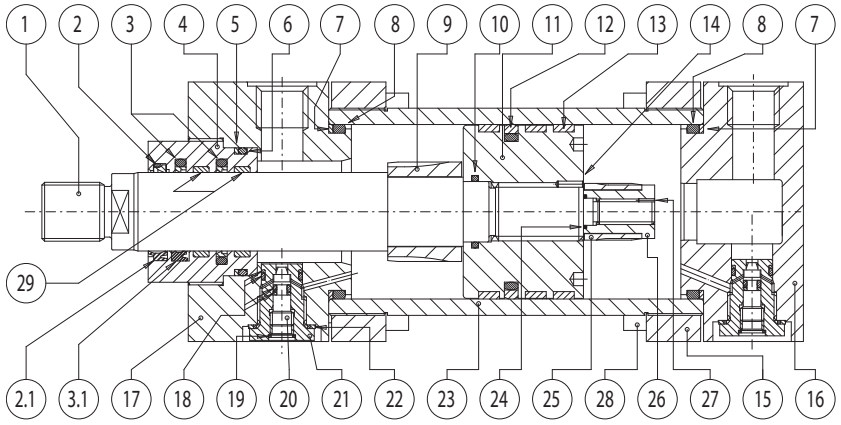
Cylinders and servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm²/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog.

16 CYLINDERS MASSES [kg] (tolerance ± 5%)

		MASS FOR STYLE X for single rod		ADDITIONAL MASSES depending on mounting styles and options					
Ø Bore [mm]	**Ø Rod** [mm]	for 100 mm stroke	each 100 mm more	Styles **A, B**	Style **L**	Style **S**	front cushioning	rear cushioning	each 50 mm spacer
50	**36**	18	1,9	2,77	3,15	1	0,2	1	1,3
63	**45**	20,1	2,75	3,96	4,64	2,58	0,3	1	2
80	**56**	35,5	4,15	7,17	7,81	4,54	0,5	1	3,08
100	**70**	58	6,5	11,14	13,38	7,18	0,8	1,5	4,81
125	**90**	100	10,17	16	23,68	14,02	1,2	2	7,40
140	**90**	144	10,73	22,5	41,09	23	1,2	2	8,90
160	**110**	189	15,12	29,92	47,92	27,5	1,7	5	11,72
180	**110**	262	17,32	41,66	70,16	45,9	2,5	5	14,92
200	**140**	335	22,94	54,22	81,12	69	2,5	5	17,75
250	**180**	660	42,62	86,01	167	116	2,5	5	30,58
320	**220**	1230	65,35	166	304	250	2,8	5	49,32

Note: the masses related to the other options, not indicated in the table, don't have a relevant influence on the cylinder's mass

17 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	Chrome plated steel	10	O-ring	NBR / FKM	21	Cushioning adjustment plug	Steel
2	Wiper	NBR / FKM and PTFE	11	Piston	Steel	22	Seal	FKM
2.1	Wiper	Polyurethane	12	Piston seal	NBR / FKM and PTFE	23	Cylinder housing	Steel
3	Rod seal	NBR / FKM and PTFE	13	Piston guide ring	PTFE	24	O-ring	NBR / FKM
3.1	Rod seal	Polyurethane	14	Screw stop pin	Steel	25	Rear cushioning piston	Steel
4	Rod bearing	Bronze / Steel	15	Counterflange	Steel	26	Cushioning piston locking	Steel
5	Anti-extrusion ring	PTFE	16	Rear head	Steel / Cast iron	27	Screw stop pin	Steel
6	O-ring	NBR / FKM	17	Front head	Steel / Cast iron	28	Screw	Steel class 12.9
7	Anti-extrusion ring	PTFE	18	O-ring and anti-extrusion ring	FKM and PTFE	29	Rod guide	PTFE
8	O-ring	NBR /FKM	19	Seeger	Steel			
9	Front cushioning piston	Steel	20	Cushioning adjustment screw	Steel			

18 SPARE PARTS - SEE TABLE SP-B241

Example for seals spare parts code

G 1	-	C C	-	50	/	36

Sealing system

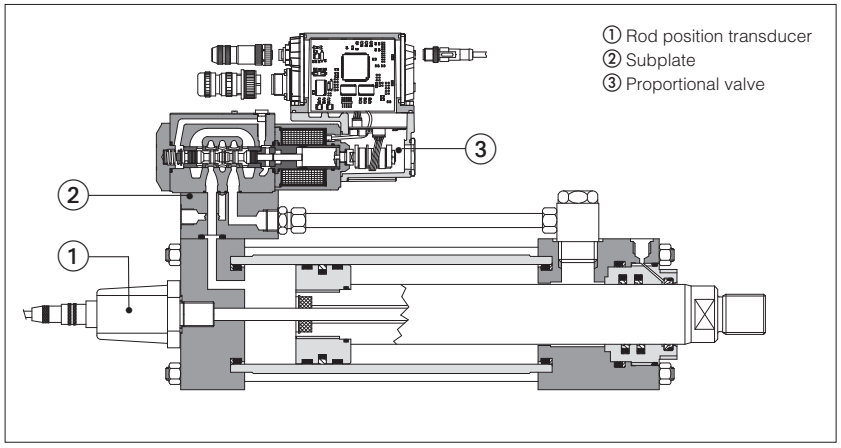
Cylinder series

Bore size [mm]

Rod diameter [mm]

Servocylinders type CK* with built-in position transducer

to ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CK* electrohydraulic servocylinders have engineered double acting construction, designed to suit the requirements of industrial applications: top reliability, high performances and long working life.
Their compact construction allows high flexibility for use in all applications. The rod position transducer ① is well protected against shocks or external dirt, and maintenance is reduced to a minimum.

- Derived from cylinders series CK according to ISO 6020-2, **see tab. B137**
- Integral position transducers: Magnetosonic analog or digital, Magnetostrictive, Potentiometric and Inductive
- Bore sizes from **40** to **200** mm
- Rod draining and air bleeds supplied as standard
- Available with incorporated subplates ② for on-board on/off or proportional valves ③ to achieve the max hydraulic strenght, fast response time and repeatability
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's choice and sizing criteria **see tab. B015**

SWC Cylinders Designer
Software for assisted selection of Atos cylinders & servocylinders codes, including cylinder's sizing, full technical information, 2D & 3D drawings in several CAD formats.

Available for download at www.atos.com

1 MODEL CODE

CK	P /	10 -	63 /	45 *	0500 -	S	2	0	8 -	K -	B1E3X1	**

Cylinder series
CK to ISO 6020 - 2, see **tab. B137**
See section 29 for other cylinder series

Rod position transducer, see section 2
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive

Incorporated subplate, see section 26
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size, see section 6, 10 and 15
from **40** to **200** mm

Rod diameter, see sections 6, 10 and 15
from **28** to **140** mm

Stroke, see section 2 and 18

Mounting style, see sections 6, 8, 10, 12, 15 and 17

		REF. ISO
C	= fixed clevis	MP1 **(4)**
D	= fixed eye	MP3 **(4)**
E	= feet	MS2
G	= front trunnion	MT1
L	= intermediate trunnion	MT4
N	= front flange	ME5
P	= rear flange	ME6 **(4)**
S	= fixed eye + spherical bearing	MP5 **(4)**
X	= basic execution	-
Y	= front tie rods extended	MX3
Z	= front threaded holes	MX5

Cushioning, see section 23 option **2** is only available for bores from 63 to 200
0 = without cushioning **2** = front adjustable cushioning

Heads' configuration (2), see section 24
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E3 = front head *
* enter E2 only for mounting style E

Options (2) (3):
Rod end, see section 7, 11 and 16
H = light male thread
Rod treatment, see section 22
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Oversized oil ports, see section 6 and 7
D = front oversized oil port
Y = rear oversized oil port
Output for CKF, CKM, CKN, CKV, see sections 3, 4, 9 and 14
A = current output (4÷20 mA)
V = voltage output (0÷10V)
N = electronic conditioning card for CKN
Digital SSI output for CKM, see section 4
Q = binary 24 bit **R** = binary 25 bit
S = gray 24 bit **U** = gray 25 bit
Fieldbus output, see section 5
C = CANopen
P = PROFIBUS DP
Fieldbus output, see section 3, 4, 5, 9, 13 and 14
M = 90° female connector

Sealing system, see section 25
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
8 = (NBR + PTFE and POLYURETHANE) low friction

Spacer, see section 19
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Series number **(1)**

(1) For spare parts request indicate the series number printed on the nameplate only for series < 40
(2) To be entered in alphabetical order
(3) Rod draining and air bleeds supplied as standard, see sections 27 and 28
(4) Not available for CKF and CKM

2 MAIN CHARACTERISTICS OF TRANSDUCERS

Code	**CKF** section 3	**CKM** section 4	**CKN** section 9	**CKP** section 13	**CKV** section 14
Transducer type	Magnetosonic, analog	Magnetosonic, programmable	Magnetostrictive	Potentiometric	Inductive
Linearity error **(1)**	< ± 0,02%	< ± 0,01%	< ± 0,02%	± 0,1%	± 0,2%
Repeatability	< ± 0,001% **(1)**	< ± 0,001% **(1)**	< ± 0,005% **(1)**	0,01 mm	± 0,05% **(1)**
Strokes	50 to 2500	25 to 3000	100 to 3000	100 to 700	30 to 1000
Interface	Voltage: 0 ÷ 10 V Current: 4 ÷ 20 mA	Analog: 0 ÷ 10 V, 4 ÷ 20 mA Digital: SSI, CANopen, PROFIBUS DP	Voltage: 0,1 ÷ 10,1 V Current: 4 ÷ 20 mA	Voltage 0 ÷ 10 V	Voltage: 0 ÷ 10 V Current: 4 ÷ 20 mA
Typical applications	Sawing or bending machines	Steel plants, plastic and rubber	Foundry and energy	Various	Simulators and energy
Temperature limits	-20°C to +75°C	-20°C to +75°C	-20°C to +90°C	-20°C to +100°C	-20°C to +120°C

(1) Percentage of the total stroke

3 SERVOCYLINDERS TYPE CKF

3.1 Magnetosonic transducers - basic working principles

The magnetosonic transducer is composed by: a waveguide element ① fixed to the cylinder's body, a permanent magnet ② rigidly connected to the cylinder's rod and an integral electronics signal conditioning ③ located on the rear head.
The position measurement is based upon the magnetostriction phenomenon: the electronics signal conditioning ③ generates a short current pulse that travels through the waveguide ①. When this pulse meets the magnetic field of the permanent magnet ②, a torsional wave is generated and it travels back to the electronics signal conditioning.
The position of the moving magnet is thus accurately determined by measuring the elapsed time between the application of the current pulse and the arrival of the torsional wave, thanks to their constant ultrasonic speed. Sensor electronics signal conditioning transforms this measurement into the analogic output feedback signal.
The contactless construction of the position transducer ensures a long working life and allows its use even in hard environmental conditions (shocks, vibrations etc.) or high working frequencies.
The transducer can be replaced without disassembling the cylinder, providing a great advantage of easy and quick maintenance.
Magnetosonic transducers, particularly simple and cost-effective, makes the CKF servocylinders commonly used as alternatives to external absolute encoders or to potentiometric transducers.

3.2 Output signal

The transducer integral electronics is available with the following configurations:

Analog

A = 4 - 20 mA
V = 0 - 10 V

Example of model code: CKF-63/45*0500-X008 -**A**-B1X1

Digital SSI output is available on request, for other output signals contact our technical office.

3.3 Transducer features

CKF are equipped with "MTS"'s magnetosonic transducers, whose main features are shown in the table at side.

3.4 Electronic connections

The 5 pin male connector M12 is located on the transducer rear head.
The straight female cable connector ④ **CON031** is included in the supply. The 90° female connector **CON041** can be supplied selecting option **M**. See the table at side for electronic connections.

3.5 Strokes

From 50 to 2500 mm by increments of 5 mm.
If a not standard stroke is required, contact our technical office.

3.6 Cylinder features

See sections 6, 7 and 8 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

3.7 Fluid requirements

CKF servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion - 90-95% water and 5-10% oil, **HFB** water in oil emulsion - 40% water, **HFC** water glycol - max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). **For the proper choice of the sealing system, in relation to the fluid characteristics, see section** 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm^2/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

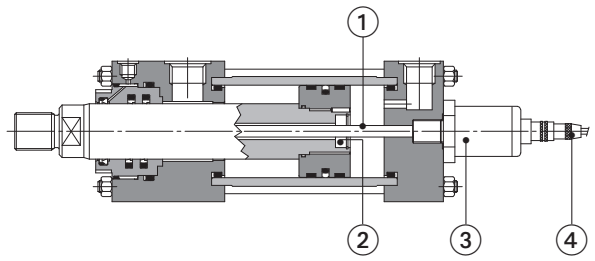
3.8 Start-up notes

During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

3.9 Warnings

Ensure that the servocylinder and wirings are kept away from strong magnetic field and electrical noise to prevent noises on the feedback signal. Check the electronic connections and switch-off the power supply before connecting or disconnecting the position transducer to avoid electronic damages.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKF



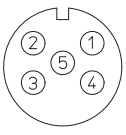
① Waveguide
② Permanent magnet
③ Integral electronics signal conditioning
④ Connector

TRANSDUCER FEATURES

Power supply	24 VDC (±15%)
Output signal	0÷10 VDC / 4÷20 mA
Resolution	infinite, restricted by the output ripple
Linearity	< ± 0,02% F.S (min ± 60 µm)
Repeatability	< ± 0,001 % F.S.
Output update frequency	< 3 kHz
Temperature coefficient	< 50 ppm/°C
Operating temperature	-20 ÷ +75 °C
Connection type	5 pin connector M12
Protection degree	IP67 to DIN 40050
Shock resistance	100g (single shock) / IEC Standard 68-2-27
Vibration resistance	15g/10÷2000 Hz / IEC Standard 68-2-6
Measuring range	50 to 2500 mm (increments of 5 mm)
Maximum speed	1 m/s

ELECTRONIC CONNECTIONS

5 PIN female connector (to solder)	**PIN**	**SIGNAL**	**NOTES**
	1	V+	Input - power supply 24 VDC (±15%)
	2	OUTPUT	Output - analog signal
	3	V0	Gnd - power supply 0 VDC
	4	NC	Do not connect
CON031 (Transducer view)	5	AGND	Gnd - analog signal



4 SERVOCYLINDERS TYPE CKM - PROGRAMMABLES

4.1 Magnetosonic transducers - basic working principles

The magnetosonic transducer is composed by: a waveguide element ① fixed to the cylinder's body, a permanent magnet ② rigidly connected to the cylinder's rod and an integral electronics signal conditioning ③ located on the rear head.
The position measurement is based upon the magnetostriction phenomenon: the electronics signal conditioning ③ generates a short current pulse that travels through the waveguide ①. When this pulse meets the magnetic field of the permanent magnet ②, a torsional wave is generated and it travels back to the electronics signal conditioning.
The position of the moving magnet is thus accurately determined by measuring the elapsed time between the application of the current pulse and the arrival of the torsional wave, thanks to their constant ultrasonic speed. Sensor electronics signal conditioning transforms this measurement into the output feedback signal.
The contactless construction of the position transducer ensures a long working life and allows its use even in hard environmental conditions (shocks, vibrations etc.) or high working frequencies.
The transducer can be replaced without disassembling the cylinder, providing a great advantage of easy and quick maintenance.
Additionally, the only electronics signal conditioning can be easily removed and replaced without removing its case; in this way the cylinder could keep on working avoiding any production-stop time.
CKM servocylinders are characterized by high performances and they are availables in several versions.

4.2 Output signal

The transducer integral electronics is available with the following configurations:

Analog	Digital SSI
A = 4-20 mA	**Q** = Binary 24 bit
V = 0-10 V	**R** = Binary 25 bit
	S = Gray 24 bit
	U = Gray 25 bit

Example of model code: CKM-63/45*0500-X008 -**A**D-B1X1

ETHERNET, I/O LINK and POWERLINK output are available on request, for other output signals contact our technical office.

4.3 Transducer features

CKM are equipped with "MTS"'s magnetosonic transducers, whose main features are shown in the table at side. The integral position tranducer is also available with an explosion-proof housing, ATEX certified, for use in explosion-hazardous environments and SIL certified.
Other integral position transducers brands are available on request, contact our technical office.

4.4 Electronic connections

The 6 or 7 pin male connector M16 is located on the transducer rear head. The straight female cable connector ④ is included in the supply:

STCO9131-D06-PG7 6 pin female connector for analog version
STCO9131-D07-PG9 7 pin female connector for digital SSI version

The 90° female connector can be supplied selecting option **M**:
STCO9131-6-PG7 6 pin 90° female connector for analog version
STCO9131-7-PG9 7 pin 90° female connector for digital SSI version

See the tables at side for electronic connections.
For other connector types or cable outputs, contact our technical office.

4.5 Strokes

From 25 to 3000 mm by increments of 5 mm.
If a not standard stroke is required, contact our technical office.

4.6 Cylinder features

See sections 6, 7 and 8 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

4.7 Fluid requirements

For the suitable fluids and the proper choice of the sealing system, in relation to the fluid characteristics, see sections 3 and 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm²/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

4.8 Start-up notes

The output signal of the CKM analog or digital SSI versions is programmable by using proper programming tools to be ordered separately:

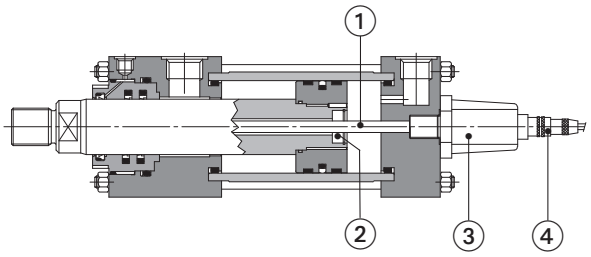
253-124 for zero/span setting of analog version
253-135 for complete re-programming of the transducers parameters (resolution, output format, length etc.) of digital SSI version

The sensor electronics case is equipped with two LED that indicate the transducer status, allowing a quick recognition of main possible faults (magnet not detected or out of set-up range).
During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

4.9 Warnings

Ensure that the servocylinder and wirings are kept away from strong magnetic field and electrical noise to prevent noises on the feedback signal. Check the electronic connections and switch-off the power supply before connecting or disconnecting the position transducer to avoid electronic damages.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKM



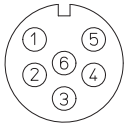
① Waveguide
② Permanent magnet
③ Integral electronics signal conditioning
④ Connector

TRANSDUCER FEATURES

	Analog	Digital SSI
Power supply	24 VDC (±15%)	
Outputs signal	0÷10 VDC/ 4÷20 mA	SSI RS 422/485 Standard
Data format (SSI)	NA	Binary / Gray
Data length (SSI)	NA	24 / 25 bit
Resolution	16 bit; 0,0015% (min. 1 µm)	5 µm
Linearity	<±0,01% F.S. (min ±50 µm)	<±0,01% F.S. (min ±40 µm)
Repeatability	<±0,001% F.S. (min ±1 µm)	
Hysteresis	< 4 µm	
Data speed (only for digital)	70 kBd÷1MBd (depending to cables lenght)	
Update frequency	0,5÷2kHz (depending to the stroke)	0,5÷3,7kHz (depenging to the stroke)
Temperature coefficient	< 30 ppm/°C	< 15 ppm/°C
Connection type	6 pin connector M16 to DIN45322	7 pin connector M16 to DIN45329
Protection degree	IP67 to DIN 40050	
Shock resistance	100g (single hit) / IEC Standard 68-2-27	
Vibration resistance	15g/10÷2000 Hz / IEC Standard 68-2-6	
Polarity protection	up to -30 VDC	
Operating temperature	-20 ÷ +75 °C	
Measuring range	25 to 3000 mm (increments of 5 mm)	
Maximum speed	2 m/s	

ELECTRONIC CONNECTIONS - ANALOG

6 PIN female connector (to solder)

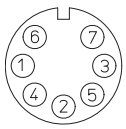


STCO9131-D06-PG7
(Transducer view)

PIN	SIGNAL	NOTES
1	OUTPUT	Output - analog signal
2	AGND	Gnd - analog signal
3	NC	Do not connect
4	NC	Do not connect
5	V+	Input - power supply 24 VDC (±15%)
6	V0	Gnd - power supply 0 VDC

ELECTRONIC CONNECTIONS - DIGITAL SSI

7 PIN female connector (to solder)



STCO9131-D07-PG9
(Transducer view)

PIN	SIGNAL	NOTES
1	DATA -	Input - serial position data (-)
2	DATA +	Output - serial position data (+)
3	CLOCK +	Output -serial syncronous clock (+)
4	CLOCK -	Input - serial syncronous clock (-)
5	V+	Input - power supply 24 VDC (±15%)
6	V0	Gnd - power supply 0 VDC
7	NC	Do not connect

5 SERVOCYLINDERS TYPE CKM - PROGRAMMABLES with fieldbus interface PROFIBUS DP or CANopen

5.1 Working basic principles

CKM servocylinders (see section 4 for magnetosonic working principle) are also available with fieldbus communication interface. Field communication networks allow to exchange a great amount of data among all the devices installed on the machines and industrial plants (servocylinders, valves, pumps, motors, etc.) by means of just one cable. It is so possible to connect all the devices of the system to the machine control unit (fieldbus master) avoiding expensive wirings and start-up costs.
Fieldbus provides also a more efficient connection that can speed up the installation task as well as prevent wiring errors.
The possibility to perform system level diagnostics on each node or device in the system represents an optimum maintenance tool and it has a positive impact on the system performances.
The remarkable aspect of these communication networks is the common standardized language ("protocol") of all the connected devices, making the control and monitoring of the whole machine very easy.

5.2 Output signal

The available feedback protocols are:

P = **PROFIBUS DP** according to EN 50 170 (ISO 74498)

C = **CANopen** according to CiA standard DS-301 V4.02 (ISO-DIS11898)

Example of model code: CKM-63/45*0500-X008 -D**P**-B1X1

Other feedback protocols are available on request, contact our technical office.

5.3 Transducer features

CKM are equipped with "MTS"'s magnetosonic transducers whose features are shown in the table at side. Other integral position transducers brands are available on request, contact our technical office.

5.4 Electronic connections

Male and female connectors are located on the transducer rear head.
The cable connectors are included in the supply:

CANopen - 2 connectors

STCO9131-D06-PG9 6 pin female M16 connector for bus input
STCO9131-D06-PG9 6 pin female M16 connector for bus output

The 90° female connector can be supplied selecting option **M**:
STCO9131-6-PG9 6 pin 90° female connector for bus input
STCO9131-6-PG9 6 pin 90° female connector for bus output

PROFIBUS DP- 4 connectors

560884 5 pin male M12 connector for bus input
560885 5 pin female M12 connector for bus output
560888 5 pin female M12 for bus terminator
560886 4 pin female M8 connector for power supply

See the table at side for electronic connections..
For other connector types, contact our technical office.

5.5 Strokes

From 25 to 3000 mm by increments of 5 mm.
If a not standard stroke is required, contact our technical office.

5.6 Cylinder features

See sections 6, 7 and 8 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

5.7 Fluid requirements

For the suitable fluids and the proper choice of the sealing system, in relation to the fluid characteristics, see sections 3 and 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm²/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

5.8 Start-up notes

The transducer's fieldbus configuration files and the manual for start-up are included in the supply.
The setup of the transducer's slave address is usually done by the bus standard service of the system: if the fieldbus master does not support this service, the setting can be done by a proper programmer tool to be separately ordered:

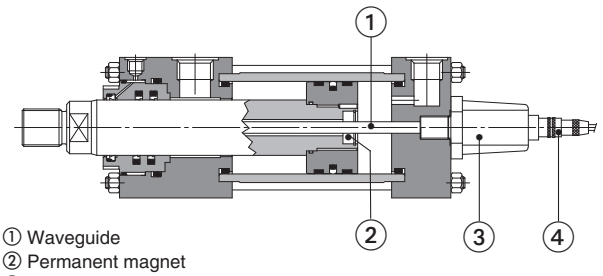
252-382-D62 for CANopen protocol
252-173-D52 for PROFIBUS DP protocol

The sensor electronics case is equipped with two LED that indicate the transducer status, allowing a quick recognition of main possible faults (magnet not detected or out of set-up range).
During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

5.9 Warnings

Ensure that the servocylinder and wirings are kept away from strong magnetic field and electrical noise to prevent noises on the feedback signal. Check the electronic connections and switch-off the power supply before connecting or disconnecting the position transducer to avoid electronic damages.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKM

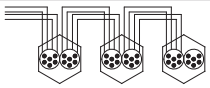


① Waveguide
② Permanent magnet
③ Integral electronics signal conditioning
④ Connector

TRANSDUCER FEATURES

Power supply	24 VDC (±15%)
Data transmission rate (with cable L < 25 m and 1 node)	**PROFIBUS DP:** max. 12 MBit/s **CAN open:** max. 1000 KBit/s
Cycle time	1 ms with stroke up to 2000 mm
Resolution (selectable by Bus)	5 µm for **CANopen** ; 1 µm for **PROFIBUS DP**
Linearity	<±0,01% F.S. (min ±50 µm)
Repeatability	<±0,001% F.S. (min ±2,5 µm)
Hysteresis	< 4 µm
Temperature coefficient	< 15 ppm/°C
Shock resistance	100g (single hit) / IEC Standard 68-2-27
Vibration resistance	15g/10÷2000 Hz / IEC Standard 68-2-6
Overvoltage protection	Up to 36 VDC
Protection degree	IP67 to DIN 40050
Operating temperature	-20 ÷ +75 °C
Measuring range	25 to 3000 mm (increments of 5 mm)
Maximum speed	2 m/s

ELECTRONIC CONNECTIONS - CANopen

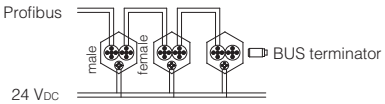


6 PIN female connector (to solder)

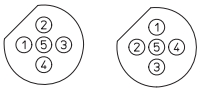
STCO9131-D06-PG9
(Transducer view)

PIN	SIGNAL	NOTES
1	CAN_L	Bus line (low)
2	CAN_H	Bus line (high)
3	NC	Do not connect
4	NC	Do not connect
5	V+	Power supply 24 VDC (±15%)
6	CAN_GND	Signal zero data line (0V)

ELECTRONIC CONNECTIONS - PROFIBUS DP



5 PIN connectors (to screw)



560884 male **560885** female
(Transducer view)

4 PIN female connector (to solder)

560886
(Transducer view)

PIN	SIGNAL	NOTES
1	+ 5V	for bus termination *
2	LINE-B	RxD/TxD-N (BUS)
3	DGND	data line and termination signal zero *
4	LINE-A	RxD/TxD-P (BUS)
5	SCHIELD	
1	V+	Input - power supply 24 VDC (±15%)
2	NC	Do not connect
3	V0	Gnd - power supply 0 VDC
4	NC	Do not connect

* Female only

6 INSTALLATION DIMENSIONS [mm] FOR SERVOCLINDERS TYPE CKF, CKM

Ø Bore	40	50	63	80	100	125	160	200
Ø Rod	**28**	**36**	**45**	**56**	**70**	**90**	**110**	**140**
A max	28	36	45	56	63	85	95	112
A1 (option **H)** max	18	22	28	36	45	56	63	85
AA	59	74	91	117	137	178	219	269
B f9	42	50	60	72	88	108	133	163
BB +3 / 0	35	46	46	59	59	81	92	115
BG min	12	18	18	24	24	27	32	40
CH h14	22	30	39	48	62	80	100	128
CO N9	12	12	16	16	16	20	30	40
DD 6g	M8x1	M12x1,25	M12x1,25	M16x1,25	M16x1,25	M22x1,5	M27x2	M30x2
D (1)	25	29	29	36	36	42	42	52
D1 (1)	29	NA	NA	42	42	52	52	58
E	63±1,5	75±1,5	90±1,5	115±1,5	130±2	165±2	205±2	245±2
EE (1) 6g	G 3/8	G 1/2	G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4
EE1(1) 6g	G 1/2	NA	NA	G 1	G 1	G1 1/4	G1 1/4	G 1 1/2
F max	10	16	16	20	22	22	25	25
FB H13	11	14	14	18	18	22	26	33
J	38	38	38	45	45	58	58	76
KC min	4	4,5	4,5	5	6	6	8	8
KK standard 6g	M20 x 1,5	M27 x 2	M33 x 2	M42 x 2	M48 x 2	M64 x 3	M80 x 3	M100 x 3
KK1 option **H** 6g	M14 x 1,5	M16 x 1,5	M20 x 1,5	M27 x 2	M33 x2	M42 x 2	M48 x 2	M64 x 3
LH h10	31	37	44	57	63	82	101	122
PJ ±1,5 **(3)**	85	74	80	93	101	117	130	165
PJ1 ±1,5 **(1) (3)**	87,5	NA	NA	93	99	121	143	167
R js13	41	52	65	83	97	126	155	190
RD f8	62	74	88	105	125	150	170	210
RT	M8x1,25	M12x1,75	M12x1,75	M16x2	M16x2	M22x2,5	M27x3	M30x3,5
SB H13	11	14	18	18	26	26	33	39
SS ±1,25 **(3)**	109	91	85	104	101	130	129	171
ST js13	12,5	19	26	26	32	32	38	44
TC h14	63	76	89	114	127	165	203	241
TD f8	20	25	32	40	50	63	80	100
TG js13	41,7	52,3	64,3	82,7	96,9	125,9	154,9	190,2
TL js13	16	20	25	32	40	50	63	80
TM h14	76	89	100	127	140	178	215	279
TO js13	87	105	117	149	162	208	253	300
TS js13	83	102	124	149	172	210	260	311
UM	108	129	150	191	220	278	341	439
UO max	110	130	145	180	200	250	300	360
US max	103	127	161	186	216	254	318	381
UT	95	116	139	178	207	265	329	401
UW max	70	88	98	127	141	168	205	269
VD	12	9	13	9	10	7	7	7
VE max	22	25	29	29	32	29	32	32
VL min	3	4	4	4	5	5	5	5
WF ±2	35	41	48	51	57	57	57	57
WH ±2	25	25	32	31	35	35	32	32
XG ±2 **(3)**	57	64	70	76	71	75	75	85
XS ±2 **(3)**	45	54	65	68	79	79	86	92
Minimum stroke	5	15	20	20	35	35	35	35
XV (2) min	100	109	120	129	148	155	161	195
±2 **(3)** max	99+stroke	98+stroke	100+stroke	115+stroke	117+stroke	134+stroke	141+stroke	166+stroke
Y ±2	62	67	71	77	82	86	86	98
Y1 ±2 **(1)**	61,5	NA	NA	75,5	83	84	79,5	97
ZB max	178	184	192	212	225	260	279	336

NOTES TO TABLE

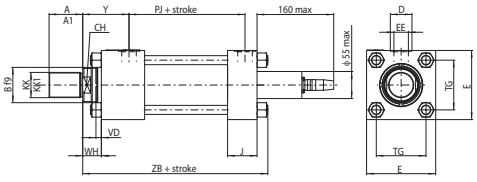
(1) Oil ports are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D. When oversized oil ports are selected, dimensions **D**, **EE**, **PJ** and **Y** are respectively modified into **D1**, **EE1**, **PJ1** and **Y1**. For bore 160 with mounting styles E, N the dimension **PJ1** reported in the table is modified, contact our technical office.

(2) XV - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table. The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CKM-50/36*0500-L208 - D - B1E3X1 **XV = 200**

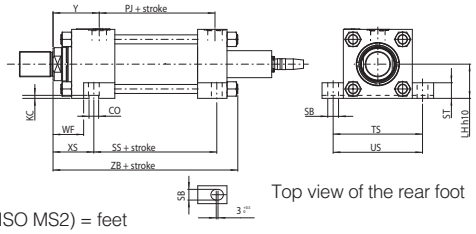
(3) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is the max stroke tolerance reported in section 18.

7 BASIC CONFIGURATION



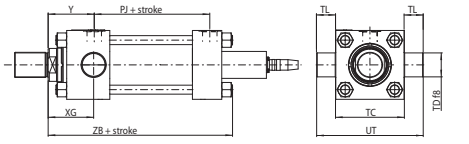
Basic configuration: X - see section 6 for dimensions

8 MOUNTING STYLE FOR SERVOCYLINDERS TYPE CKF, CKM

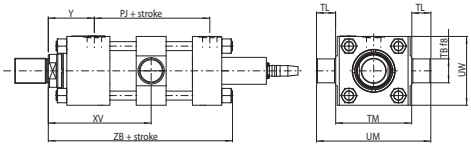


Top view of the rear foot

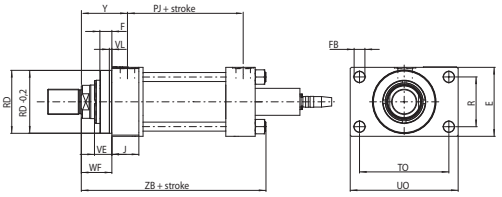
E (ISO MS2) = feet



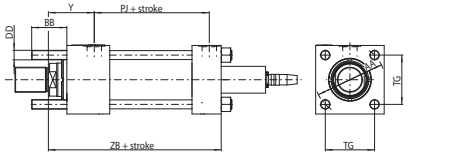
G (ISO MT1) = front trunnion



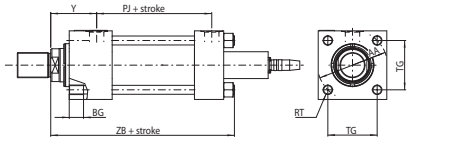
L (ISO MT4) = intermediate trunnion



N (ISO ME5) = front flange



Y (ISO MX3) = front tie rods extended



Z (ISO MX5) = front threaded holes

9 SERVOCYLINDERS TYPE CKN

9.1 Magnetostrictive transducers - basic working principles

The magnetostrictive transducer is composed by: a waveguide element ① fixed to the cylinder's body, a permanent magnet ② rigidly connected to the cylinder's rod and an integral electronics signal conditioning ③ located inside the rear head.
The position measurement is based upon the magnetostriction phenomenon: the electronics signal conditioning ③ generates a short current pulse that travels through the waveguide ①. When this pulse meets the magnetic field of the permanent magnet ②, a torsional wave is generated and it travels back to the electronics signal conditioning.
The position of the moving magnet is thus accurately determined by measuring the elapsed time between the application of the current pulse and the arrival of the torsional wave, thanks to their constant ultrasonic speed. Sensor electronics signal conditioning transforms this measurement into the analogic output feedback signal.
The contactless construction of the position transducer ensures a long working life and allows its use even in hard environmental conditions (shocks, vibrations etc.) or high working frequencies.
The small size of this magnetostrictive transducer allows the installation completely inside the cylinder, providing a very compact construction and a reduction of the overall dimensions respect to CKF and CKM servocylinders. These features make CKN servocylinders the best alternative to external absolute encoders, potentiometric and inductive transducers.

9.2 Output signal

The transducer integral electronics is available with the following configurations:

Analog

A = 4 - 20 mA
V = 0,1 - 10,1 V (0 - 10 V with electronic conditioning card)

The option **A** or **V** for the output signal has to be always entered in the cylinder code.
Transducer's performance can be enhanced with the optional electronic conditioning card, option **N**, which allows to adjust zero and gain references by a "magnetic pen" included in the supply.

Example of model code for CKN with electronic conditioning card and current output:
CKN-63/45*0500-X008 -**AN**-B1X1

9.3 Transducer features

CKN are equipped with "GEFRAN"'s magnetostrictive transducers whose features are shown in the tables at side.

9.4 Electronic connections

The 6 pin male connector M16 is mounted on side 4 of the cylinder rear head. The electronic conditioning card (option **N**) has to be connected to the transducer by wire clamp IP67 and screw terminals.
The straight female cable connector ④ **STCO9131-D06-PG7** is included in the supply, for option N the connector is supplied with a cable 3 m long connected to the electonic conditioning card. The 90° female connector **STCO9131-6-PG7** can be supplied selecting option **M**. See the table at side for electronic connections. The 5 pin male connector M12 allows the connection of the electronic conditioning card to the control system, the straight female connector M12 5 pin **CON031** is included in the supply.

9.5 Strokes

From 100 to 3000 mm by increments of 100 mm.
If a not standard stroke is required, contact our technical office.

9.6 Cylinder features

See sections 10, 11 and 12 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

9.7 Fluid requirements

CKN servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion - 90-95% water and 5-10% oil, **HFB** water in oil emulsion - 40% water, **HFC** water glycol - max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). **For the proper choice of the sealing system, in relation to the fluid characteristics, see section** 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm^2/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

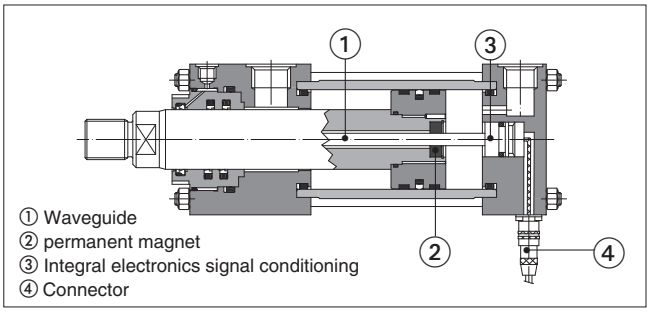
9.8 Start-up notes

CKN servocylinders are supplied with the zero/span values adjusted to the cylinder's mechanical stroke ends.
During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

9.9 Warnings

Ensure that the servocylinder and wirings are kept away from strong magnetic field and electrical noise to prevent noises on the feedback signal. Check the electronic connections and switch-off the power supply before wiring, connecting or disconnecting the position transducer to avoid electronic damages. Ensure that the maximum distance between the servocylinder and the electronic conditioning card is lower than the recommended one: 50 m.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKN



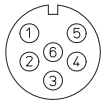
① Waveguide
② permanent magnet
③ Integral electronics signal conditioning
④ Connector

TRANSDUCER FEATURES

Power supply	18 - 30 VDC (±15%)
Output signal	0,1 ÷10,1 VDC / 4 ÷20 mA
Resolution	infinite, restricted by the output ripple
Linearity	< ± 0,02% F.S (min ± 60 µm)
Repeatability	< ± 0,01 mm (hysteresis< ± 0,005 % F.S.)
Cycle time	1 ms (1,5 for 1100 < strokes < 2000 ; 2 for strokes > 2000 mm)
Temperature coefficient	50 ppm/°C
Operating temperature	-20 ÷ +90°C (+70°C for strokes > 2500 mm)
Connection type	6 pin connector M16 to DIN 45322
Protection degree	IP67 to DIN 40050
Shock resistance	100g (single hit) / IEC Standard 68-2-27
Vibration resistance	20g / 10÷2000 Hz / IEC Standard 68-2-6
Measuring range	100 to 3000 mm (increments of 100 mm)
Maximum speed	1 m/s

ELECTRONIC CONNECTIONS - OPTION A,V

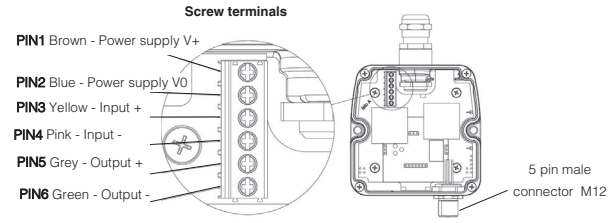
6 PIN female connector (to solder)



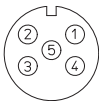
STCO9131-D06-PG7
(Transducer view)

PIN	SIGNAL	NOTES
1	V+	Input - power supply 24 VDC (±15%)
2	V0	Gnd - power supply 0 VDC
3	OUTPUT	Output - analog signal
4	AGND	Gnd - analog signal
5	NC	Not connect
6	NC	Not connect

ELECTRONIC CONDITIONING CARD - OPTION N



5 PIN female connector (to solder)



CON031
(Transducer view)

PIN	SIGNAL	NOTES
1	OUTPUT1	Output - analog signal
2	AGND	Gnd - analog signal
3	OUTPUT2	Output2 - analog signal
4	V0	Gnd - power supply 0 VDC
5	V+	Input - power supply 24 VDC (±15%)

ELECTRONIC CONDITIONING CARD FEATURES

	Current output A	Voltage output V
Output	4÷20 mA	0÷10 VDC
Output load	< 500 Ω	2 kΩ
Max output value	25 mA	10,6 V
Output ripple	< 5 mV pp	
Supply voltage	from 10 to 30 VDC	
Resolution	16 bit	
Speed calculation time	sampling time +500 µ s	
Operating temperature	0 ÷ +70°C (storage -40 ÷ +85°C)	

10 INSTALLATION DIMENSIONS [mm] FOR SERVOCLINDERS TYPE CKN

Ø Bore		40	50	63	80	100	125	160	200
Ø Rod		28	36	45	56	70	90	110	140
A max		28	36	45	56	63	85	95	112
A1 option **H** max		NA	NA	NA	36	45	56	63	85
AA ref		59	74	91	117	137	178	219	269
B f9		42	50	60	72	88	108	133	163
BB +3 / 0		35	46	46	59	59	81	92	115
BG min		12	18	18	24	24	27	32	40
CB A16		20	30	30	40	50	60	70	80
CD H9		14	20	20	28	36	45	56	70
CF max		42	62	62	83	103	123	143	163
CH h14		22	30	39	48	62	80	100	128
CO N9		12	12	16	16	16	20	30	40
CX	value	20	25	30	40	50	60	80	100
	tolerance	0 -0,012					0 -0,015		0 -0,02
D (1)		25	29	29	36	36	42	42	52
DD		M8x1	M12x1,25	M12x1,25	M16x1,25	M16x1,25	M22x1,5	M27x2	M30x2
E		63±1,5	75±1,5	90±1,5	115±1,5	130±2	165±2	205±2	245±2
EE (1) 6g		G 3/8	G 1/2	G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4
EP max		13	17	19	23	30	38	47	57
EW h14		20	30	30	40	50	60	70	80
EX		16 0/-0,12	20 0/-0,12	22 0/-0,12	28 0/-0,12	35 0/-0,12	44 0/-0,15	55 0/-0,15	70 0/-0,2
F max		10	16	16	20	22	22	25	25
FB H13		11	14	14	18	18	22	26	33
J ref		38	38	38	45	45	58	58	76
KC min		4	4,5	4,5	5	6	6	8	8
KK 6g		M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x3	M80x3	M100x3
KK1 option **H** 6g		M14x1,5	M16x1,5	M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x2
L min		19	32	32	39	54	57	63	82
LH h10		31	37	44	57	63	82	101	122
LT min		25	31	38	48	58	72	92	116
MR max		17	29	29	34	50	53	59	78
MS max		29	33	40	50	62	80	100	120
PJ ±1,5 (3)		85	74	80	143	151	167	180	190
R js13		41	52	65	83	97	126	155	190
RD f8		62	74	88	105	125	150	170	210
RT		M8x1,25	M12x1,75	M12x1,75	M16x2	M16x2	M22x2,5	M27x3	M30x3,5
SB H13		11	14	18	18	26	26	33	39
SS ±1,25 (3)		109	91	85	154	151	180	179	196
ST js13		12,5	19	26	26	32	32	38	44
TC h14		63	76	89	114	127	165	203	241
TD f8		20	25	32	40	50	63	80	100
TG js13		41,7	52,3	64,3	82,7	96,9	125,9	154,9	190,2
TL js13		16	20	25	32	40	50	63	80
TM h14		76	89	100	127	140	178	215	279
TO js13		87	105	117	149	162	208	253	300
TS js13		83	102	124	149	172	210	260	311
UM ref		108	129	150	191	220	278	341	439
UO max		110	130	145	180	200	250	300	360
US max		103	127	161	186	216	254	318	381
UT ref		95	116	139	178	207	265	329	401
UW max		70	88	98	127	141	168	205	269
VD		12	9	13	9	10	7	7	7
VE max		22	25	29	29	32	29	32	32
VL min		3	4	4	4	5	5	5	5
WF ±2		35	41	48	51	57	57	57	57
WH ±2		25	25	32	31	35	35	32	32
XC ±1,5 (3)		237	256	265	279	307	339	358	406
XG ±2 (3)		57	64	70	76	71	75	75	85
XO ±1,5 (3)		243	255	271	288	311	354	387	440
XS ±2 (3)		45	54	65	68	79	79	86	92
XV (2) ±2 (3)	Minimum stroke	5	15	20	20	35	35	35	35
	min	100	109	120	129	148	155	161	195
	max	99+stroke	98+stroke	100+stroke	115+stroke	117+stroke	134+stroke	141+stroke	166+stroke
Y ±2		62	67	71	77	82	86	86	98
ZB max		231	241	250	262	275	310	329	361
ZJ ±1 (3)		218	224	233	240	253	282	295	324

NOTES TO TABLE

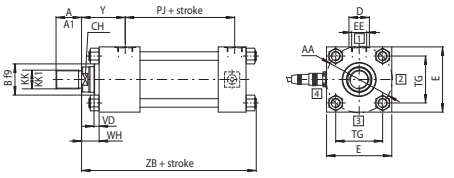
(1) Oil ports with dimension EE are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D.

(2) XV - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CKN-50/36*0500-L208 - AK - B1E3X1 **XV = 200**

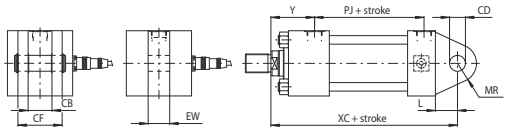
(3) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is the max stroke tolerance reported in section 18.

11 BASIC CONFIGURATION

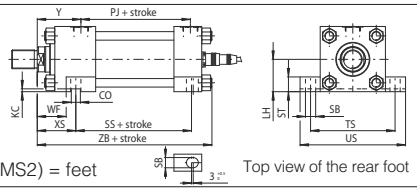


Basic configuration: X - see section 10 for dimensions
Electrical connector on side 4

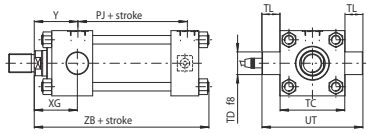
12 MOUNTING STYLES FOR SERVOCYLINDERS TYPE CKN



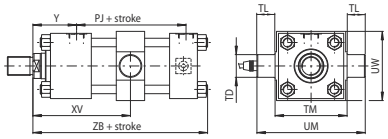
C (ISO MP1) = fixed clevis
D (ISO MP3) = fixed eye



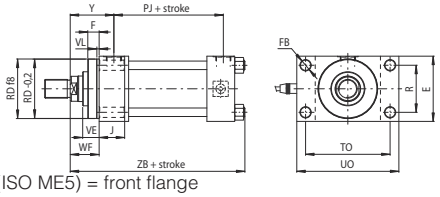
E (ISO MS2) = feet Top view of the rear foot



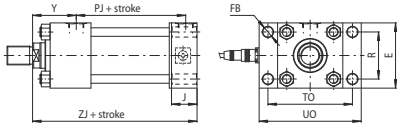
G (ISO MT1) = front trunnion



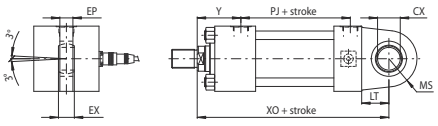
L (ISO MT4) = intermediate trunnion



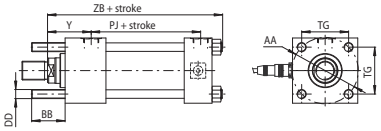
N (ISO ME5) = front flange



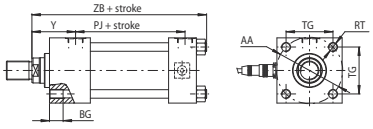
P (ISO ME6) = rear flange



S (ISO MP5) = fixed eye with spherical bearing



Y (ISO MX3) = front tie rods extended



Z (ISO MX5) = front threaded holes

13 SERVOCYLINDERS TYPE CKP

13.1 Potentiometric transducers - basic working principles

The potentiometric transducer is composed by two resistive tracks ① and a wiper ② which realizes the sliding contact through two metallic brushes. The resistive track is an aluminium element with a conductive plastic coating fixed to the cylinder's rear head. The wiper is mounted on the piston rod and moves together with it.
The tracks of the potentiometer have to be connected to a stabilized DC voltage to allow a small current flow. The two brushes of the wiper close the electronic circuit with the tracks (see figure at side), changing the resistance value and thus the voltage output proportionally to the rod position (principle of potential divider).
CKP servocylinders present the best price/performance ratio. Their compact construction allows the easy application of servocylinders in place of a standard cylinders without transducer.

13.2 Transducer features

For all the transducer features see the table at side.

13.3 Electronic connections

The 4 pin male connector is mounted on side 4 of the cylinder rear head for all mounting styles except style E (ISO MS2), where it is mounted along the cylinder axis, see section 17.
The straight female cable connector ③ **STCO9131-D04-PG7** is included in the supply. The 90° female connector **STCO9131-4-PG7** can be supplied selecting option **M**.
See the table at side for electronic connections.

13.4 Strokes

From 100 to 700 mm by increments of 100 mm.
If a not standard stroke is required, contact our technical office.

13.5 Cylinder features

See sections 15, 16 and 17 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

13.6 Fluids requirements

CKP servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**) **not compatible with glycol water and water based fluids.**

For the proper choice of the sealing system, in relation to the fluid characteristics, see section 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm²/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

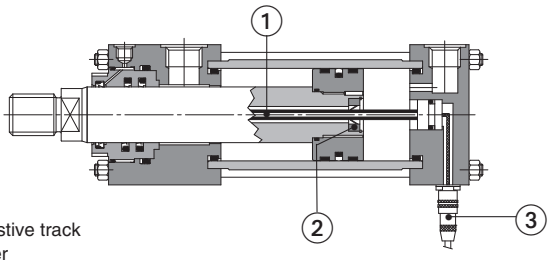
13.7 Start-up notes

During the start-up it is necessary to bleed off the air from the servocylinder. The air bleed is located on the rod end, see figure at side.
For a proper use of the air-bleed unlock the grub screw ④ M8 x 10 with a wrench for hexagonal head screws, moves the cylinder for the necessary cycles to bleed-off the air and retighten by a torque of 20 Nm.
Take care to completely bleed off the air from the inside because the compressibility effects of the air trapped-in may compromise the contact between the brushes and the resistive tracks.
Ensure to bleed off the air after every long time stop of the servocylinder.
For other details refer to the start-up instructions included in the supply.

13.8 Warnings

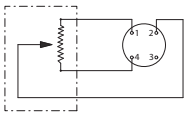
For a correct functioning, the transducer must be exclusively used as a potential divider.
Ensure to observe the maximum rating power indicated in the table "transducer features" to avoid any component damage.
The power supply must be stabilized: variations on the voltage provided have direct influence on the output values.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKP



① Resistive track
② Wiper
③ Straight connector

ELECTRONIC CIRCUIT



TRANSDUCER FEATURES

Supply reference	10 VDC recommended (max 30 VDC)
Dissipation	3 W at 40°C, 0 W at 120°C
Linearity	±0,1% F.S.
Repeatability	0,01 mm
Total resistance	10 kΩ at full stroke
Insulation resistance	> 100 MΩ to 500 VDC
Wiper current	Recommended: a few µA (10mA max)
Temperature limits	-20 ÷ + 100°C
Connection type	4 pin connector to Mil-C-26482
Protection degree	IP67 to DIN 40050
Measuring range	100 to 700 mm (increments of 100 mm)
Maximum speed	0,5 m/s

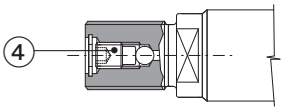
ELECTRONIC CONNECTIONS

4 PIN female connector (to solder)

STCO9131-D04-PG7
(Transducer view)

PIN	SIGNAL	NOTES
1	V0	Gnd - power supply 0 VDC
2	OUTPUT	Output - 0 - 10 V
3	NC	Do not connect
4	Vref	Input - power supply 10 VDC

ROD AIR BLEED



14 SERVOCYLINDERS TYPE CKV

14.1 Inductive transducers - basic working principles

The transducer is composed by a single coil-winding ① and a ferromagnetic core ②. The coil-winding is integrated into a tube fixed to the cylinder's rear head, the core is fixed to the piston rod and moves together with it.
When the core moves together with the piston, the inductance of the coil-winding changes proportionally to the core position. The separate electronic conditioning card sends a sinusoidal signal to the primary coil-winding, it reads the corresponding signal of the secondary coil-winding and, from their difference, it calculates the inductance and computes the analog output feedback signal.
The contactless principle of the transducer ensures a long working life and its ruggedness construction allows to withstand high frequencies or dynamical stresses (i.e. simulators, vibropresses etc.).
The compact construction of CKV allows the easy application of the servocylinders in place of cylinders without transducer.
The separate conditioning card makes the inductive transducer ideal for all applications with high temperatures: in this case the max temperature is limited by the sealing system.

14.2 Transducer features

CKV are equipped with "Penny & Giles"'s ICT inductive transducers whose features are shown in the table at side.
The performances of the transducer indicated in the table at side refer exclusively to the use with its proper conditioning card.

14.3 Electronic conditioning card

In order to grant the performance in the table at side, it is mandatory to purchase the electronic conditioning card with one of the two following configurations:

A = 4 - 20 mA
V = 0 - 10 V

Other output ranges are available on request, contact our technical office.

The electronic conditioning card allows to adjust the zero and gain references by a screwdriver.
The card format fits to DIN EN50022 or EN50035 rails or allows a wall mounting by 4 screws M5x30.

14.4 Electronic connections

The 4 pin male connector is mounted on side 4 of the cylinder rear head for all mounting styles except style E (ISO MS2), where it is mounted along the cylinder's axis, see section 17.
The straight female cable connector ③ **STCO9131-D04-PG7** is supplied with a cable 3 m long connectedto the electronic conditioning card by wire clamp IP66 and screw terminals. The 90° female connector **STCO9131-4-PG7** can be supplied selecting option **M**.
See the table at side for electronic connections.

14.5 Strokes

From 30 to 1000 mm by increments of 10 mm.
If a not standard stroke is required, contact our technical office.

14.6 Cylinder features

See sections 15, 16 and 17 for sizes, mounting style and dimensions.
See sections from 18 to 26 for materials and options.

14.7 Fluid requirements

CKV servocylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion - 90-95% water and 5-10% oil, **HFB** water in oil emulsion - 40% water, **HFC** water glycol - max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters).
For the proper choice of the sealing system, in relation to the fluid characteristics, see section 25.
Recommended fluid characteristics:
- Viscosity: 15 ÷ 100 mm^2/s
- Temperature range: 0 ÷ 70°C
- Fluid contamination class: for normal operation ISO4406 class 18/16/13 NAS1638 class 7. Longer life class 16/14/11 NAS1638 class 5; see also filter section at www.atos.com or KTF catalog.

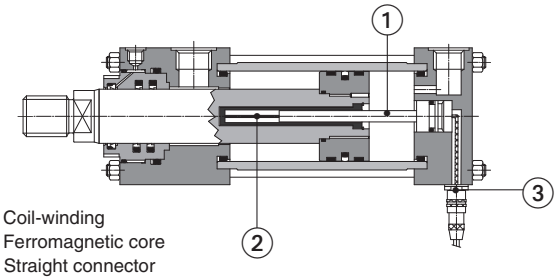
14.8 Start-up notes

CKV servocylinders are supplied with zero/span values adjusted to the cylinder's mechanical stroke ends. During the start-up it is necessary to bleed off the air from the servocylinder as indicated in section 27.
For other details refer to the start-up instructions included in the supply.

14.9 Warnings

Ensure that the maximum distance between the servocylinder and the conditioning card is lower than the recommended one: 10 m.
It is recommended to connect the draining port, supplied as standard, to the tank without back pressure, see section 28 for details.

SERVOCYLINDER TYPE CKV



① Coil-winding
② Ferromagnetic core
③ Straight connector

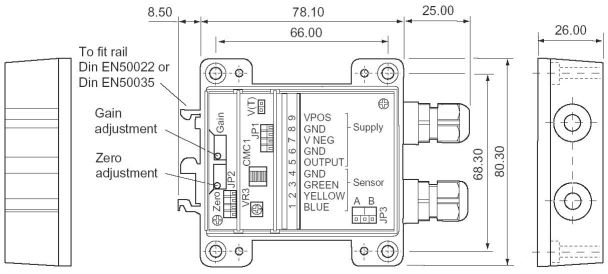
TRANSDUCER FEATURES

Linearity	±0,2%
Repeatability	±0,05 %
Insulation resistance	>50 MΩ to 50 VDC
Temperature coefficient	±200 ppm/°C from -20 to +100°C
Operating temperature	-20 ÷ +120°C
Connection type	4 pin connector to Mil-C-26482
Protection degree	IP67 to DIN 40050
Measuring range	30 to 1000 mm (increments of 10 mm)
Maximum speed	1 m/s

ELECTRONIC CONNECTIONS

4 PIN female connector (to solder)	PIN	SIGNAL	NOTES
① ② ④ ③	1	Ve+	Coil V+
	2	Ve-	Coil V-
	3	NC	Do not connect
STCO9131-D04-PG7 (Transducer view)	4	V0	Sensor ground

ELECTRONIC CONDITIONING CARD



	Analog output A	Voltage output V
Supply voltage	from 10 to 30 VDC	from 13,5 to 30 VDC
Supply current	12,6 mA max	19 mA max
Output	4÷20 mA	0÷10 VDC
Zero adjustment range	-10% to +60% of span	
Gain adjustment range	+40% to +110% of span	
Output ripple	< 5 mV rms	
Output load	10 kΩ min.	
Operating temperature	0 ÷ +70°C (storage -40 ÷ +85°C)	
Temperature coefficient	300 ppm/°C	
Protection degree	IP66 to DIN 40050	

15 INSTALLATION DIMENSIONS [mm] FOR SERVOCLINDERS TYPE CKP, CKV

Ø Bore		40	50	63	80	100	125	160	200
Ø Rod		28	36	45	56	70	90	110	140
A max		28	36	45	56	63	85	95	112
A1 option **H** max		NA	NA	NA	36	45	56	63	85
AA ref		59	74	91	117	137	178	219	269
B f9		42	50	60	72	88	108	133	163
BB +3 / 0		35	46	46	59	59	81	92	115
BG min		12	18	18	24	24	27	32	40
CB A16		20	30	30	40	50	60	70	80
CD H9		14	20	20	28	36	45	56	70
CF max		42	62	62	83	103	123	143	163
CH h14		22	30	39	48	62	80	100	128
CO N9		12	12	16	16	16	20	30	40
CX	value	20	25	30	40	50	60	80	100
	tolerance	0 -0,012					0 -0,015		0 -0,02
D (1)		25	29	29	36	36	42	42	52
DD 6g		M8x1	M12x1,25	M12x1,25	M16x1,25	M16x1,25	M22x1,5	M27x2	M30x2
E		63±1,5	75±1,5	90±1,5	115±1,5	130±2	165±2	205±2	245±2
EE (1) 6g		G 3/8	G 1/2	G 1/2	G 3/4	G 3/4	G 1	G 1	G 1 1/4
EP max		13	17	19	23	30	38	47	57
EW h14		20	30	30	40	50	60	70	80
EX		16 0/-0,12	20 0/-0,12	22 0/-0,12	28 0/-0,12	35 0/-0,12	44 0/-0,15	55 0/-0,15	70 0/-0,2
F max		10	16	16	20	22	22	25	25
FB H13		11	14	14	18	18	22	26	33
J ref		38	38	38	45	45	58	58	76
KC min		4	4,5	4,5	5	6	6	8	8
KK 6g		M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x3	M80x3	M100x3
KK1 option **H** 6g		M14x1,5	M16x1,5	M20x1,5	M27x2	M33x2	M42x2	M48x2	M64x2
L min		19	32	32	39	54	57	63	82
LH h10		31	37	44	57	63	82	101	122
LT min		25	31	38	48	58	72	92	116
MR max		17	29	29	34	50	53	59	78
MS max		29	33	40	50	62	80	100	120
PJ ±1,5 (3)		85	74	80	93	101	117	130	165
R js13		41	52	65	83	97	126	155	190
RD f8		62	74	88	105	125	150	170	210
RT		M8x1,25	M12x1,75	M12x1,75	M16x2	M16x2	M22x2,5	M27x3	M30x3,5
SB H13		11	14	18	18	26	26	33	39
SS ±1,25 (3)		109	91	85	104	101	130	129	171
ST js13		12,5	19	26	26	32	32	38	44
TC h14		63	76	89	114	127	165	203	241
TD f8		20	25	32	40	50	63	80	100
TG js13		41,7	52,3	64,3	82,7	96,9	125,9	154,9	190,2
TL js13		16	20	25	32	40	50	63	80
TM h14		76	89	100	127	140	178	215	279
TO js13		87	105	117	149	162	208	253	300
TS js13		83	102	124	149	172	210	260	311
UM ref		108	129	150	191	220	278	341	439
UO max		110	130	145	180	200	250	300	360
US max		103	127	161	186	216	254	318	381
UT ref		95	116	139	178	207	265	329	401
UW max		70	88	98	127	141	168	205	269
VD		12	9	13	9	10	7	7	7
VE max		22	25	29	29	32	29	32	32
VL min		3	4	4	4	5	5	5	5
WF ±2		35	41	48	51	57	57	57	57
WH ±2		25	25	32	31	35	35	32	32
XC ±1,5 (3)		184	191	200	229	257	289	308	381
XG ±2 (3)		57	64	70	76	71	75	75	85
XO ±1,5 (3)		190	190	206	238	261	304	337	415
XS ±2 (3)		45	54	65	68	79	79	86	92
XV (2) ±2 (3)	**Minimum stroke**	5	15	20	20	35	35	35	35
	min	100	109	120	129	148	155	161	195
	max	99+stroke	98+stroke	100+stroke	115+stroke	117+stroke	134+stroke	141+stroke	166+stroke
Y ±2		62	67	71	77	82	86	86	98
ZB max		178	176	185	212	225	260	279	336
ZJ		165	159	168	190	203	232	245	299

NOTES TO TABLE

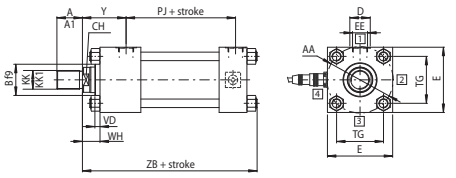
(1) Oil ports with dimension EE are threaded according to ISO 1179-1 (GAS standards) with counterbore dimension D.

(2) XV - For cylinders with mounting style **L** the stroke must always exceed the minimum values reported in the table.The requested XV value must be included between **XV min** and **XV max** and it must be always indicated, with dimension in millimeters, together with the cylinder code. See the following example:

CKP-50/36*0500-L208 - K - B1E3X1 **XV = 200**

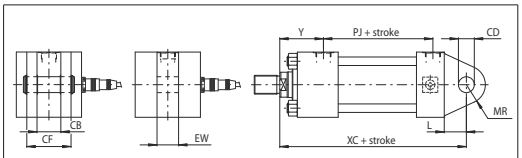
(3) The tolerance is valid for strokes up to 1250 mm, for longer strokes the upper tolerance is the max stroke tolerance reported in section 18.

16 BASIC CONFIGURATION

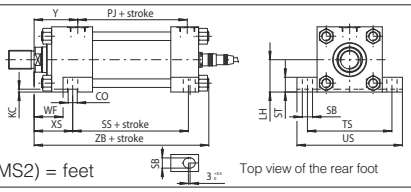


Basic configuration: X - see section 15 for dimensions
Electrical connector on side 4

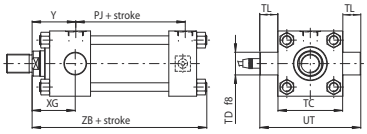
17 MOUNTING STYLES FOR SERVOCYLINDERS TYPE CKP, CKV



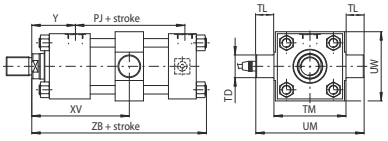
C (ISO MP1) = fixed clevis
D (ISO MP3) = fixed eye



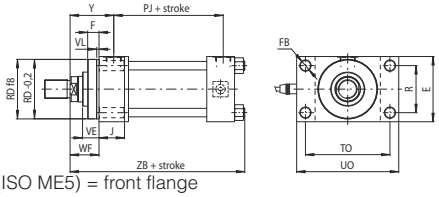
E (ISO MS2) = feet



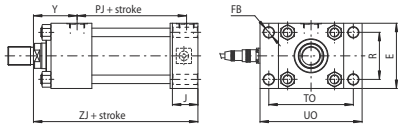
G (ISO MT1) = front trunnion



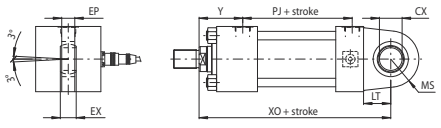
L (ISO MT4) = intermediate trunnion



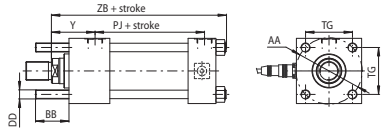
N (ISO ME5) = front flange



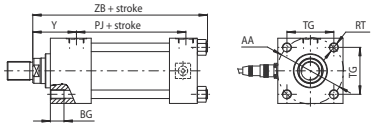
P (ISO ME6) = rear flange



S (ISO MP5) = fixed eye with spherical bearing



Y (ISO MX3) = front tie rods extended



Z (ISO MX5) = front threaded holes

18 STROKE SELECTION

Stroke has to be selected a few mm longer than the working stroke to prevent the use of the cylinder heads as mechanical stroke-end. The stroke tolerances are reported in the table at side.

19 SPACER

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' lenght has to be added to all stroke dependent dimensions in sections 6 , 10 and 15.

20 CYLINDER'S HOUSING FEATURES

The cylinder's housings are made in "cold drawn and stressed steel"; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0,25 µm.

21 TIE RODS FEATURES

The cylinder's tie rods are made in "normalized automatic steel"; end-threads are rolled to improve the fatigue working life. They are screwed to the heads or mounted by means of nuts with a prefixed tightening torque MT, see the table at side.

22 RODS FEATURES and options

The rods materials have high strength, which provide safety coefficients higher than 4 in static stress conditions, at maximum working pressure. The rod surface is chrome plated: diameter tolerances f7; roughness Ra ≤ 0,25 µm. Corrosion resistance of 100 h in neutral spray to ISO 9227 NSS

ø Rod	Material	Rs min [N/mm²]	Chrome	
			min. thickness [mm]	hardness [HV]
28÷90	hardened and tempered alloy-steel	700	0,020	850-1150
110÷140	alloy steel	450		

Rod diameters from 28 to 70 mm have rolled threads; in rolling process the component material is stressed beyond its yield point, being deformed plastically. This offers many technical advantages: higher profile accuracy, improved fatigue working life and high wear resistance. See **tab. B015** for the calculation of the expected rod fatigue life. The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK, indicated in the tables 6 , 10 and 15.The piston is screwed to the rod by a prefixed tightening torque in order to improve the fatigue resistance. The stop pin ① avoids the piston unscrewing. **Contact our technical office** in case of heavy duty applications.

Rod corrosion resistance and hardness can be improved selecting the options **K** and **T** (option K affects the strength of standard rod, see **tab. B015** for the calculation of the expected rod fatigue life):
K = Nickel and chrome-plating (for rods from 28 to 110 mm)
Corrosion resistance (rating 10 to ISO 10289):
- 500 h in acetic acid salt spray to ISO 9227 AASS
- 1000 h in neutral spray to ISO 9227 NSS

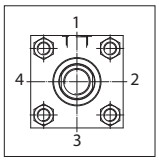
T = Induction surface hardening and chrome plating:
- 56-60 HRC (613-697 HV) hardness

23 CUSHIONING

Cushioning are recommended for applications where: • the piston makes a full stroke with speed over than 0,05 m/s; • it is required to reduce undesirable noise and mechanical shocks; • vertical application with heavy loads. The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). See **tab. B015** for the max damping energy.
The cylinder is provided with needle valve to optimize cushioning performances in different applications. The regulating screws are supplied fully screwed in (max cushioning effect).
In case of high masses and/or very high operating speeds we recommend to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

Ø Bore		**63**	**80**	**100**	**125**	**160**	**200**
Ø Rod		**45**	**56**	**70**	**90**	**110**	**140**
Cushioning length [mm]	Lf	27	29	27	25	34	34

24 POSITION OF THE OIL PORTS AND CUSHIONING ADJUSTMENTS



FRONT HEAD: **B1** = oil port position; **E* =** cushioning adjustment position
REAR HEAD: **X1** = oil port position.
The oil ports and cushioning adjustment positions are available, respectively, on sides 1 and 3 for all styles except E (see the figure at side): the style E has the cushioning adjustment on side 2.

Example of model code: CKM/00-50/22 *0500-S201 - D - **B1E3X1**

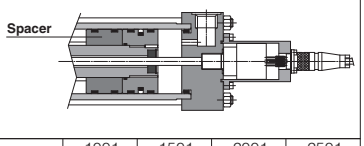
25 SEALING SYSTEM FEATURES

The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**.
Seals **2** and **4** not available for CKP since they are not compatible with glycol water and water based fluids.
Special sealing system for low temperature, high frequencies (up to 20 Hz), long working life and heavy duty are available, see **tab. TB020**. All the seals, static and dynamic, must be periodically replaced: proper spare kits are available, see **tab. B137**. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition.

STROKE TOLERANCES

- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

RECOMMENDED SPACERS [mm]

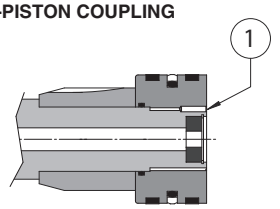


Stroke	1001 ÷ 1500	1501 ÷ 2000	2001 ÷ 2500	2501 ÷ 3000
Spacer code	**2**	**4**	**6**	**8**
Length	50	100	150	200

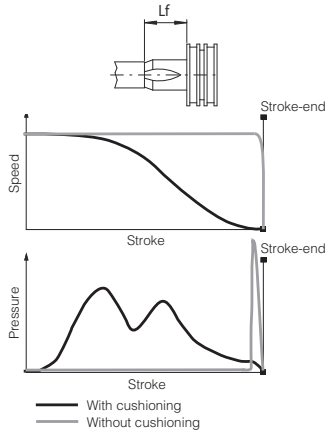
TIE RODS TIGHTENING TORQUES

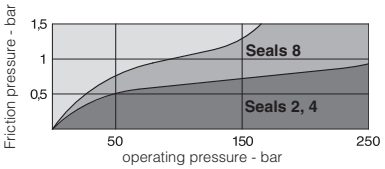
Ø Bore	**40**	**50**	**63**	**80**
MT [Nm]	20	70	70	160
Wrench	13	19	19	24
Ø Bore	**100**	**125**	**160**	**200**
MT [Nm]	160	460	820	1160
Wrench	24	32	41	46

ROD-PISTON COUPLING



Lf is the total cushioning lenght. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning lenght Lf; in this way the cushioning effect does not influence the movement during the operating stroke.

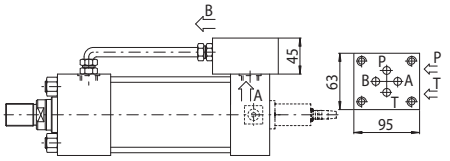




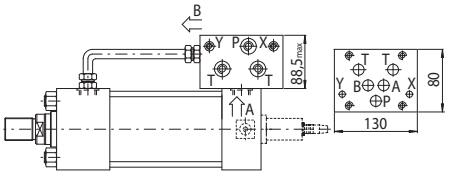
Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
2	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFB, HFC (water max 45%), HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
8	NBR + PTFE + POLYURETHANE	**low friction**	0,5	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606	ISO 7425/1	ISO 7425/2

26 INCORPORATED SUBPLATE

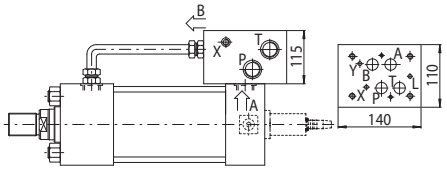
CK* cylinders with oil ports positions 1 can be supplied with ISO (size 06, 10, 16 and 25) incorporated subplates for mounting of valves directly on the cylinder.



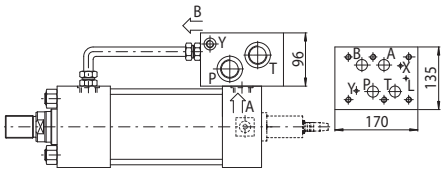
10 = subplate with mounting surface 4401-03-02-0-05 (size 06)
Oil ports P and T = G 3/8
For bores from 40 to 200 and strokes longer than 100 mm
For shorter strokes, the cylinder must be provided with suitable spacer



20 = subplate with mounting surface 4401-05-05-0-05 (size 10)
Oil ports P and T = G 3/4; X and Y = G 1/4
For bores from 40 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinders must be provided with suitable spacer



30 = subplate with mounting surface 4401-07-07-0-05 (size 16)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 80 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinders must be provided with suitable spacer

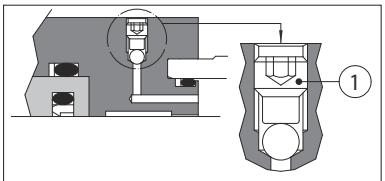


40 = subplate with mounting surface 4401-08-08-0-05 (size 25)
Oil ports P and T = G 1; L, X and Y = G 1/4
For bores from 125 to 200 and strokes longer than 150 mm
For shorter strokes, the cylinders must be provided with suitable spacer

Note: for the choice of suitable spacer see section 19. The addition of spacer length and working stroke must be at least equal or upper than the minimum stroke indicated above, see the following example:
Subplate **20**; working stroke = **70** mm; min. stroke = **150** mm → select spacer **4** (lenght = **100**mm)

27 AIR BLEEDS

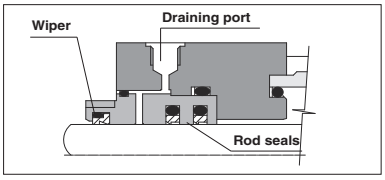
The air in the hydraulic circuit must be removed to avoid noise, vibrations and irregular cylinder's motion: air bleed valves realize this operation easily and safely.
Air bleeds are positioned on side 3 except for rear heads of CKV, CKP cylinders with bores from 80 to 200 mm (on side 2) and for heads of mounting style **E** (on side 2), see section 24.
For a proper use of the air-bleed (see figure on side) unlock the grub screw ① with a wrench for hexagonal head screws, moves the cylinder for the necessary cycles to bleed-off the air and retighten as indicated in table at side.



Ø Bore	Screwing	Tightening torque
40	M5 x 4	8 Nm
50 - 200	M8 x 10	20 Nm

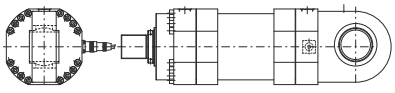
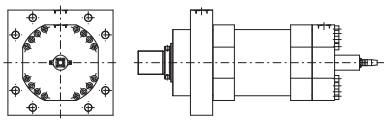
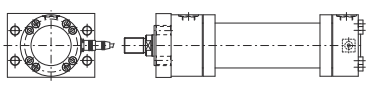
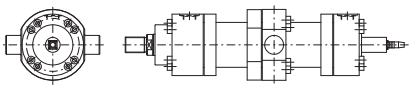
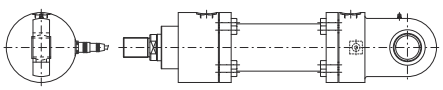
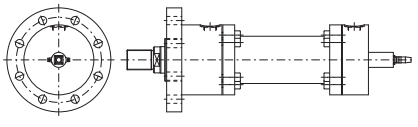
28 DRAINING

The rod side draining reduces the seals friction and increases their reliability.
The draining is positioned on the same side of the oil port, between the wiper and the rod seals (see figure at side).
It is recommended to connect the draining port to the tank without backpressure.
Draining port is G1/8.



29 SERVOCYLINDERS DERIVED FROM SERIES CH, CN, CC

Servocylinders derived from CH (ISO 6020-2 P = 160 bar; **tab. B140**), CH big bores (ISO 6020-3 P = 160 bar; **tab. B160**), CN (ISO 6020-1 P = 160 bar; **tab. B180**) and CC series (ISO 6022 P = 250 bar; **tab. B241**) are available on request. Contact our technical office for details.

BASIC CYLINDER	DERIVED SERVOCYLINDERS	
CH big bore (tab. B160) **ISO 6020-3** Pnom 160 bar Pmax 250 bar Ø bore 250÷400 mm Ø rod 140÷220 mm	**CHP, CHV -** example of style "S" 	**CHF, CHM -** example of style "N" 
CN (tab. B180) **ISO 6020-1** Pnom 160 bar Pmax 250 bar Ø bore 40÷200 mm Ø rod 22÷140 mm	**CNP, CNV -** example of style "N" 	**CNF, CNM -** example of style "L" 
CC (tab. B241) **ISO 6022** Pnom 250 bar Pmax 320 bar Ø bore 50÷320 mm Ø rod 36÷220 mm	**CCP, CCV -** example of style "S" 	**CCF, CCM -** example of style "A" 

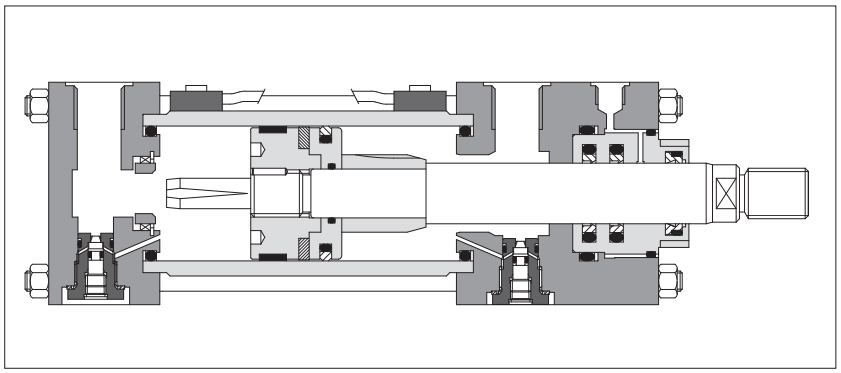
30 SPARE PARTS - SEE TABLE SP-B310

Example for seals spare parts code

G 8	-	CKF	-	125	/	90
Sealing system						
Cylinder series						
Bore size [mm]						Rod diameter [mm]

Hydraulic cylinders type CKS - with adjustable proximity sensors

to ISO 6020-2 - nominal pressure 10 MPa (100 bar) - max 15 MPa (150 bar)



CKS cylinders are derived from standard CK (tab. B137) with stainless steel piston and housing and with a special design to equip external proximity sensors for rod position detection."Reed" or "Hall effect" sensors are easily assembled on one of the four tie rods by means of proper clamps which allows to position them along the cylinder housing. The sensors switch their electric circuit when they detect the permanent magnet integrated into the piston. Thus they can be used to perform motion cycles, operating sequences, fast-slow cycles and safety functions.

- Bore sizes from **25** to **100** mm
- **2** rod diameters per bore
- Piston and housing in stainless steel
- Rods and tie rods with rolled threads
- **14** standard mounting styles
- **3** seals options
- Adjustable or fixed cushioning
- **ATEX** sensors
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's dimensions and options **see tab. B137**

1 PROXIMITY SENSORS: MAIN FEATURES

Reed	Hall effect
- High switching power, up to 230 VDC or VAC - Suitable to directly pilot a power load - 2 wires circuit for easy connection	- Electronic sensor - Infinite electric life (no moving parts inside it) - High sensitivity and switching reliability - Not suitable to directly pilot a power load - 3 wires circuit to avoid voltage drop

2 PROXIMITY SENSORS: MAIN DATA

	Power supply [VDC/AC]	Max power [W]	Max current [mA]	Voltage drop [V]	Switching time [ms]		Circuit style	Contact (2)	Output	Cable section	Cable shealt	Cable shealt [mm]	Temperature range [°C]	Protection degree
					ON	OFF								
P / R (REED)	3 ÷230	10 VA	500	-	0,5	0,1	2 wires	N.O.	-	2x0,25	PVC	2500	-20 ÷+85	IP67
Q / S (HALL)	10 ÷30 **(1)**	6	250	0,7	0,2	0,1	3 wires	N.O.	PNP	3x0,14	PVC	2500	-20 ÷+85	IP67
ATEX (HALL)	8,2 **(1)**	6	250	-	0,2	0,1	3 wires	N.O.	-	2x0,14	PVC	6000	-20 ÷+70	IP67

Notes: **(1)** Only VDC
(2) N.O.= Normally Open

3 MODEL CODE

CKS	-	50	/	22	*	0500	-	S	3	0	1	-	R	-	B1E3X1Z3	**

Cylinder series
CKS to ISO 6020 - 2
CKSA with ATEX sensors

Bore size, see section 8
from **25** to **100** mm

Rod diameter, see sections 8
from **12** to **70** mm

Stroke, see section 8
from **20** to **3000** mm

Mounting style (1)

		REF. ISO
C	= fixed clevis	MP1
D	= fixed eye	MP3
E	= feet	MS2
G	= front trunnion	MT1
H	= rear trunnion	MT2
N	= front flange	ME5
P	= rear flange	ME6
S	= fixed eye + spherical bearing	MP5
T	= threaded hole+tie rods extended	MX7
V	= rear tie rods extended	MX2
W	= both end tie rods extended	MX1
X	= basic execution	-
Y	= front tie rods extended	MX3
Z	= front threaded holes	MX5

Cushioning (1)
0 = none

Slow adjustable	Fast fixed
4 = rear only	**7** = rear only
5 = front only	**8** = front only
6 = front and rear	**9** = front and rear

Sealing system (1)
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds

Spacer, see section 5
0 = none **1** = 25 mm **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Heads' configuration (1) (3)
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
* = selected position (1, 2, 3 or 4)

Options (3):
Rod end **(1)**
F =female thread
G =light female thread
H =light male thread

Proximity sensor type for CKS, see sections 1 and 2 **(4)**
P = REED with connector
Q = HALL with connector
R = REED with cable output
S = HALL with cable output

Air bleeds **(1)**
A =front air bleed
W =rear air bleed

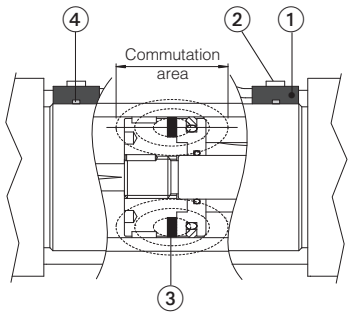
Draining **(1)**
L =rod side draining

Series number **(2)**

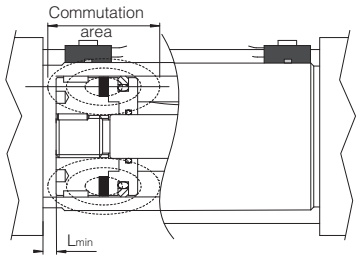
(1) For details refer to **tab. B137** **(2)** For spare parts request indicate the series number printed on the nameplate only for series < 30
(3) To be entered in alphabetical order **(4)** 2 proximity sensors are included in the supply, for spare parts see section 9

4 BASIC WORKING PRINCIPLES

The rod position detection system is composed by: one or more magnetic sensors ① fixed to a tie rod by proper clamps ② and a permanent magnet ③ integrated into the piston.
Both the “Reed” and “Hall effect” sensors are defined by a “commutation area” of variable dimension depending to the bore and sensor type (see section 6). The permanent magnet generates a magnetic field of suitable power and shape. When the piston gets close to the sensor and the magnetic field enters into its “sensitive area”④, the electric circuit is closed and the piston position detected, see figures at side. The electric circuit remains closed depending to the commutation area length, see section 6. The distance of the piston rod from the mechanical stroke-end at which the sensor commutation occurs depends to the sensor type and position, see Lmin dimension in section 6 The sensors can be assembled at any position of the cylinder stroke unscrewing the metallic clamp and moving the sensor to the desired position.
The sensors are equipped with a LED signal that indicates the commutation status.



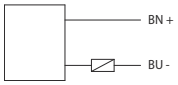
Commutation not occurred



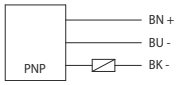
Commutation occurred

5 ELECTRIC CIRCUITS

“REED ” sensors
2 wires



“HALL effect” sensors
3 wires



BN = brown BU = blue BK = black

3 PIN female connector
for sensors **P**, **Q**

(sensor view)

PIN	WIRING	SIGNAL REED	SIGNAL HALL
1	blue	V0	V0
2	black	-	V0
3	brown	V+	V+

Notes:
The sensors **P** and **Q** are supplied with 3 pin female connector
All the sensors are supplied with an output cable 2,5 m long
Reed sensors are also available with 3 wires circuit, **contact our technical office**

6 INSTALLATION AND WORKING DATA

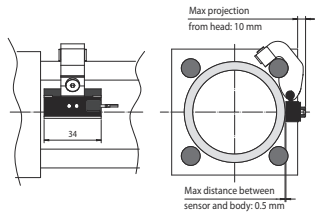
Ø Bore	Option **P / R (Reed sensors)**					Option **Q / S (Hall effect sensors)**				
	Max piston speed [m/s]	**L min (1)** [mm] front	rear	**Commutation area** [mm]	**Hysteresis** [mm]	**Max piston speed** [m/s]	**L min (1)** [mm] front	rear	**Commutation area** [mm]	**Hysteresis** [mm]
25	0.4	4	3	4	2	0.15	0	0	10	1
32	0.4	6	5	4	2	0.15	0	0	10	1
40	0.5	13	6	4	2	0.15	0	0	14	1
50	0.5	10	8	4	3	0.15	0	0	14	1
63	0.5	13	7	6	5	0.2	2	2	16	1
80	0.5	15	8	5	4	0.2	2	2	14	1
100	0.5	21	10	7	5	0.3	3	3	14	1

Note: (1) distance of the piston rod from the mechanical stroke-end at which the sensor commutation occurs with the sensor positioned stuck to the head, see figures in section 4

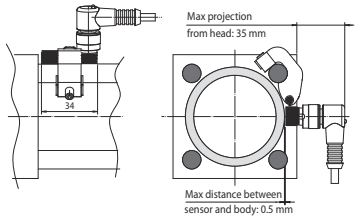
7 OPERATING LIMITS

The cylinder housing and piston are made in stainless steels to avoid dispersion and distorsion of the magnetic field generated by the permanent magnet, integrated into the piston. This limits the working pressure up to 100 bar: ensure to not exceed this pressure values.
For the proper use of the sensor and to avoid lecture faults (absence of signal or double signal) it is necessary to:
- Respect the max distance between the sensor and the body (max 0,5 mm)
- Avoid the presence of ferromagnetic objects near the sensor (minimum distance 10 mm)
- Make sure that there are no external magnetic fields around the cylinder
- Not exceed maximum piston speed shown in section 6

Proximity sensors with cable output



Proximity sensors with connector



8 BORE / ROD SIZES AND STROKE

The table shows the available bore/rod sizes, refer to **tab. B137** for installation dimensions and options.
For the proper use of proximity sensors the stroke must be selected greater than the values reported below, lower strokes can be achieved by selecting the spacer **1**.The introduction of spacers increases the overall cylinder’s dimensions.

Ø Bore		25	32	40	50	63	80	100
Ø Rod	standard	12	14	18	22	28	36	45
	differential	18	22	28	36	45	56	70
Min. stroke		20	20	25	25	30	30	40

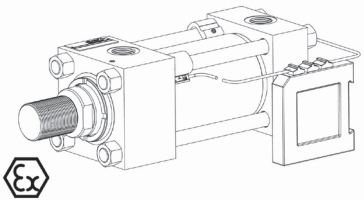
9 ATEX SENSORS FOR CKA

CKSA cylinders are supplied with magnetic sensors with ATEX certifications:

Ex II 1G Ex ia IIC T4 Ga for gas (zone 0/1/2),
Ex II 1D Ex ia IIIC t 135°C Da for dusts (zone 20/21/22)

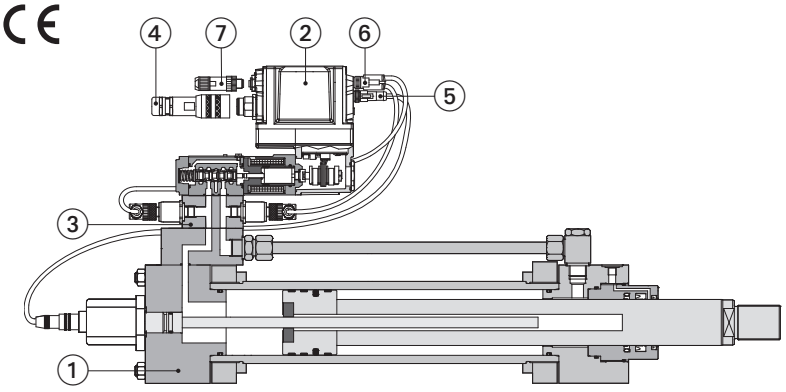
The sensors are supplied with an amplifier which it serves as the interface between eletrical signals from the hazardous area and the non-hazardous area (safe zone).
For certification and start up refer to the user’s guide included in the supply.

ATEX sensors with amplifier



Digital electrohydraulic servoactuators

with integral axis controller, for closed loop position and force control



***** AZC-D-SF-EH/CKM200/100D0500/V040**

① Servocylinder with integral position transducer
② Servoroportional valve with integral axis controller
③ Block with double pressure transducer
④ Main connector
⑤ Position transducer connector
⑥ Pressure transducers connector
⑦ Fieldbus connectors

AZC

Digital electrohydraulic servoactuators are stand-alone units performing closed loop position controls.
The complete motion control cycle can be operated by external signals (from machine PLC) or programmed internally to the controller.
S options add alternate pressure / force control to the basic position one with pressure transducers or load cell factory pre-assembled and wired.
The servoacuators are composed by a servocylinder with position transducer, servoproportional valve with integral driver + axis controller, factory assembled and tested.
They can be provided with optional fieldbus interfaces for functional parameters setting, reference signals and real time diagnostics.
The USB interface is always present for connection to Atos PC software which allows to easily customize the AZC configuration to the specific application requirements.

1 MODEL CODE

***	AZC	M	-	D	-	SF	-	EH	/	CK	M	200	/	100	D	0500	/	V0	40

******* Design number

AZC Digital electrohydraulic servoactuator for linear axis position control

Cycle Generation type:
- = none
I = injection
M = mold
P = parison
S = synchronism
X = positioning
9 = customized

Position transducer type:
A = analog
D = digital

Optional alternated Position/Force control:
SN = none
SP = with integral single pressure transducer
SF = with integral double pressure transducer
SL = with integral load cell transducer
XL = with remote load cell transducer

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Servocylinder Type, tech table **B310**:
CN = ISO 6020-1, Pmax 250 bar - tech table **B180**
CK = ISO 6020-2, Pmax 250 bar - tech table **B137**
CH = ISO 6020-3, Pmax 250 bar - tech table **B160**
CC = ISO 6022, Pmax 320bar - tech table **B241**

Bore diameter [mm]

Rod diameter [mm]

Rod
S = single rod
D = double rod

Stroke [mm]

Servoproportional valve size with axis controller:
V0 = direct, size 06
V1 = direct or piloted, size 10
V2 = piloted size 16
V4 = piloted size 25 or size 27

Servoproportional valve configuration, zero spool overlap:
40 = with fail safe, sleeve execution, direct (tech table **FS610**)
60 = without fail safe, sleeve execution, direct (tech table **FS610**) or piloted (tech table **FS630**)
70 = spring central position, direct (tech table **FS620**) or piloted (tech table **FS630**)

Cylinder position transducer type, see section 6 **:**

Analog (only for AZC-A)
P = potentiometer, max stroke 900mm
F = analog magnetosonic, max stroke 2500mm
N = analog magnetostrictive, max stroke 4000mm
T = LVDT, max stroke 16mm
L = LVDT, max stroke 30mm
V = inductive, max stroke 900mm

Digital (only for AZC-D)
M = SSI magnetosonic, max stroke 900mm

Analog or Digital
9 = special
X = remoted

2 MAIN CHARACTERISTICS

Assembly position		Any position	
Ambient temperature range		standard execution = -20°C ÷ +60°C	
Storage temperature range		Standard execution = -20°C ÷ +70°C	
Protection degree to EN60529		IP66 / IP67	
Duty factor		Continuous rating (ED=100%)	
Recommended fluid temperature		-20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

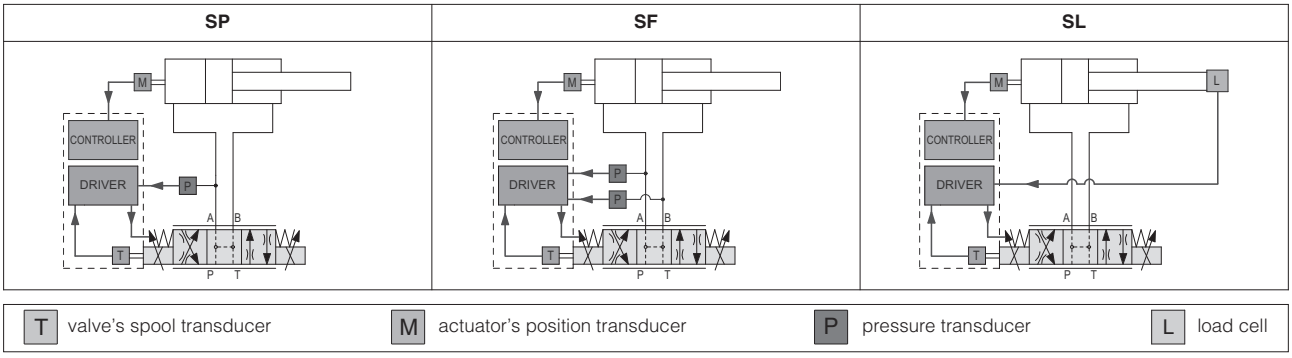
Hydraulic fluid	Classification	Ref. Standard
Mineral oils	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	HFDU, HFDR	ISO 12922
Flame resistant with water	HFC	

3 AXIS CONTROLLER

Digital servoproportionals direct or pilot operated include integral valve's driver + axis controller to perform the position closed loop of hydraulic actuator. Axis controllers are operated by an external or internally generated reference position signal.
For detailed information about integral axis controller see tech tables **FS610**, **FS620**, **FS630**.

4 ALTERNATED P/Q CONTROLS

S options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the position control function. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
For detailed information about SP, SF, SL controls, see tech table **GS002**.



T valve's spool transducer M actuator's position transducer P pressure transducer L load cell

5 FIELDBUS

Fieldbus allows the direct communication of the servoactuator with machine control unit for digital reference signal, diagnostics and settings of functional parameters. Analog reference signal remain available on the main connector for quick commissioning and maintenance.
For detailed information about fieldbus features and specification see tech table **GS510**.

6 ACTUATOR'S TRANSDUCER CHARACTERISTICS

6.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controllers, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

6.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer. Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

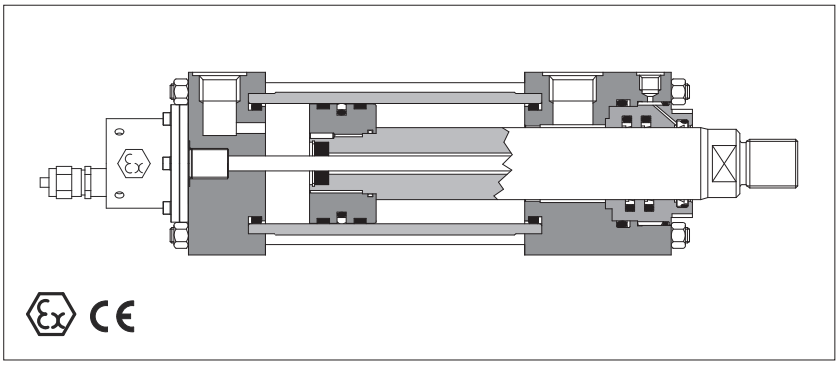
6.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				Pressure/Force
Execution	A		D		SP, SF, SL
Input type	Potentiometer	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	±10 Vdc	+24 Vdc	+5 Vdc / +24 Vdc	+5 Vdc / +24 Vdc	+24 Vdc
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by digital controller **(2)** percentage of total stroke **(3)** Balluff BTL7 with SSI interface is not supported

Hydraulic cylinders type CKA - for potentially explosive atmospheres

ATEX - ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CKA cylinders are derived from standard CK (tab.B137) with certification according to ATEX 2014/34/EU. They are designed to limit the external surface temperature, according to the certified class, to avoid the self-ignition of the explosive mixtures potentially present in the environment. CKAM servocylinders are equipped with ex-proof built-in digital magnetostrictive position transducer, ATEX certified.

- Optional ex-proof proximity sensors, ATEX certified
- Bore sizes from **25** to **200** mm
- Up to **3** rod diameters per bore
- Strokes up to **5000** mm
- Single or double rod
- **15** standard mounting styles
- **5** seals options
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's dimensions and options **see tab B.137**

For cylinder's choice and sizing criteria **see tab. B015**

1 ATEX CERTIFICATION

Cylinder type	Group	Equipment category	Gas/dust group	Temperature class (1)	Zone
CKA	II	2 GD	II C/III C	T85°C(T6) / T135 °C(T4)	1,2,21,22
CKA + ex-proof rod position transducer **(2)**	II	2 G	II B	T6/T5	1,2
	II	2 D	III C	T85°C/T100°C	21,22
CKA + ex-proof proximity sensors	II	3 G	II	T4	2

(1) Temperature class depends to the max fluid temperature and sealing system
(2) The rod position transducer is certified to work with explosive gas (cat. 2G) and dust (cat. 2D)

2 MODEL CODE

CKA | **M** / **10** - **50** / **22** / **22** * **0500** - **S** | **3** | **0** | **1** - **A** - **B1E3X1Z3** | ******

Cylinder series
CKA to ATEX 2014/34/EU dimensions to ISO 6020 - 2

Ex-proof position transducer
See section 5
- = omit if not requested
M = Digital magnetostrictive

Incorporated subplate (1)
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size (1)
from **25** to **200** mm

Rod diameter (1)
from **12** to **140** mm

Second rod diameter for double rod **(1)**
from **12** to **140** mm, omit for single rod

Stroke (1)
up to **5000** mm (**4000** mm for **CKAM**)

Mounting style (1)

		REF. ISO
C	fixed clevis	MP1 **(4)**
D	fixed eye	MP3 **(4)**
E	feet	MS2
G	front trunnion	MT1
H	rear trunnion	MT2 **(4)**
L	intermediate trunnion	MT4 **(5)**
N	front flange	ME5
P	rear flange	ME6 **(4)**
S	fixed eye + spherical bearing	MP5 **(4)**
T	threaded hole+tie rods extended	MX7
V	rear tie rods extended	MX2
W	both end tie rods extended	MX1
X	basic execution	-
Y	front tie rods extended	MX3
Z	front threaded holes	MX5

Spacer (1)
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Cushioning (1)
0 = none

Fast adjustable	Slow adjustable	Fast fixed
1 = rear only	**4** = rear only	**7** = rear only
2 = front only	**5** = front only	**8** = front only
3 = front and rear	**6** = front and rear	**9** = front and rear

Sealing system, see section 7
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
6 = (NBR + PTFE) very low friction, single acting - pushing
7 = (NBR + PTFE) very low friction, single acting - pulling

Options (1)(3):
Rod end
F = female thread
G = light female thread
H = light male thread
Oversized oil ports
D = front oversized oil port
Y = rear oversized oil port
Ex-proof proximity sensors, see section 8
R = front sensor
S = rear sensor
Rod treatment
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds
A = front air bleed
W = rear air bleed
Draining
L = rod side draining

Heads' configuration (1)(3)
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
* = selected position (1, 2, 3 or 4)

Series number **(2)**

(1) For details see table **B137**
(2) For spare parts request indicate the series number printed on the nameplate only for series < 30
(3) To be entered in alphabetical order
(4) Not available for double rod
(5) XV dimension must be indicated in the model code

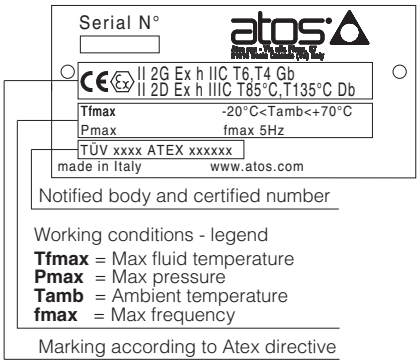
3 CERTIFICATION

In the following are resumed the cylinders marking according to Atex certification.
Reference norm ISO 80079-36, ISO 80079-37.

II 2G Ex h IIC T6, T4 Gb (gas) **II 2D Ex h IIIC T85°C, T135°C Db (dust)**

GROUP II, Atex

II = Group II for surface plants
2 = High protection (equipment category)
G = For gas, vapours
D = For dust
Ex = Equipment for explosive atmospheres
IIC = Gas group
IIIC = Dust group
T85°C/T135°C = Surface temperature class for dust, see section 6
T6/T4 = Surface temperature class for gas, see section 6
Gb/Db = EPL Equipment group



4 INSTALLATION NOTES

Before installation and start-up refer to tab. BX900

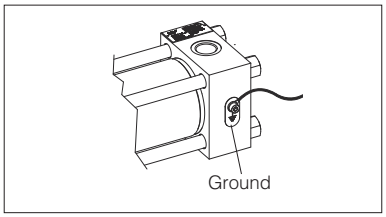
- The max surface temperature indicated in the nameplate must be lower than the following values:

GAS - **80% of gas ignition temperature**

DUST - max value between **dust ignition temperature - 75°C** and **2/3 of dust ignition temperature**

- The ignition temperature of the fluid must be 50°C greater than the maximum surface temperature indicated in the nameplate
- The cylinder must be grounded using the threaded hole on the rear head, evidenced by the nameplate with ground symbol. The hydraulic cylinder must be put at the same electric potential of the machine

GROUNDING



5 EX-PROOF ROD POSITION TRANSDUCER

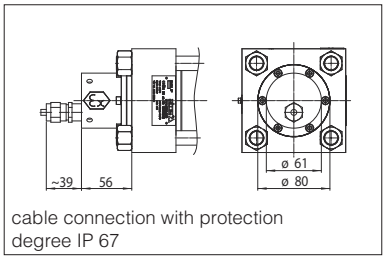
CODE: **M**
CKA cylinders are available with "Balluff" Ex-proof rod position transducer, ATEX certified to **II 1/2 G Ex d IIC T6/T5 Ga/Gb** for gas and **II 2D Ex tb IIIC T85°C/T100°C Db IP 67 -40°C Ta +65°C (T6) -40°C Ta +80°C (T5)** for dust. Ex-proof transducers meet the requirements of the following european standard documentations:

II 1/2 G Ex d IIC T6/T5 Ga/Gb	**II 2D Ex tb IIIC T85°C/T100°C Db IP 67**
EN 60079-0	EN 61241-0
EN 60079-1	EN 61241-0/AA
EN 60079-26	EN 61241-1

The transducer housing is made in AISI 303.
For dimensions and details, contact our technical office.

For certification and start-up refer to the user's guide included in the supply
The transducer is available with SIL certified on request

CKAM WITH ROD POSITION TRANSDUCER



cable connection with protection degree IP 67

6 MAIN CHARACTERISTICS AND FLUID REQUIREMENTS

Ambient temperature	-20÷+70°C; -40 ÷ +65°C for **CKAM**
Fluid temperature	-20÷+70°C (**T6**); -20÷+120°C (**T4**) for seals type **2** (*)
Max surface temperature	≤ +85 °C (**T6**); ≤ +135 °C (**T4**) for seals type **2** (*)
Max working pressure	16 MPa (160 bar)
Max pressure	25 MPa (250 bar)
Max frequency	5 Hz
Max speed (see section 7)	1 m/s (seals type 2, 4, 6, 7); 0,5 m/s (seals type 1)
Recommended viscosity	15 ÷ 100 mm²/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

Note: (*) Cylinders with seals type **2** may also be certified **T6** limiting the max fluid temperature to 70°C

CKA cylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters) depending to the sealing system.

7 SEALING SYSTEM FEATURES

The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**
When single acting seals are selected (types **6** and **7**), the not pressurized cylinder's chamber must be connected to the tank. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition.

Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
1	NBR + POLYURETHANE	**high static and dynamic sealing**	0.5	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	**very low friction and high temperatures**	1	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, fire resistance fluids HFA, HFB, HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	1	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
6 - 7	NBR + PTFE	**very low friction single acting - pushing/pulling**	1	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2

8 EX-PROOF PROXIMITY SENSORS

CODES: **R** = front sensor; **S** = rear sensor
CKA cylinders are available with ex-proof proximity sensors, ATEX certified to **Ex II 3G Ex nA II T4 -25≤Ta≤80°C**. They meet the requirements of the following european standard documentations: EN 60079-0, EN 60079-15.
Their functioning is based on the variation of the magnetic field, generated by the sensor itself, when the cushioning piston enters on its influence area, causing a change of state (on/off) of the sensors. The sensor housing is made in stainless steel.
For dimensions and details, contact our technical office.

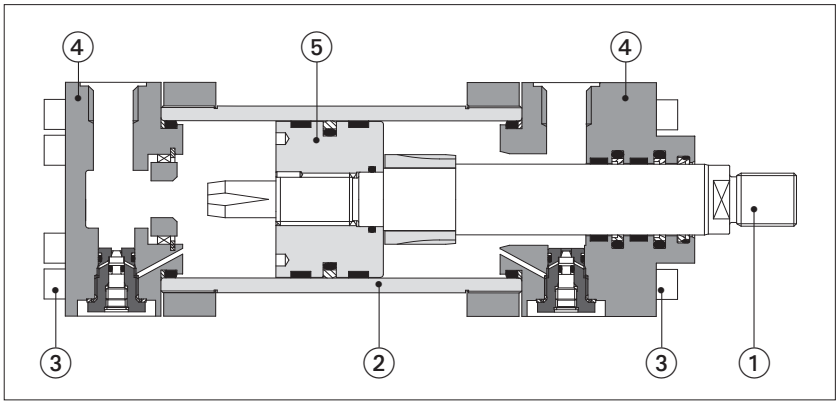
For certification and start-up refer to the user's guide included in the supply

SENSORS TECHNICAL DATA

Ambient temperature	-25 ÷ +80°C
Nominal voltage	24 VDC
Operating voltage	10 ÷ 30 VDC
Max load	200 mA
Repeatability	<5%
Protection degree	IP 68
Max frequency	1000 Hz
Max pressure	25 MPa

Hydraulic cylinders type CNX - stainless steel round heads with counterflanges

to ISO 6020-1 - nominal pressure 10 MPa (100 bar) - max 15 MPa (150 bar)



CNX cylinders are derived from standard CN (tab. B180) with stainless steel construction to withstand extreme and corrosive environmental conditions and to ensure compatibility with water based fluids or pure water.
They are ideally suited for a variety of applications and industries including: pharmaceutical, marine, military, waste management, offshore and chemical processing.

- Bore sizes from **50** to **100** mm
- Strokes up to **3000** mm
- Rods with rolled threads
- **9** standard mounting styles
- **3** seals options
- Rod guide rings for low wear
- Adjustable or fixed cushioning
- Optional built-in position transducer, **see tab. B310**

Stainless steel attachments are available on request, for dimensions **see tab. B800**
For cylinder dimensions and options **see tab. B180**

1 MATERIALS AND SPECIFICATIONS

Cylinder component	Material	Features
ROD ① and PISTON ⑤	AISI 431	High strenght and good corrosion resistance
HOUSING ② and HEADS ④	AISI 316L	Optimum corrosion resistance
SCREWS ③	AISI 316 A4	Optimum corrosion resistance and high strength

2 MODEL CODE

CNX	F	-	63	/	45	*	0500	-	S	3	0	8	-	A	-	B1E3X1Z3	**

Cylinder series
CNX to ISO 6020 - 1

Rod position transducer
see section 4
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Bore size, see section 6
from **50** to **100** mm

Rod diameter, see sections 6
from **36** to **70** mm

Stroke (1)
up to **3000** mm

Mounting style (1)	REF. ISO
A = front round flange	MF3
B = rear round flange	MF4
D = fixed eye	MP3
E = feet	MS2
L = intermediate trunnion	MT4 **(3)**
N = front square flange	MF1
P = rear square flange	MF2
S = fixed eye + spherical bearing	MP5
X = basic execution	-

Cushioning (1)
0 = none

Fast adjustable	Fast fixed
1 = rear only	**7** = rear only
2 = front only	**8** = front only
3 = front and rear	**9** = front and rear

Spacer (1)
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Sealing system, see section 5
3 = (FKM + PTFE) very low friction, high temperatures and water based fluids
5 = (NBR + PTFE) very low friction, high speeds and water based fluids
8 = (NBR + PTFE and POLYURETHANE) high static and dynamic sealing

Options (1) (2):
Air bleeds
A = front air bleed
W = rear air bleed

Heads' configuration (1) (2)
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E3 = front head*
Z3 = rear head*
* = enter E2 and Z2 for mounting style E

Series number

(1) For details see **tab. B180**
(2) To be entered in alphabetical order
(3) XV dimension must be indicated in the model code, see **tab. B180**

3 STAINLESS STEEL PROPERTIES

CNX cylinders are manufacured with selected stainless steel to withstand extended exposure to aggressive environments, the table at side shows the compatibility of AISI 316L and AISI 431 with the main aggressive substances.
The rod is chromeplated: chrome thickness 0,020 mm; hardness 850-1150 HV.
The low strength of AISI 316L limits the max pressure to 150 bar; for heavy duty applications AISI 630 is recommended, contact our technical office.

Material	Cylinder component	Mechanical properties **Rm min** [MPa]	**Rs min** [MPa]	Corrosion resistance (2)
AISI 316L	housing and heads	450	195	> 1200 h
AISI 316 A4 70	screws	700	450	> 1200 h
AISI 431	piston and rod	800	600	> 600 h
AISI 420	Spherical bearing of style S	700	500	< 100 h
AISI 630 (17-4 ph) **(1)**	housing and rod	860	724	> 1000 h

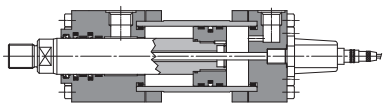
Note: (1) Available on request for heavy duty applications
(2) Corrosion resistance in neutral salt spray to ISO 9227 NSS

Corrosion index for AISI 316L and AISI 431

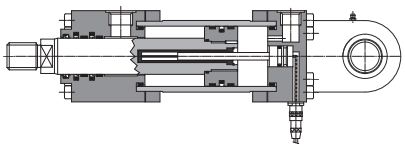
Substance	Corrosion index AISI 316L	AISI 431
Marine atmospheres	very good	good
Salt water	good	sufficient
33% Acetic acid	excellent	limited
2% Muriatic acid	good	limited
70% Phosphoric acid	limited	limited
65% Nitric acid	good	good
2% Sulfuric acid	excellent	limited
20% Sulfuric acid	limited	limited

4 CNX WITH BUILT-IN POSITION TRANSDUCER

CNXM - Magnetosonic programmable



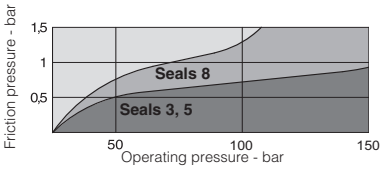
CNXV - Inductive



CNX cylinders are also available with magnetostrictive, potentiometric and inductive rod position transducers.
Stainless steel or aluminum materials used for transducers components make CNX servocylinders ideal for extreme working conditions as aggressive external environments or corrosive fluids.
For transducer performance and other details see **tab. B310**

5 SEALING SYSTEM FEATURES

The sealing system must be choosen according to the working conditions of the system: speed, fluid type and temperature.
For HFA fluids or pure water it is recommended the use of proper additives to increase the sealing working life. Contact our technical office to check the compatibility with other fluids not mentioned below and specify type and composition.



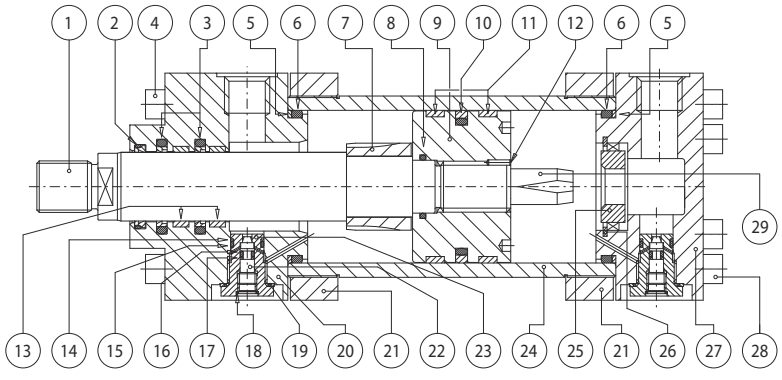
Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals Piston	Rod
3	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV fire resistance fluids HFA, HFB, HFD-U, HFD-R and water	ISO 7425/1	ISO 7425/2
5	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606; fire resistance fluids HFA, HFC (water max 45%), HFD-U and water	ISO 7425/1	ISO 7425/2
8	NBR + PTFE + POLYURETHANE	**high static and dynamic sealing**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV	ISO 7425/1	ISO 7425/2

6 BORE / ROD SIZES

Ø Bore	**50**	**63**	**80**	**100**
Ø Rod	**36**	**45**	**56**	**70**

The table at side shows the available bore/rod sizes, see **tab. B180** for installation dimensions and options.

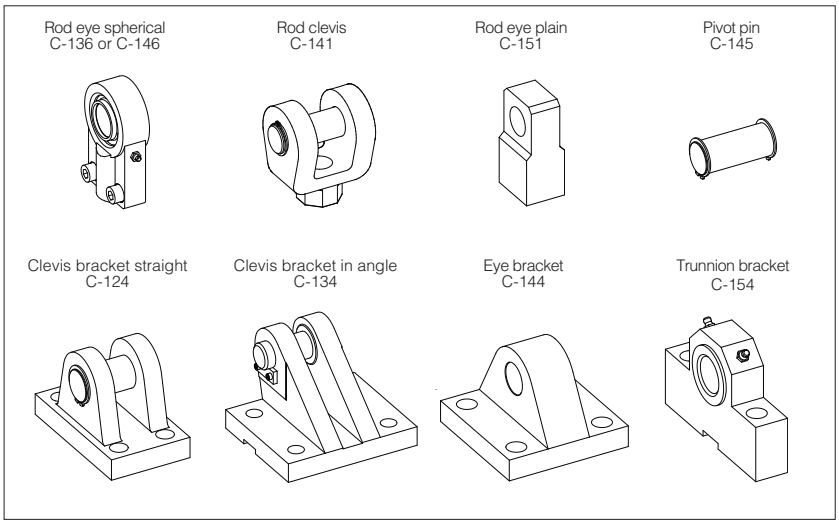
7 CYLINDER SECTION



POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	AISI 431 Chromeplated	11	Piston guide rings	PTFE	21	Counterflange	AISI 316L
2	Wiper	NBR / FKM and PTFE	12	Screw stop pin	AISI 304 / AISI 316L	22	Cushioning adjustment screw	AISI 316L
3	Rod seal	NBR / FKM and PTFE	13	Rod guide rings	PTFE	23	Cushioning adjustment plug	AISI 316L
4	Screw	AISI 316 A4	14	Anti-extrusion ring	PTFE	24	Cylinder housing	AISI 316L
5	Anti-extrusion ring	PTFE	15	O-ring	FKM	25	Rear cushioning sleeve	Bronze
6	O-ring	NBR / FKM	16	O-ring	FKM	26	Toroidal ring	AISI 304 / AISI 316L
7	Front cushioning piston	AISI 431	17	Anti-extrusion ring	PTFE	27	Rear head	AISI 316L
8	O-ring	NBR / FKM	18	Seeger	AISI 304 / AISI 316L	28	Screw	AISI 316 A4
9	Piston	AISI 431	19	Seal	FKM	29	Rear cushioning piston	AISI 431
10	Piston seal	NBR / FKM and PTFE	20	Front head	AISI 316L			

Attachments for hydraulic cylinders

to ISO 6982, ISO 8132 and ISO 8133



SWC Cylinders Designer

Software for assisted selection of Atos cylinders & servocylinders codes, including cylinder's sizing, full technical information, 2D & 3D drawings in several CAD formats.

Available for download at www.atos.com

The table at side shows the Atos range of standard rod attachments and brackets: they are available for each cylinder bore. See section 2 for possible combinations. Stainless steel attachments are available on request.

1 MODEL CODE

C	-	141	12	-	V
Standard attachment		**Rod attachments**: **136**= Rod eye spherical **146**= Rod eye spherical **141**= Rod clevis **151**= Rod eye plain **145**= Pivot pin **Brackets:** **124** = Clevis bracket straight **134** = Clevis bracket in angle **144**= Eye bracket **154**= Trunnion bracket	**Bore** size/rod diameter [mm]		**Painting** see sect. 5

2 POSSIBLE COMBINATIONS

Ø Rod	Rod attachments codes					Ø Bore	Brackets codes			
	(b)									
12 **18** opt.**H**(a)	NA	C-14612	C-14112	C-15112	C-14512	**25**	NA	C-13425	C-14425	C-15425
14 **22** opt.**H**(a)	C-13616	C-14614	C-14114	C-15114	C-14514	**32**	NA	C-13432	C-14432	C-15432
18 **22** opt.**H**(a) **28** opt.**H**	C-13618	C-14618	C-14118	C-15118	C-14518	**40**	C-12422 (c)	C-13440	C-14440	C-15440
22 **28** opt.**H**(a) **36** opt.**H**	C-13622	C-14622	C-14122	C-15122	C-14522	**50**	C-12428 (c) C-12436 (d)	C-13450	C-14450	C-15450
28 **36** opt.**H**(a) **45** opt.**H**	C-13628	C-14628	C-14128	C-15128	C-14522	**63**	C-12436 (c) C-12445 (d)	C-13463	C-14463	C-15463
36 **45** opt.**H**(a) **56** opt.**H**	C-13636	C-14636	C-14136	C-15136	C-14536	**80**	C-12445 (c) C-12456 (d)	C-13480	C-14480	C-15480
45 **56** opt.**H**(a) **70** opt.**H**	C-13645	C-14645	C-14145	C-15145	C-14545	**100**	C-12456 (c) C-12470 (d)	C-134100	C-144100	C-154100
56 **70** opt.**H**(a) **90** opt.**H**	C-13656	C-14656	C-14156	C-15156	C-14556	**125**	C-12470 (c) C-12490 (d)	C-134125	C-144125	C-154125
70 **90** opt.**H**(a) **110** opt.**H**	C-13670	C-14670	C-14170	C-15170	C-14570	**160**	C-12490 (c) C-124100 (d)	C-134160	C-144160	C-154160
90 **110** opt.**H**(a) **140** opt.**H**	C-13690	C-14690	C-14190	C-15190	C-14590	**200**	C-124100 (c)	C-134200	C-144200	C-154200

Notes:

(**a**) Option **H** : light male thread, for details see table B137 or B140

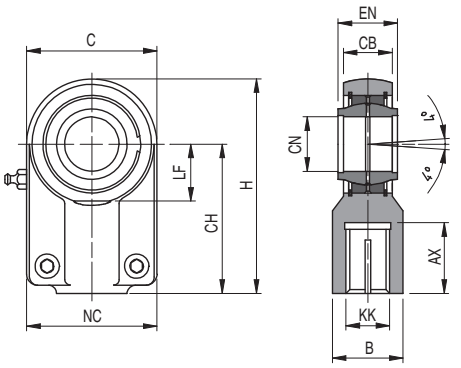
(**b**) C-136 is also available for rods 110, 140, 180 and 220. See section 3

(**c**) For S mounting styles in CN cylinder

(**d**) For S mounting styles in CC cylinder

3 DIMENSIONS [mm]

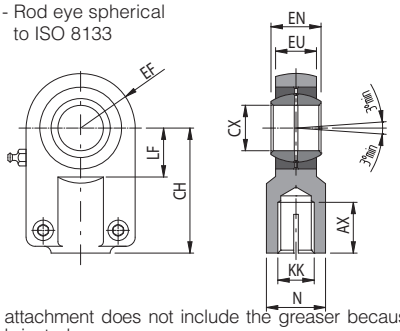
C-136 - Rod eye spherical
to ISO 6982 and 8132



Notes:
(1) This attachment does not include the greaser because it is selflubricated
(2) Dynamic loads has to be considered when the cylinders work with oscillatory motions or push-pull loads in high frequencies
(3) Attachment not compliant with ISO standard

Code	KK	AX min	B max	C max	CB max	CH js13	CN H7	EN h12	H	LF min	NC	Mass [kg]	Max load [kN] (2) Dynamic	Max load [kN] (2) Static	Screws torque
C-13616 (1)	M12x1,25	17	19	33	11	38	12	12	54	13	32	0,11	10,8	24,5	6 Nm
C-13618	M14x1,5	19	22	41	14	44	16	16	64	16,5	40	0,2	17,6	36,5	10 Nm
C-13622	M16x1,5	23	28	50	17,5	52	20	20	75	20,5	47	0,35	30	48	25 Nm
C-13628	M20x1,5	29	31	64	22	65	25	25	96	25,5	54	0,62	48	78	25 Nm
C-13636	M27x2	37	38	80	28	80	32	32	118	30	66	1,15	67	114	49 Nm
C-13645	M33x2	46	47	100	34	97	40	40	146	39	80	2,18	100	204	49 Nm
C-13656	M42x2	57	58	126	42	120	50	50	179	47	96	3,96	156	310	86 Nm
C-13670	M48x2	64	70	145	53,5	140	63	63	211	58	114	6,8	255	430	210 Nm
C-13690	M64x3	86	91	184	68	180	80	80	270	74	148	13	400	695	410 Nm
C-13690A (3)	M72x3	91	100	185	72	195	90	90	296	91	160	19,1	490	750	410 Nm
C-136110	M80x3	96	110	228	85,5	210	100	100	322	94	178	25	610	1.060	710 Nm
C-136110A (3)	M90x3	106	125	235	88	235	110	110	364	106	190	32	655	1.200	710 Nm
C-136140	M100x3	113	135	320	105	260	125	125	405	116	200	46	950	1.430	710 Nm
C-136180	M125x4	126	165	400	133	310	160	160	488	145	250	82,5	1.370	2.200	710 Nm
C-136220	M160x4	161	215	500	165	390	200	200	620	190	320	168	2.120	3.650	1500Nm

C-146 - Rod eye spherical
to ISO 8133

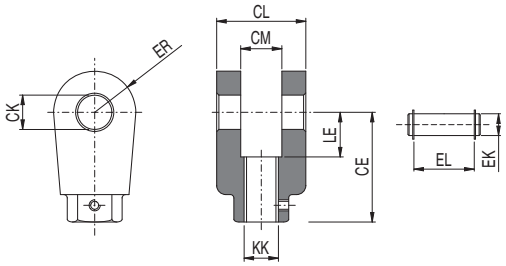


Notes:
(1) This attachment does not include the greaser because it is selflubricated
(2) Dynamic loads has to be considered when the cylinders work with oscillatory motions or push-pull loads in high frequencies
(3) Not compliant with ISO 8133

Code	KK	AX min	CH js13	CX	EF max	EN	EU max	LF min	N max	Mass [kg]	Max load [kN] (2) Dynamic	Max load [kN] (2) Static	Screws torque
C-14612 (1)	M10x1,25	15	42	$12^{\ 0}_{-0,008}$	18	$10^{\ 0}_{-0,12}$ (3)	8,5	16	19	0,12	10,8	17	10 Nm
C-14614 (1)	M12x1,25	17	48	$16^{\ 0}_{-0,008}$	23	$14^{\ 0}_{-0,12}$ (3)	11,5	20	22	0,22	21,1	28,5	10 Nm
C-14618 (1)	M14x1,5	19	58	$20^{\ 0}_{-0,01}$	28	$16^{\ 0}_{-0,12}$ (3)	13,5	25	28	0,43	30	42,5	25 Nm
C-14622	M16x1,5	23	68	$25^{\ 0}_{-0,01}$	33	$20^{\ 0}_{-0,12}$ (3)	18	30	31	0,67	48	67	25 Nm
C-14628	M20x1,5	29	85	$30^{\ 0}_{-0,01}$	41	$22^{\ 0}_{-0,12}$ (3)	20	35	37	1,25	62	108	49 Nm
C-14636	M27x2	37	105	$40^{\ 0}_{-0,012}$	51	$28^{\ 0}_{-0,12}$ (3)	24	45	47	2,16	100	156	49 Nm
C-14645	M33x2	46	130	$50^{\ 0}_{-0,012}$	61	$35^{\ 0}_{-0,12}$ (3)	31	58	57	3,9	156	245	86 Nm
C-14656	M42x2	57	150	$60^{\ 0}_{-0,015}$	80	$44^{\ 0}_{-0,15}$	39	68	69	7,15	245	380	210 Nm
C-14670	M48x2	64	185	$80^{\ 0}_{-0,015}$	102,5	$55^{\ 0}_{-0,15}$	48	92	91	15	400	585	410 Nm
C-14690	M64x3	86	240	$100^{\ 0}_{-0,02}$	120	$70^{\ 0}_{-0,20}$	57	116	110	27,3	610	865	710 Nm

C-141 - Rod clevis
to ISO 8133

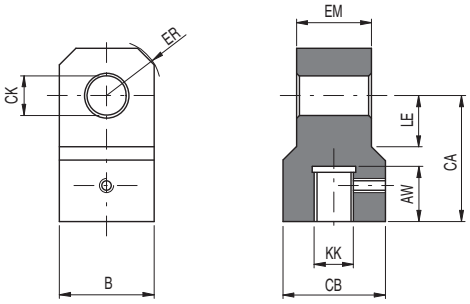
C-145 - Pivot pin



Note: Pivot pin C-145* is included in the supply

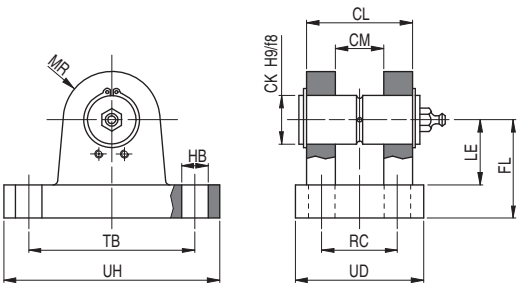
Code	KK	CE JS13	CK H9	CL max	CM A13	EK f8	EL min	ER max	LE min	Mass [kg]	Max load **static** [kN]
C-14112 C-14512	M10x1,25	32	10	26	12	10	29	12	13	0,1	8
C-14114 C-14514	M12x1,25	36	12	34	16	12	37	17	19	0,18	12,5
C-14118 C-14518	M14x1,5	38	14	42	20	14	45	17	19	0,23	20
C-14122 C-14522	M16x1,5	54	20	62	30	20	66	29	32	0,9	32
C-14128 C-14522	M20x1,5	60	20	62	30	20	66	29	32	0,91	50
C-14136 C-14536	M27x2	75	28	83	40	28	87	34	39	1,92	80
C-14145 C-14545	M33x2	99	36	103	50	36	107	50	54	4,92	125
C-14156 C-14556	M42x2	113	45	123	60	45	129	53	57	6,53	200
C-14170 C-14570	M48x2	126	56	143	70	56	149	59	63	10,11	320
C-14190 C-14590	M64x3	168	70	163	80	70	169	78	83	19,2	500

C-151 - Rod eye plain
to ISO 8133



Code	KK	AW min	B	CA JS13	CB max	CK H9	EM h13	ER max	LE min	Mass [kg]	Max load **static** [kN]
C-15112	M10x1,25	14	18	32	18	10	12	12	13	0,08	8
C-15114	M12x1,25	16	22	36	22	12	16	17	19	0,15	12,5
C-15118	M14x1,5	18	25	38	20	14	20	17	19	0,22	20
C-15122	M16x1,5	22	35	54	30	20	30	29	32	0,5	32
C-15128	M20x1,5	28	40	60	30	20	30	29	32	1,1	50
C-15136	M27x2	36	50	75	40	28	40	34	39	1,5	80
C-15145	M33x2	45	70	99	50	36	50	50	54	2,5	125
C-15156	M42x2	56	100	113	65	45	60	53	57	4,2	200
C-15170	M48x2	63	116	126	90	56	70	59	63	11,8	320
C-15190	M64x3	85	160	168	110	70	80	78	83	17	500

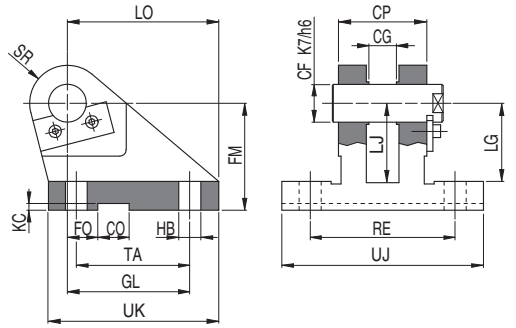
C-124 - Clevis bracket straight
to ISO 8132



Note: Pivot pin and seeger are included in the supply
Supplied with threaded holes for pivot pin locking plate (not included)

Code	CK H9	CL h16	CM A13	FL JS12	HB H13	LE min	MR max	RC JS14	TB JS14	UD max	UH max	Mass [kg]	Max load static [kN]
C-12414	12	28	12	34	9	22	12	20	50	40	70	0,31	8
C-12418	16	36	16	40	11	27	16	26	65	50	90	0,59	12,5
C-12422	20	45	20	45	11	30	20	32	75	58	98	0,9	20
C-12428	25	56	25	55	13,5	37	25	40	85	70	113	1,6	32
C-12436	32	70	32	65	17,5	43	32	50	110	85	143	2,8	50
C-12445	40	90	40	76	22	52	40	65	130	108	170	5	80
C-12456	50	110	50	95	26	65	50	80	170	130	220	10,1	125
C-12470	63	140	63	112	33	75	63	100	210	160	270	15,4	200
C-12490	80	170	80	140	39	95	80	125	250	210	320	30	320
C-124100	100	210	100	180	45	120	100	160	315	260	400	60,2	500

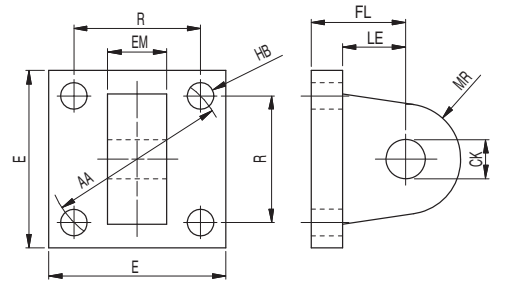
C-134 - Clevis bracket in angle
to DIN 24556 or ISO 8133 with additional machining for dimension CO



Notes:
Pivot pin with locking plate is included in the supply
(1) Not compliant with ISO 8133

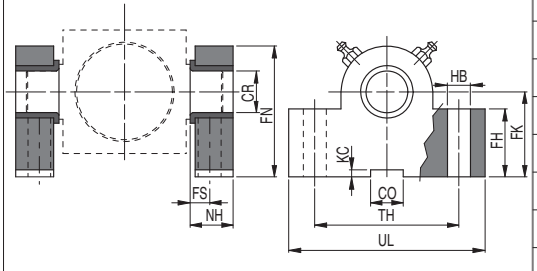
Code	CF H9 (1)	CG +0,1/+0,3	CO H9	CP h14	FM js13	FO	GL JS13	HB H13	KC	LG	LJ min	LO max	RE js13	SR max	TA js13	UJ max	UK max	Mass [kg]	Max load static [kN]
C-13425	12	10	10	30	40	16	46	9	3,3	28	29	56	55	12	40	75	60	0,52	8
C-13432	16	14	16	40	50	18	61	11	4,3	37	38	74	70	16	55	95	80	1,05	12,5
C-13440	20	16	16	50	55	20	64	13,5 (1)	4,3	39	40	80	85	20	58	120	90	1,72	20
C-13450	25	20	25	60	65	22	78	15,5 (1)	5,4	48	49	98	100	25	70	140	110	2,72	32
C-13463	30	22	25	70	85	24	97	17,5 (1)	5,4	62	63	120	115	30	90	160	135	5,15	50
C-13480	40	28	36	80	100	24	123	22	8,4	72	73	148	135	40	120	190	170	9,3	80
C-134100	50	35	36	100	125	35	155	30	8,4	90	92	190	170	50	145	240	215	18,3	125
C-134125	60	44	50	120	150	35	187	39	11,4	108	110	225	200	60	185	270	260	35	200
C-134160	80	55	50	160	190	35	255	45	11,4	140	142	295	240	80	260	320	340	63	320
C-134200	100	70	63	200	210	35	285	48	12,4	150	152	335	300	100	300	400	400	109	500

C-144 - Eye bracket
to ISO 8133



Code	CK H9	AA	E max	EM h13	FL js13	HB H13	LE min	MR max	R js13	Mass [kg]	Max load static [kN]
C-14425	10	40	40	12	23	5,5	13	12	28,3	0,3	8
C-14432	12	47	46	16	29	6,6	19	17	33,2	0,45	12
C-14440	14	59	65	20	29	9	19	17	41,7	0,9	20
C-14450	20	74	79	30	48	13,5	32	29	52,3	1,3	32
C-14463	20	91	91	30	48	13,5	32	29	64,3	1,9	50
C-14480	28	117	118	40	59	17,5	39	34	82,7	4	80
C-144100	36	137	132	50	79	17,5	54	50	96,9	6,25	125
C-144125	45	178	174	60	87	24	57	53	125,9	11,4	200
C-144160	56	219	215	70	103	30	63	59	154,9	20,8	320
C-144200	70	269	256	80	132	33	82	78	190,2	38,8	500

C-154 - Trunnion bracket
(for cylinders whit mounting styles G,H and L)
to ISO 8132

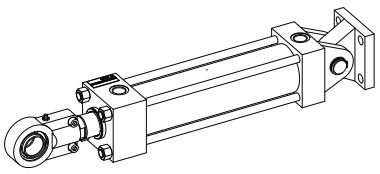


Note: The code includes two trunnion brackets
(1) To ISO 8133

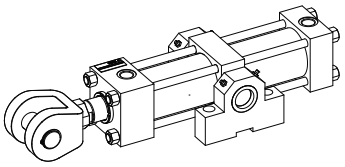
Code	CR H7	CO N9	FH max	FK JS12	FN max	FS js13	HB H13	KC 0/+0,3	NH max	TH js13	UL max	Mass [kg]	Max load static [kN]
C-15425	12	10	25	34	50	8	9	3,3	17	40	63	0,46	8
C-15432	16	16	30	40	60	10	11	4,3	21	50	80	0,83	12,5
C-15440	20	16	38	45	70	10	11	4,3	21	60	90	1,21	20
C-15450	25	25	45	55	80	12	13,5	5,4	26	80	110	2,15	32
C-15463	32	25	52	65	100	15	17,5	5,4	33	110	150	4,63	50
C-15480	40	36	60	76	120	16	22	8,4	41	125	170	7,78	80
C-154100	50	36	75	95	140	20	26	8,4	51	160	210	14,3	125
C-154125	63	50	85	112	180	25	33	11,4	61	200	265	23,4	200
C-154160	80	50	112	140	220	31	39	11,4	81	250	325	53,1	320
C-154200 (1)	100	63	150	200	300	42	52	12,4	101	320	410	112	500

4 EXAMPLES OF ATTACHMENTS

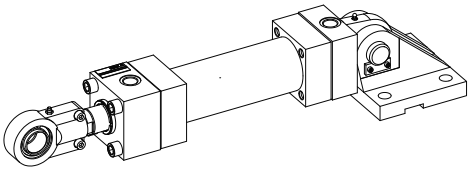
CK - mounting style **C** with rod eye **C-136** and bracket **C-144**



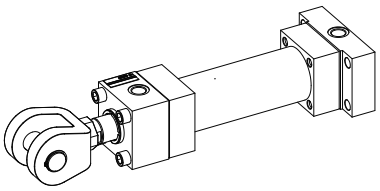
CK - mounting style **L** with rod clevis **C-141** and bracket **C-154**



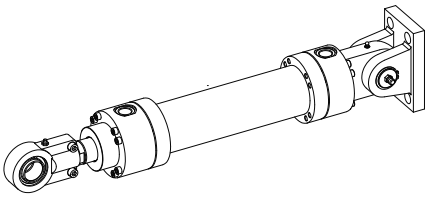
CH - mounting style **S** with rod eye **C-136** and bracket **C-134**



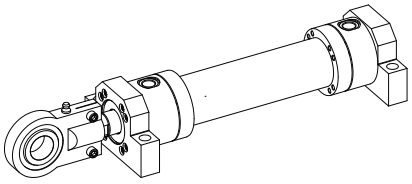
CH - mounting style **P** with rod clevis **C-141**



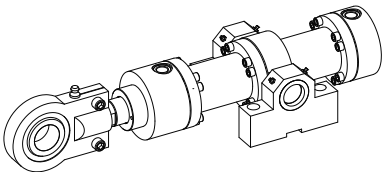
CN - mounting style **S** with rod eye **C-136** and bracket **C-124**



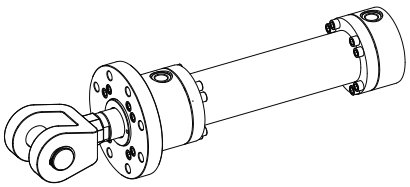
CN - mounting style **E** with rod eye **C-146**



CC - mounting style **L** with rod eye **C-146** and bracket **C-154**



CC - mounting style **A** with rod clevis **C-141**



5 SURFACE TREATMENT

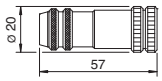
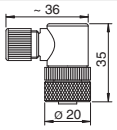
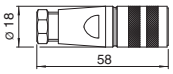
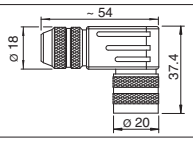
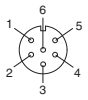
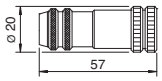
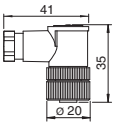
Some attachments are provided with additional surface treatment to increase the corrosion resistance (24h in neutral salt spray), see table below for details. All the attachments, except pivot pin C-145, can be supplied with standard painting RAL 9007 (200h in neutral salt spray) selecting option **-V**, special painting are available on request.

Code	Surface treatment	Code	Surface treatment
 C-136 or C-146	No treatment	 C-124	No treatment
 C-141	No treatment	 C-134	No treatment
 C-151	Black phosphate	 C-144	Black phosphate
 C-145	Black phosphate	 C-154	No treatment

Electric and electronic connectors

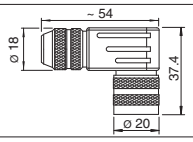
for CK* servocylinders

1 CONNECTORS FOR ANALOG POSITION TRANSDUCERS

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
CON031 	Straight female metallic connector - 5 pin: - magnetosonic transducer for CKF servocylinders - electronic conditioning card for CKN servocylinders Transducer output signal: analog			PG9 ø 6 ÷ 8 mm	M12 IEC 61076-2-101 Protection degree IP 67 EN 60529
CON041 	Female plastic connector at 90° - 5 pin: - magnetosonic transducer for CKF servocylinders - electronic conditioning card for CKN servocylinders Transducer output signal: analog			PG9 ø 6 ÷ 8 mm	M12 IEC 61076-2-101 Protection degree IP 67 EN 60529
STCO9131-D06-PG7 	Straight female metallic connector - 6 pin: - magnetosonic transducer for CKM servocylinders - magnetostrictive transducer for CKN servocylinders Transducer output signal: analog			PG7 ø 4 ÷ 6 mm	Protection degree IP 67 EN 60529
STCO9131-6-PG7 	Female metallic connector at 90° - 6 pin: - magnetosonic transducer for CKM servocylinders - magnetostrictive transducer for CKN servocylinders Transducer output signal: analog			PG7 ø 4 ÷ 6 mm	Protection degree IP 67 EN 60529
STCO9131-D04-PG7 	Straight female metallic connector - 4 pin: - potentiometer transducer for CKP servocylinders - inductive transducer for CKV servocylinders Transducer output signal: analog			PG7 ø 4 ÷ 6 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
STCO9131-4-PG7 	Female plastic connector at 90° - 4 pin: - potentiometer transducer for CKP servocylinders - inductive transducer for CKV servocylinders Transducer output signal: analog			PG7 ø 4 ÷ 6 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

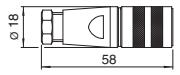
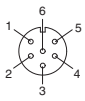
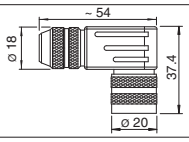
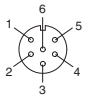
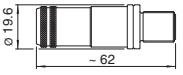
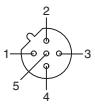
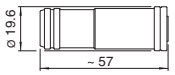
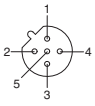
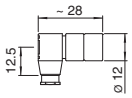
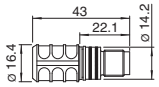
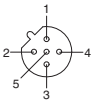
(1) the wiring of electrical terminals has to be realized according to specific servocylinder's technical table

2 CONNECTORS FOR SSI DIGITAL POSITION TRANSDUCERS

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
STCO9131-D07-PG9 	Straight female metallic connector - 7 pin: - potentiometer transducer for CKM servocylinders Transducer output signal: digital SSI			PG9 ø 6 ÷ 8 mm	Protection degree IP 67 EN 60529
STCO9131-7-PG9 	Female metallic connector at 90° - 7 pin: - potentiometer transducer for CKM servocylinders Transducer output signal: digital SSI			PG9 ø 6 ÷ 8 mm	Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be realized according to specific servocylinder's technical table

3 CONNECTORS FOR FIELDBUS POSITION TRANSDUCERS

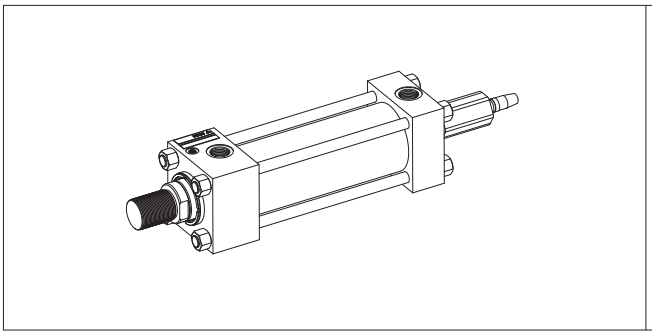
CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
STCO9131-D06-PG9 	Straight female metallic connector - 6 pin: - CANopen input and output fieldbus interface for CKM servocylinders			PG9 ø 6 ÷ 8 mm	Protection degree IP 67 EN 60529
STCO9131-6-PG9 	Female metallic connector at 90° - 6 pin: - CANopen input and output fieldbus interface for CKM servocylinders			PG9 ø 6 ÷ 8 mm	Protection degree IP 67 EN 60529
560884 	Straight male metallic connector - 5 pin: - PROFIBUS DP for CKM servocylinders (input)			PG9 ø 6,5 ÷ 8,5 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
560885 	Straight female metallic connector - 5 pin: - PROFIBUS DP for CKM servocylinders (output)			PG9 ø 6,5 ÷ 8,5 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
560886 	Female plastic connector at 90° - 4 pin: - PROFIBUS DP for CKM servocylinders (power supply)			PG7 ø 3,5 ÷ 5 mm	M8 IEC 61076-2-104 Protection degree IP 67 EN 60529
560888 	Straight female plastic connector - 4 pin: - PROFIBUS DP for CKM servocylinders (terminator)			PG9 ø 6,5 ÷ 8,5 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529

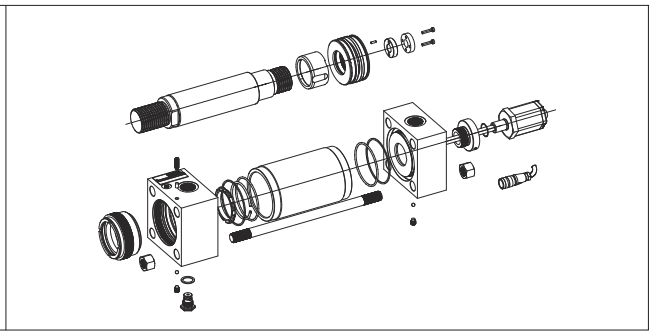
(1) the wiring of electrical terminals has to be realized according to specific servocylinder's technical table

Operating and maintenance information

for industrial cylinders & servocylinders

These operating and maintenance information are valid only for Atos hydraulic cylinders and are intended to provide useful guidelines to avoid risks when hydraulic cylinders are installed in a machine or a system. Information and notes on the transport and storage of hydraulic cylinders are also provided.
These norms must be strictly observed to avoid damages and ensure trouble-free operation. The respect of these operating and maintenance information ensures an increased working life and thus reduced repairing cost of the hydraulic cylinders and system.





1 SYMBOLS CONVENTIONS

⚠ This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The cylinder operating and maintenance information are part of the operating instructions for the complete machine but they cannot replace them

Atos is not liable for damages resulting from an incorrect observance of these instructions.
All the hydraulic cylinders have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorised mechanical or electronic interventions
- The hydraulic cylinders are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

3 HARMONIZED STANDARDS

Hydraulic cylinders are subject to PED directive 2014/68/UE, see sec. 6 for details. Machinery Directive 2006/42/CE does not apply to hydraulic cylinders. For an overall view relevant to application of the European directive in electrohydraulics, see www.atos.com, **tab. P004**

⚠ **Check the code in the nameplate to ensure that the hydraulic cylinder is suitable for the installation area**

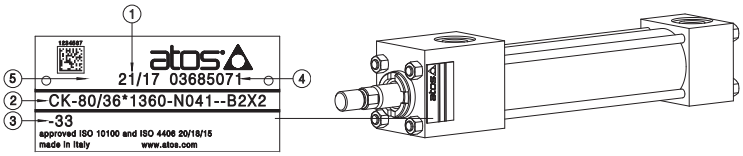
4 WORKING CONDITIONS

⚠ **The operation of hydraulic cylinders is not permitted at different operating and environmental conditions than those specified below**

Description	CK, CK*, CH, CN	CC
Ambient temperature	-20 ÷ +120°C	-20 ÷ +120°C
Fluid temperature	-20 ÷ +120°C	-20 ÷ +120°C
Max surface temperature	-	-
Max working pressure	16 MPa (160 bar)	25 MPa (160 bar)
Max pressure	25 MPa (250 bar)	32 MPa (320 bar)
Max frequency	5 Hz	5 Hz
Max speed	4 m/s	
Recommended viscosity	15 ÷ 100 mm^2/s	
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog	

5 NAMEPLATES

Nameplate - Standard



Nameplate - Standard (1)

Pos.	Description
①	Delivery date
②	Cylinder code
③	Series number
④	Customer code (only if requested)
⑤	CE mark (see section 6)

Notes: (1) The position of the nameplate on the rear or front heads can change due to the cylinder overall dimensions

6 CE MARKING

Hydraulic cylinders are considered as pressure vessels and thus they are subject to the PED directive (2014/68/UE), point 1 a) of article 4. Particularly they are designed to be used with fluids of group 2 (oil hydraulic fluids) and they have to be marked if the product **Pmax** x **V** (Volume under pressure) is higher than 10.000 bar x liter. Tables below show the minimum stroke over which the cylinders have to be CE marked. ATEX cylinders are CE marked according to ATEX directive (2014/34/EU).

Cylinders CK, CH and CN - Pmax = 250 bar			
Bore [mm]	Rod [mm]	Stroke min [mm] single rod	Stroke min [mm] double rod
125	56 70 90	3255	4075 4745 5000
160	70 90 110	1985	2460 2910 3770
200	90 140	1270	1595 2495
250	140	810	1185
320	180	495	725
400	220	315	455

Cylinders CC - Pmax = 320 bar			
Bore [mm]	Rod [mm]	Stroke min [mm] single rod	Stroke min [mm] double rod
100	70	3975	5000
125	90	2545	5000
140	90	2030	3455
160	110	1550	2945
180	110	1225	1960
200	140	990	1950
250	180	635	1320
320	220	385	735
400	280	245	485

7 SAFETY NOTES

7.1 General

- The presence of cushioning can lead to a peak of pressure that can reduce the cylinder working life, ensure that the dissipated energy is less than the max value reported in **tab. B015**
- Make sure that the maximum working conditions, shown in section 4, are not exceeded
- Ensure to use hydraulic fluids compatible with the selected sealing system, see **tab. B137**, **B140**, **B160**, **B180**, **B241** and **B310**
- The rod must be handled with care to prevent damages on the surface coating which can deteriorate the sealing system and lead to the corrosion of the basic material
- The mounting screws must be free from shearing stress
- Transverse forces on the rods must always be avoided
- When the cylinder has to drive a rotating structure or where little alignment errors are expected, mounting style with spherical bearing should be used
- Contact surfaces, support elements in tolerance, elastic materials and labels must be covered before painting the cylinder

7.2 Proximity sensors

- Proximity sensors are supplied already adjusted, if other regulations are necessary see **tab. B137** or contact our technical office
- Ensure not to remove the sensor while the cylinder is under pressure
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.3 Position measuring system

- Position transducers must never be removed, if not otherwise specified in **tab. B310**, while the cylinder is under pressure
- Observe the information provided in **tab. B310** for the electronic connections
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.4 Installation

- Consult **tab. P002** for installation, commissioning and maintenance of electrohydraulic system
- The piping have to be dimensioned according to the max pressure and max flow rate required
- All pipes and surfaces must be cleaned from dirt before mounting
- Remove all plug screws and covers before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the cylinders
- Bleed-off the system or the hydraulic cylinder using the proper device, see the technical data sheet for details
- Ensure that the cylinder mounting allow easy of acces for the purpose of maintenance and the adjustment of cushioning

8 MAINTENANCE

⚠ **Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics**

8.1 Preliminary check and ordinary maintenance

Atos hydraulic cylinders don't require any maintenance after commissioning. Anyway it is recommended to take into account the following remarks:

- Results of maintenance and inspection must be planned and documented
- Check oil escaping from oil ports or leakages at the cylinder heads
- Check for damages of the chromeplated surface of the rod: damages may indicate oil contamination or the presence of excessive transverse load
- Determine lubricating intervals for spherical clevises, trunnion and all parts not self-lubricated
- The rod should always be retracted during long stop of the machine or system
- Remove any salt, machining residuals or other dirt cumulated on the rod surface
- Follow the maintenance instructions of the fluid manufacturer

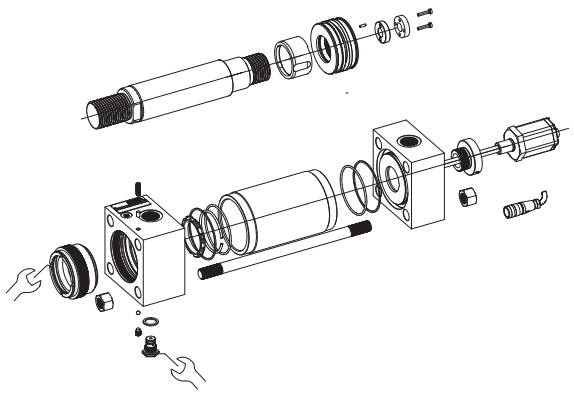
8.2 Repairing

Before beginning any repairing observe the following guidelines:

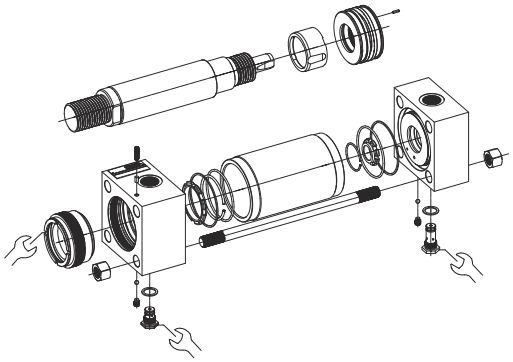
- Unauthorized opening of the cylinder during the warranty period results in the warranty expiration
- Be sure to use only original spare parts manufactured or supplied by Atos
- Provide all the required tools to make the repair operations safely and not damage the components
- Read and follow all the safety notes given in section 7
- Ensure that the cylinder is well locked before beginning any operation
- Disassembly or assembly the cylinder with the right order as indicated in section **8.3**
- When mounting rod or piston guides and seals observe the correct position as indicated in section **8.4**. Any bad positioning can result in oil leakages
- It is strongly recommended the use of expanding sleeves to insert the seals in the proper groove
- Tighten all the screws or nuts as follow: lubricates the threads, insert the screw or the nut by hand for some turns, tighten the screw crosswise with the tightening torque specified in the technical table (a pneumatic screw driver may be used)
- Rod bearing and piston must be locked respectively to the front head and to the rod by means of special pin to avoid unscrewing
- The replacement of wear parts such as seals, rod bearing and guide rings depends on the operating conditions, temperature and quality of the fluid

8.3 Cylinders exploded views

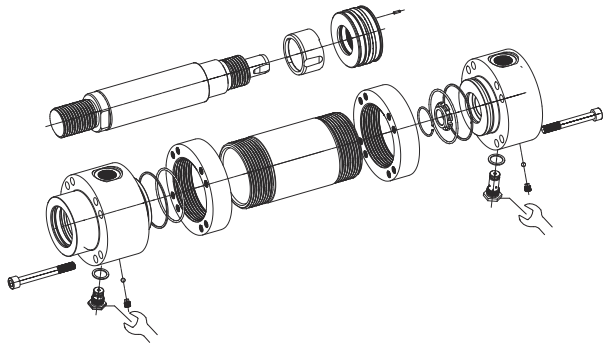
CK* servocylinder - For spare parts see tab. SP-B310



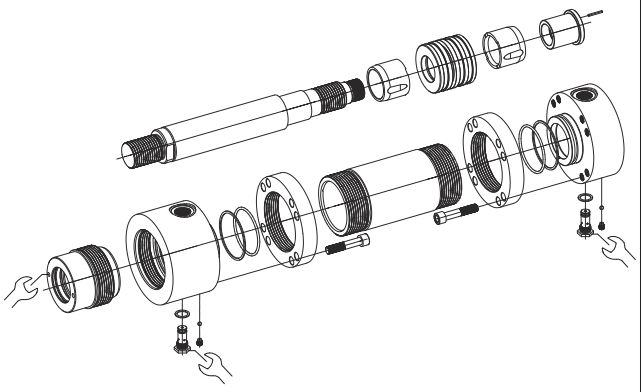
CK/CH - For spare parts see tab.SP-B137, SP-B140 and SP-B160



CN - For spare parts see tab. SP-B180



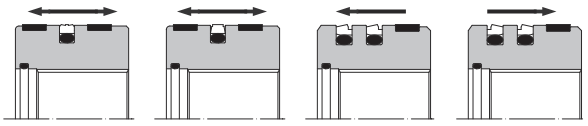
CC - For spare parts see tab. SP-B241



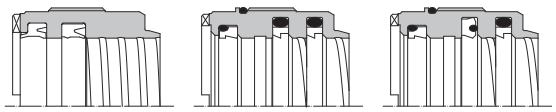
Note: this symbol means that a particular equipment is required for mounting, contact our technical office

8.4 Sealing system mounting

PISTON



ROD BEARING



9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transport of hydraulic cylinders:

- Cylinders have to be transported using a forklift truck or a lifting gear always ensuring a stable position of the cylinder
- Cylinders have to be transported in horizontal position in their original packaging
- Use soft lifting belts to move or lift the cylinders in order to avoid damages
- Before any movement check the cylinders weight (due to tolerances, the weight may be 10% greater than the values specified in the technical table)

⚠ **Additional parts such as pipes, subplates and transducers must never be used for lifting**

9.2 Storage

Corrosion protection is achieved with alkyd primer painting RAL 9007: the primer grants a storage period up to 12 months. Additionally all cylinders are tested

with mineral oil OSO 46; the oil film, presents in the cylinder chambers after testing, ensures the internal corrosion protection.

Anyway be care to observe the following remarks:

- When a storage in the open air is foreseen ensure that cylinders are well protected against water
- The cylinders must be inspected at least once a year and rotated through 90° every six months to preserve the seals

⚠ **In case of storage period longer than 12 months, contact our technical office**

10 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads involve a premature wear of the bronze bushing, seals and wear rings	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **C**-**D**-**G**-**H**-**S**-**L**
	Fluid contaminants produce scratch and score marks on the seals	Check the fluid contamination class is < 20/18/15
	Chemical attack cause the deterioration of seals compound	Check seals compatibility with operating fluid
	High temperatures (fluid/ambient) the seals dark and flaked	a) Decrease the fluid temperature b) Install **G2** sealings for high temperatures
	Low temperature (ambient) make the seals brittle	a) Move the cylinder in a higher temperature zone b) Install **G9** seals for low temperatures
	High rod speed reduce the lubricant capacity of the seals	For rod speed > 0,5 m/s Install **G2** – **G4** seals
	High frequency reduce the lubricant capacity of the seals	For rod frequency > 5 hz Install **G0** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect)	Bleed off completely the air inside the hydraulic circuit
Wiper or seal extrusion	Overpressure	a) Limit the pressure of the system b) Install **G2**-**G4**-**G8** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	a) See possible causes and solutions for oil leakage troubles b) Install draining option **L**
Lose of cushioning effect	Rod speed too low at end stroke	a) Check the cushioning adjustment is not fully open, regulate it if necessary b) Replace "fast" cushioning **1**-**2**-**3**, with "slow" cushioning **4**-**5**-**6** if the cushioning is not effective with cushioning adjustment fully closed
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants produce scratch and score marks on the cushioning piston	Check the fluid contamination class is < 20/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking	a) Replace "fixed" cushioning **7**-**9** with "adjustable" cushioning **1**-**3** b) For adjustable cushioning, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances	Check the fluid contamination class is < 20/18/15
Rod failure	Overload/overpressure involves ductile rod failure	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation involves fatigue rod failure	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G2**-**G4**, see tech.table **B015**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 20/18/15
	High oil flow speed > 6 m/s	a) Increase the piping diameters to reduce the oil flow speed b) Install oversized oil ports, options **D**-**Y**

11 SERVOCYLINDERS TROUBLESHOOTING

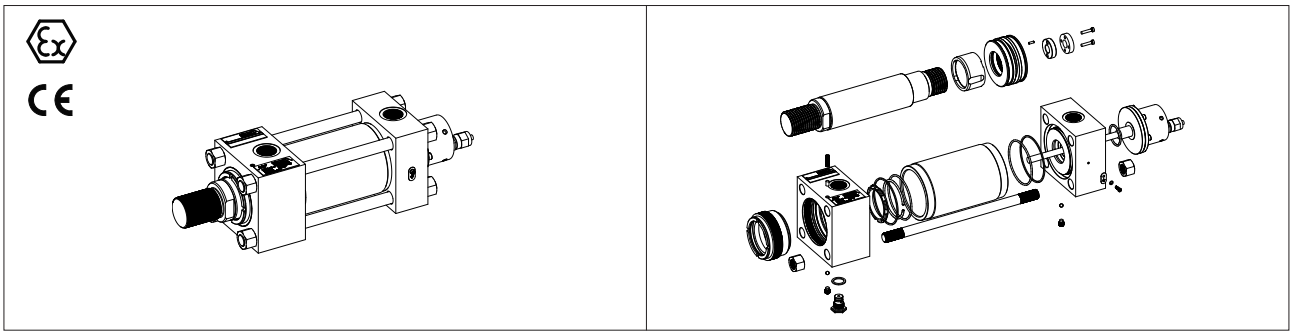
TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

Note: for cylinders troubleshooting refer to section 10

Operating and maintenance information

for ex-proof cylinders & servocylinders

These operating and maintenance information are valid only for Atos ex-proof cylinders & servocylinders; they are intended to provide useful guidelines to avoid risks when hydraulic cylinders are installed in a machine or a system. Information and notes about transportation and storage of hydraulic cylinders are also provided.
These norms must be strictly observed to avoid damages and ensure trouble-free operation. The respect of these operating and maintenance information ensures an increased working life and thus reduced repairing cost of the hydraulic cylinders and system.



1 SYMBOLS CONVENTIONS

⚠ This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The cylinder operating and maintenance information are part of the operating instructions for the complete machine but they cannot replace them

Atos is not liable for damages resulting from an incorrect observance of these instructions.
All the hydraulic cylinders have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorised mechanical or electronic interventions
- The hydraulic cylinders are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

3 HARMONIZED STANDARDS

CKA cylinders meet the requirements laid down in the Explosion protection directive 2014/34/EU with reference to European standards documentations:

ISO 80079-36 "Non electrical equipment for potentially explosive atmospheres - Basic method and requirements"
ISO 80079-37 "Non electrical equipment for explosive atmospheres - Protection constructional safety 'c', liquid immersion 'k'"

The hydraulic cylinder must be exclusively used in areas and zones assigned to the equipment group and category. Also observe the other details about explosion protection given as follow. See section 6 for zones in relation to equipment groups and category.

⚠ **Check the code in the nameplate to ensure that the hydraulic cylinder is suitable for the installation area**

4 WORKING CONDITIONS

⚠ **The operation of hydraulic cylinders is not permitted at different operating and environmental conditions than those specified below**

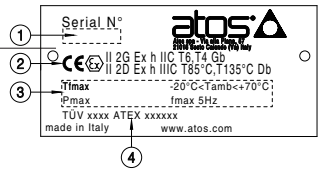
Description	**CKA, CKAM**
Ambient temperature	-20 ÷ +70°C -40 ÷ +65°C for **CKAM**
Fluid temperature	-20 ÷ +70°C (**T6**) -20 ÷ +120°C (**T4**) for seals type **G2** (1)
Max surface temperature	≤ +85 °C (**T6**) ≤ +135 °C (**T4**) for seals type **G2** (1)
Max working pressure	16 MPa (160 bar)
Max pressure	25 MPa (250 bar)
Max frequency	5 Hz
Max speed	1 m/s 0,5 m/s for seals type **G1**
Recommended viscosity	15 ÷ 100 mm^2/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

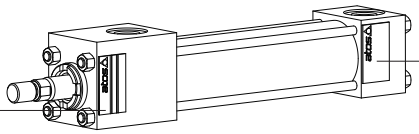
Note: (1) Cylinders with seals type **G2** may also be certified **T6** limiting the max fluid temperature to 70°C

5 NAMEPLATES

Nameplate 1 - Standard

Nameplate 2 - ATEX





Nameplate 1 - Standard (2)

Pos.	Description
①	Delivery date
②	Cylinder code
③	Series number
④	Customer code (only if requested)
⑤	CE mark

Nameplate 2 - ATEX (1)(2)

Pos.	Description
①	Cylinder serial number
②	Marking according to ATEX directive
③	Working limit conditions
④	Notified body and certified number

Working conditions - legend

Sym.	Meaning
Tfmax	Max fluid temperature
Pmax	Max pressure
Tamb	Ambient temperature
fmax	Max frequency

Notes: (1) ATEX cylinders are supplied with 2 nameplates: standard and ATEX
(2) The position of the nameplate on the rear or front heads can change due to the cylinder overall dimensions

6 ATEX CERTIFICATION

The user must define the overall areas of the system into different explosive atmospheres zones in accordance with directive EN 60079-10-1/2. The table below shows the available installation zones related to the equipment group and category.

EN 60079-0		Directive 2014/34/EU		Application, properties (exerpt from Directives)	Zones EN 60079-10-1/2
EPL	**Group**	**Equipment group**	**Category**		
Gb	II	II	2G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur occasionally. **High level of protection**	1, 2
Gc		II	3G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur for short periods. **Normal level of protection**	2
Db	III	II	2D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur occasionally. **High level of protection**	21,22
Dc		II	3D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur rarely or for short periods. **Normal level of protection**	22

⚠ **The cylinder group and category may change when rod position transducers or proximity sensors are provided, see table below and tab. BX500. For details about certification and safety notes consult the user's guides included in the supply**

Cylinder type		Group	Equipment category	Gas/dust group	Temperature class	Zone
CKA		II	2 GD	II C/III C	T85°C(T6) / T135°C(T4)	1,2,21,22
CKA with ex-proof rod position transducer	**GAS**	II	2 G	II B	T6/T5	1,2
	DUST	II	2 D	IIIC	T85°C/T100°C	21,22
CKA with ex-proof proximity sensors		II	3 G	II	T4	2

II 2G Ex h IIC T6,T4 Gb (gas) **II 2D Ex h IIIC T85°C, T135°C Db (dust)**

GROUP II, Atex

II = Group II for surface plants
2 = High protection (equipment category)
G = For gas, vapours
D = For dust
Ex = Equipment for explosive atmospheres
IIC = Gas group
IIIC = Dust group
T85°C/T135°C = Surface temperature class for dust
T6/T4 = Surface temperature class for gas
Gb/Db = EPL Equipment group

7 SAFETY NOTES

7.1 General

- The presence of cushioning can lead to a peak of pressure that can reduce the cylinder working life, ensure that the dissipated energy is less than the max value reported in **tab. B015**
- Make sure that the maximum working conditions, shown in section 4, are not exceeded
- Ensure to use hydraulic fluids compatible with the selected sealing system, see **tab. BX500**
- The rod must be handled with care to prevent damages on the surface coating which can deteriorate the sealing system and lead to the corrosion of the basic material
- The mounting screws must be free from shearing stress
- Transverse forces on the rods must always be avoided
- When the cylinder has to drive a rotating structure or where little alignment errors are expected, mounting style with spherical bearing should be used
- Contact surfaces, support elements in tolerance, elastic materials and labels must be covered before painting the cylinder

7.2 Proximity sensors

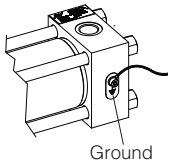
- Proximity sensors are supplied already adjusted, if other regulations are necessary see **tab. BX500** or contact our technical office
- Ensure not to remove the sensor while the cylinder is under pressure
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.3 Position measuring system

- Position transducers must never be removed, if not otherwise specified in **tab. BX500**, while the cylinder is under pressure
- Observe the information provided in **tab. BX500** for the electronic connections
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.4 Installation

- Consult **tab. P002** for installation, commissioning and maintenance of electrohydraulic system
- The piping have to be dimensioned according to the max pressure and max flow rate required
- All pipes and surfaces must be cleaned from dirt before mounting
- Remove all plug screws and covers before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the cylinders
- Bleed-off the system or the hydraulic cylinder using the proper device, see the technical data sheet for details
- Ensure that the cylinder mounting allow easy of acces for the purpose of maintenance and the adjustment of cushioning
- The max surface temperature indicated in the nameplate must be lower than the following values:
  GAS - **80% of gas ignition temperature**
  DUST - max value between **dust ignition temperature - 75°C** and **2/3 of dust ignition temperature**
- The ignition temperature of the fluid must be 50°C greater than the maximum surface temperature indicated in the nameplate
- The cylinder must be grounded using the threaded hole on the rear head, evidenced by the nameplate with ground symbol. The hydraulic cylinder must be put at the same electric potential of the machine



⚠ **For details about ex-proof proximity sensors or position transducer refer to the user's guide included in the supply**

8 MAINTENANCE

- Ordinary maintenance of the cylinder consist of cleaning of the external surfaces using a wet cloth to avoid accumulation of dust layer > 5 mm
- Do not use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires immediate stop of the system and inspection of the relevant components

⚠ **Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics**

8.1 Preliminary check and ordinary maintenance

Atos hydraulic cylinders don't require any maintenance after commissioning. Anyway it is recommended to take into account the following remarks:

- Results of maintenance and inspection must be planned and documented
- Check oil escaping from oil ports or leakages at the cylinder heads
- Check for damages of the chromeplated surface of the rod: damages may indicate oil contamination or the presence of excessive transverse load
- Determine lubricating intervals for spherical clevises, trunnion and all parts not self-lubricated
- The rod should always be retracted during long stop of the machine or system

⚠ **Any repairing must be performed only by experienced personnel, authorized by Atos**

- Remove any salt, machining residuals or other dirt cumulated on the rod surface
- Follow the maintenance instructions of the fluid manufacturer

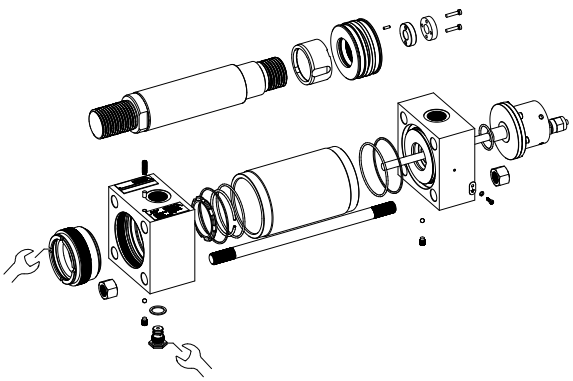
8.2 Repairing

Before beginning any repairing observe the following guidelines:

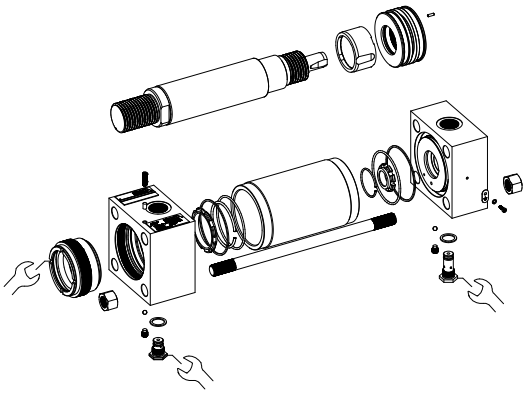
- Unauthorized opening of the cylinder during the warranty period results in the warranty expiration
- Be sure to use only original spare parts manufactured or supplied by Atos
- Provide all the required tools to make the repair operations safely and not damage the components
- Read and follow all the safety notes given in section 7
- Ensure that the cylinder is well locked before beginning any operation
- Disassembly or assembly the cylinder with the right order as indicated in section **8.3**
- When mounting rod or piston guides and seals observe the correct position as indicated in section **8.4**. Any bad positioning can result in oil leakages
- It is strongly recommended the use of expanding sleeves to insert the seals in the proper groove
- Tighten all the screws or nuts as follow: lubricates the threads, insert the screw or the nut by hand for some turns, tighten the screw crosswise with the tightening torque specified in the technical table (a pneumatic screw driver may be used)
- Rod bearing and piston must be locked respectively to the front head and to the rod by means of special pin to avoid unscrewing
- The replacement of wear parts such as seals, rod bearing and guide rings depends on the operating conditions, temperature and quality of the fluid

8.3 Cylinders exploded views

CKAM servocylinder - For spare parts contact our technical office



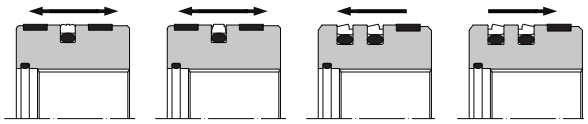
CKA - For spare parts contact our technical office



Note: this symbol means that a particular equipment is required for mounting, contact our technical office

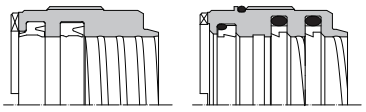
8.4 Sealing system mounting

PISTON



G1 | G2-G4 | G6 Single effect pushing | G7 Single effect pulling

ROD BEARING



G1 | G2-G4-G6-G7

9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transport of hydraulic cylinders:

- Cylinders have to be transported using a forklift truck or a lifting gear always ensuring a stable position of the cylinder
- Cylinders have to be transported in horizontal position in their original packaging
- Use soft lifting belts to move or lift the cylinders in order to avoid damages
- Before any movement check the cylinders weight (due to tolerances, the weight may be 10% greater than the values specified in the technical table)

⚠ **Additional parts such as pipes, subplates and transducers must never be used for lifting**

9.2 Storage

Corrosion protection is achieved with alkyd primer painting RAL 9007: the primer grants a storage period up to 12 months. Additionally all cylinders are tested with mineral oil OSO 46; the oil film, presents in the cylinder chambers after testing, ensures the internal corrosion protection.

Anyway be care to observe the following remarks:

- When a storage in the open air is foreseen ensure that cylinders are well protected against water
- The cylinders must be inspected at least once a year and rotated through 90° every six months to preserve the seals

⚠ **In case of storage period longer than 12 months, contact our technical office**

10 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads involve a premature wear of the bronze bushing, seals and wear rings	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **C**-**D**-**G**-**H**-**S**-**L**
	Fluid contaminants produce scratch and score marks on the seals	Check the fluid contamination class is < 20/18/15
	Chemical attack cause the deterioration of seals compound	Check seals compatibility with operating fluid
	High temperatures (fluid/ambient) the seals dark and flaked	a) Decrease the fluid temperature b) Install **G2** sealings for high temperatures
	Low temperature (ambient) make the seals brittle	a) Move the cylinder in a higher temperature zone b) Install **G9** seals for low temperatures
	High rod speed reduce the lubricant capacity of the seals	For rod speed > 0,5 m/s Install **G2** – **G4** seals
	High frequency reduce the lubricant capacity of the seals	For rod frequency > 5 hz Install **G0** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect)	Bleed off completely the air inside the hydraulic circuit
Wiper or seal extrusion	Overpressure	a) Limit the pressure of the system b) Install **G2**-**G4**-**G8** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	a) See possible causes and solutions for oil leakage troubles b) Install draining option **L**
Lose of cushioning effect	Rod speed too low at end stroke	a) Check the cushioning adjustment is not fully open, regulate it if necessary b) Replace "fast" cushioning **1**-**2**-**3**, with "slow" cushioning **4**-**5**-**6** if the cushioning is not effective with cushioning adjustment fully closed
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants produce scratch and score marks on the cushioning piston	Check the fluid contamination class is < 20/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking	a) Replace "fixed" cushioning **7**-**9** with "adjustable" cushioning **1**-**3** b) For adjustable cushioning, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances	Check the fluid contamination class is < 20/18/15
Rod failure	Overload/overpressure involves ductile rod failure	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation involves fatigue rod failure	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G2**-**G4**, see tech.table **B015**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 20/18/15
	High oil flow speed > 6 m/s	a) Increase the piping diameters to reduce the oil flow speed b) Install oversized oil ports, options **D**-**Y**

11 SERVOCYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

Note: for cylinders troubleshooting refer to section 10

Operating and maintenance information

for stainless steel cylinders & servocylinders

These operating and maintenance information are valid only for Atos hydraulic cylinders and are intended to provide useful guidelines to avoid risks when hydraulic cylinders are installed in a machine or a system. Information and notes on the transport and storage of hydraulic cylinders are also provided.
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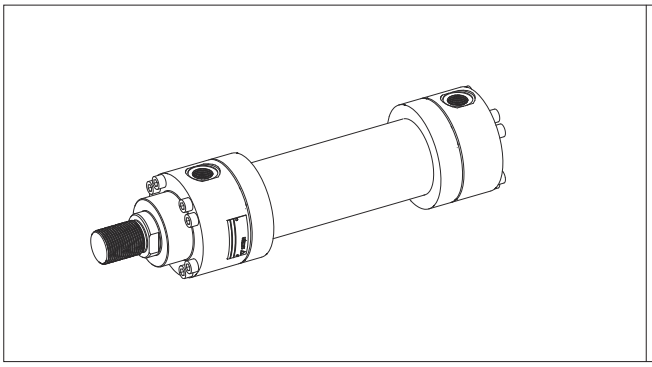
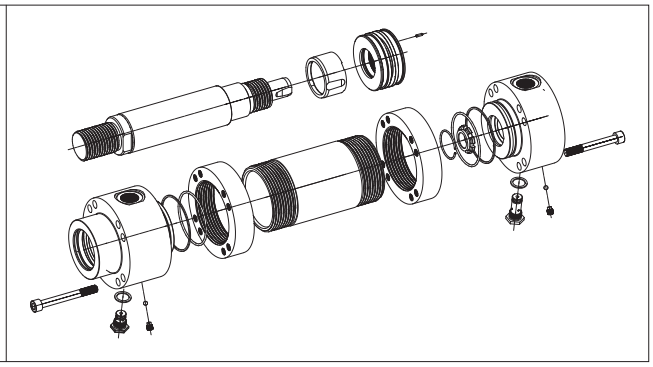




1 SYMBOLS CONVENTIONS

⚠ This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The cylinder operating and maintenance information are part of the operating instructions for the complete machine but they cannot replace them

Atos is not liable for damages resulting from an incorrect observance of these instructions.
All the hydraulic cylinders have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorised mechanical or electronic interventions
- The hydraulic cylinders are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

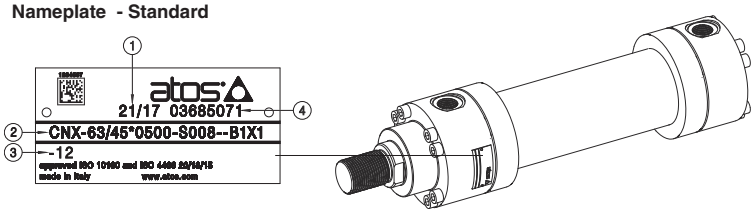
3 WORKING CONDITIONS

⚠ **The operation of hydraulic cylinders is not permitted at different operating and environmental conditions than those specified below**

Description	CNX
Ambient temperature	-20 ÷ +120°C
Fluid temperature	-20 ÷ +120°C
Max surface temperature	-
Max working pressure	10 MPa (100 bar)
Max pressure	15 MPa (150 bar)
Max frequency	5 Hz
Max speed	4 m/s
Recommended viscosity	15 ÷ 100 mm^2/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

4 NAMEPLATES

Nameplate - Standard



Nameplate - Standard (1)

Pos.	Description
①	Delivery date
②	Cylinder code
③	Series number
④	Customer code (only if requested)

Notes: (1) The position of the nameplate on the rear or front heads can change due to the cylinder overall dimensions

5 SAFETY NOTES

5.1 General

- The presence of cushioning can lead to a peak of pressure that can reduce the cylinder working life, ensure that the dissipated energy is less than the max value reported in **tab. B015**
- Make sure that the maximum working conditions, shown in section 3, are not exceeded
- Ensure to use hydraulic fluids compatible with the selected sealing system, see **tab. BW500**
- The rod must be handled with care to prevent damages on the surface coating which can deteriorate the sealing system and lead to the corrosion of the basic material
- The mounting screws must be free from shearing stress
- Transverse forces on the rods must always be avoided
- When the cylinder has to drive a rotating structure or where little alignment errors are expected, mounting style with spherical bearing should be used
- Contact surfaces, support elements in tolerance, elastic materials and labels must be covered before painting the cylinder

5.2 Position measuring system

- Position transducers must never be removed, if not otherwise specified in **tab. B310**, while the cylinder is under pressure
- Observe the information provided in **tab. B310** for the electronic connections
- The connectors must never be plugged or unplugged when the power supply is switched-on

5.3 Installation

- Consult **tab. P002** for installation, commissioning and maintenance of electrohydraulic system
- The piping have to be dimensioned according to the max pressure and max flow rate required
- All pipes and surfaces must be cleaned from dirt before mounting
- Remove all plug screws and covers before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the cylinders
- Bleed-off the system or the hydraulic cylinder using the proper device, see the technical data sheet for details
- Ensure that the cylinder mounting allow easy of acces for the purpose of maintenance and the adjustment of cushioning

6 MAINTENANCE

⚠ **Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics**

6.1 Preliminary check and ordinary maintenance

Atos hydraulic cylinders don't require any maintenance after commissioning. Anyway it is recommended to take into account the following remarks:

- Results of maintenance and inspection must be planned and documented
- Check oil escaping from oil ports or leakages at the cylinder heads
- Check for damages of the chromeplated surface of the rod: damages may indicate oil contamination or the presence of excessive transverse load
- Determine lubricating intervals for spherical clevises, trunnion and all parts not self-lubricated
- The rod should always be retracted during long stop of the machine or system
- Remove any salt, machining residuals or other dirt cumulated on the rod surface
- Follow the maintenance instructions of the fluid manufacturer

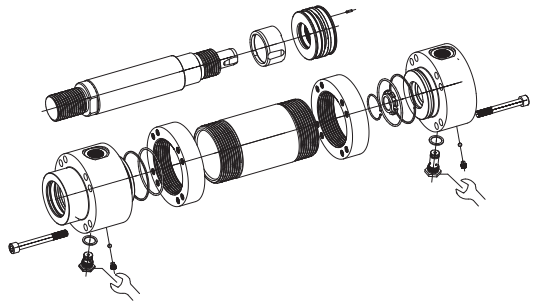
6.2 Repairing

Before beginning any repairing observe the following guidelines:

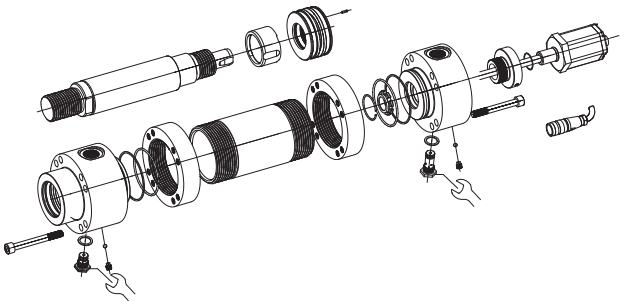
- Unauthorized opening of the cylinder during the warranty period results in the warranty expiration
- Be sure to use only original spare parts manufactured or supplied by Atos
- Provide all the required tools to make the repair operations safely and not damage the components
- Read and follow all the safety notes given in section 5
- Ensure that the cylinder is well locked before beginning any operation
- Disassembly or assembly the cylinder with the right order as indicated in section **6.3**
- When mounting rod or piston guides and seals observe the correct position as indicated in section **6.4**. Any bad positioning can result in oil leakages
- It is strongly recommended the use of expanding sleeves to insert the seals in the proper groove
- Tighten all the screws or nuts as follow: lubricates the threads, insert the screw or the nut by hand for some turns, tighten the screw crosswise with the tightening torque specified in the technical table (a pneumatic screw driver may be used)
- Rod bearing and piston must be locked respectively to the front head and to the rod by means of special pin to avoid unscrewing
- The replacement of wear parts such as seals, rod bearing and guide rings depends on the operating conditions, temperature and quality of the fluid

6.3 Cylinders exploded views

CNX - For spare parts contact our technical office



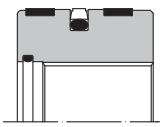
CNX* - For spare parts contact our technical office



Note: this symbol means that a particular equipment is required for mounting, contact our technical office

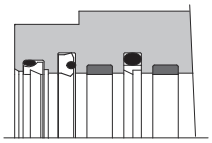
6.4 Sealing system mounting

PISTON

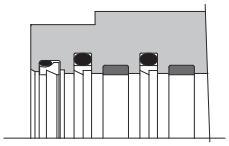


G3-G5-G8

ROD BEARING



G8



G3-G5

7 TRANSPORT AND STORAGE

7.1 Transport

Observe the following guidelines for transport of hydraulic cylinders:
- Cylinders have to be transported using a forklift truck or a lifting gear always ensuring a stable position of the cylinder
- Cylinders have to be transported in horizontal position in their original packaging
- Use soft lifting belts to move or lift the cylinders in order to avoid damages
- Before any movement check the cylinders weight (due to tolerances, the weight may be 10% greater than the values specified in the technical table)

⚠ **Additional parts such as pipes, subplates and transducers must never be used for lifting**

7.2 Storage

Corrosion protection is achieved with alkyd primer painting RAL 9007: the primer grants a storage period up to 12 months. Additionally all cylinders are tested with mineral oil OSO 46; the oil film, presents in the cylinder chambers after testing, ensures the internal corrosion protection.
Anyway be care to observe the following remarks:
- When a storage in the open air is foreseen ensure that cylinders are well protected against water
- The cylinders must be inspected at least once a year and rotated through 90° every six months to preserve the seals

⚠ **In case of storage period longer than 12 months, contact our technical office**

8 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads involve a premature wear of the bronze bushing, seals and wear rings	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **D**-**S**-**L**
	Fluid contaminants produce scratch and score marks on the seals	Check the fluid contamination class is < 20/18/15
	Chemical attack cause the deterioration of seals compound	Check seals compatibility with operating fluid
	High temperatures (fluid/ambient) the seals dark and flaked	a) Decrease the fluid temperature b) Install **G3** sealings for high temperatures
	Low temperature (ambient) make the seals brittle	Move the cylinder in a higher temperature zone
	High rod speed reduce the lubricant capacity of the seals	For rod speed > 5 m/s Install **G3**-**G5** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect)	Bleed off completely the air inside the hydraulic circuit
Wiper or seal extrusion	Overpressure	a) Limit the pressure of the system b) Install **G3**-**G5** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	See possible causes and solutions for oil leakage troubles
Lose of cushioning effect	Rod speed too low at end stroke	Check the cushioning adjustment is not fully open, regulate it if necessary
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants produce scratch and score marks on the cushioning piston	Check the fluid contamination class is < 20/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking	a) Replace "fixed" cushioning **7**-**9** with "adjustable" cushioning **1**-**3** b) For adjustable cushioning, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances	Check the fluid contamination class is < 20/18/15
Rod failure	Overload/overpressure involves ductile rod failure	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation involves fatigue rod failure	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G3**-**G5**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 20/18/15
	High oil flow speed > 6 m/s	Increase the piping diameters to reduce the oil flow speed

9 SERVOCYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

Note: for cylinders troubleshooting refer to section 8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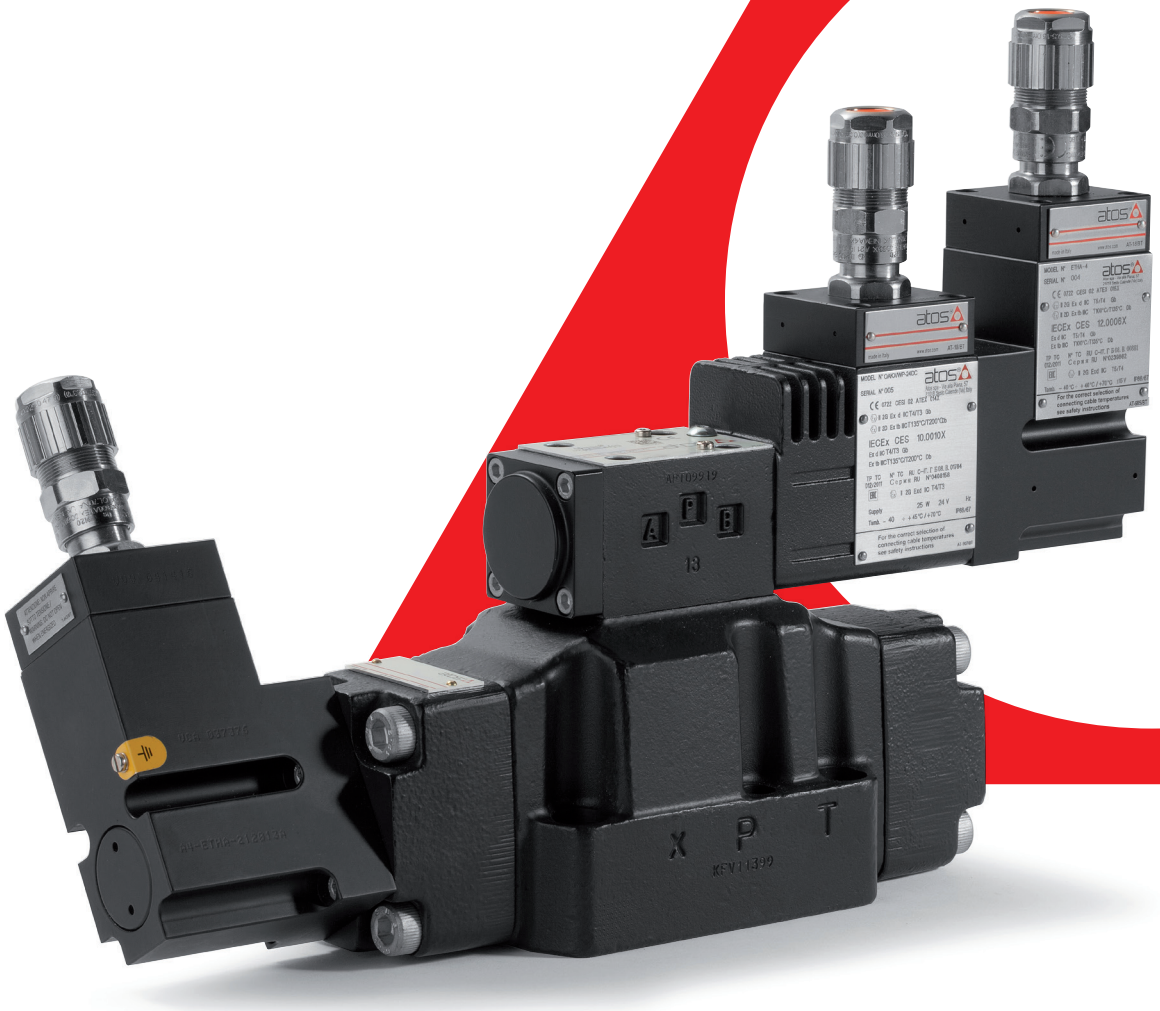
EX-PROOF

ELECTROHYDRAULICS

MASTER CATALOG



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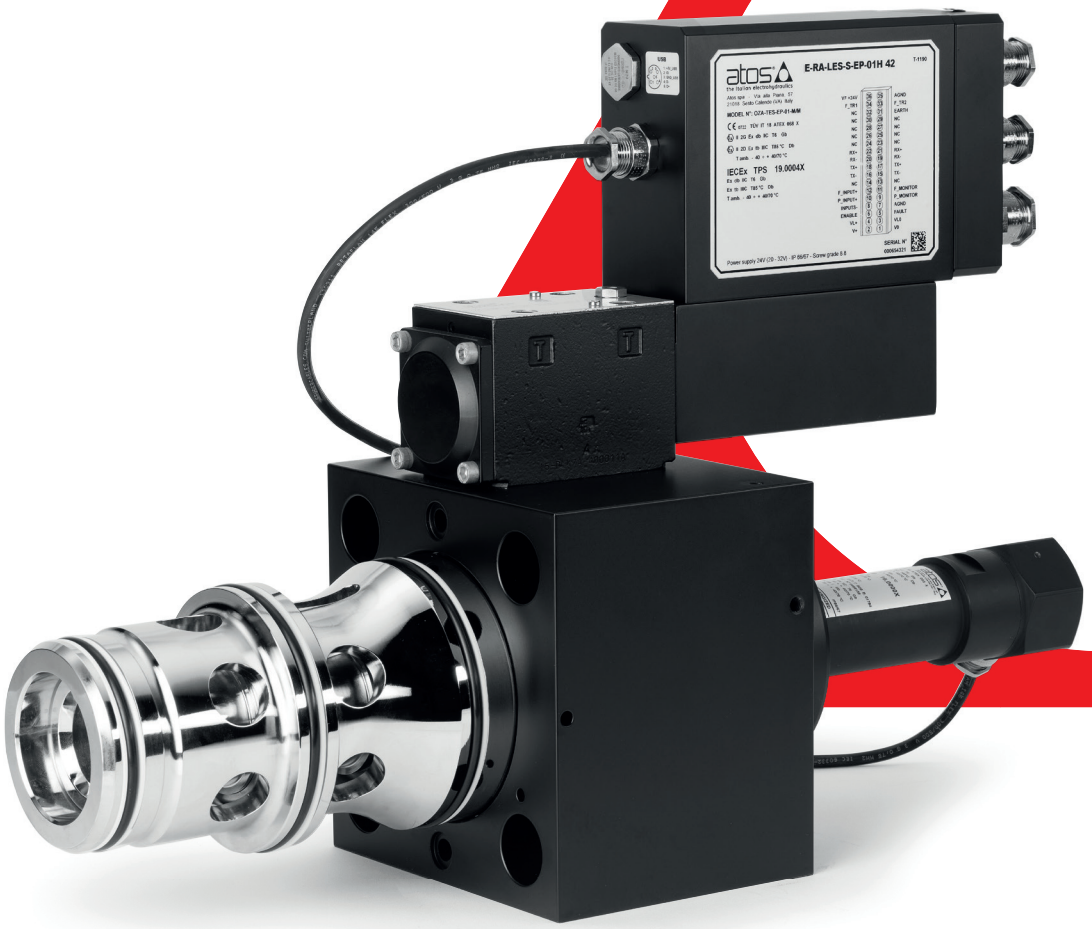
Professional team
to quickly meet every
customer need

GENERAL INDEX

1 PROPORTIONAL VALVES



INDEX

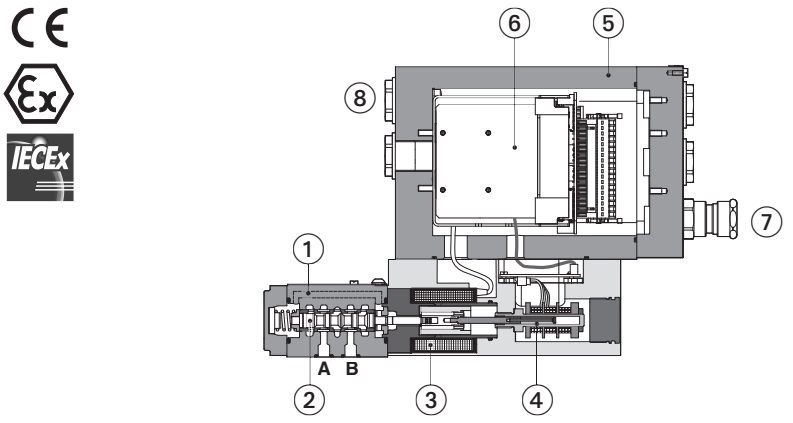
PROPORTIONAL VALVES

Ex-d

Supplementary components range available on **www.atos.com**

Ex-proof digital servoproportional directional valves sleeve execution

direct, with on-board driver, LVDT transducer and zero spool overlap - **ATEX and IECEx**



DLHZA-TES-SN-EP-040

① valve body
② spool
③ ex-proof solenoid
④ ex-proof LVDT transducer
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

DLHZA-TES, DLKZA-TES

Ex-proof digital servoproportional directional valves, direct, sleeve execution, with LVDT position transducer and zero spool overlap for best performances in any position closed loop control.

They are equipped with ex-proof on-board digital driver, LVDT transucer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment. The driver and solenoid are also designed to limit the surface temperature within the classified limits.

TEZ execution includes valve driver plus axis card to perform position control (see section 6).

DLHZA:
Size: **06** -ISO 4401
Max flow: **50 l/min**
Max pressure: **350 bar**

DLKZA:
Size: **10** -ISO 4401
Max flow: **100 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DLHZA	- TES	- SN	- NP	- 0	40	- L	7	3	/ M	/ *	*	/ *

DLHZA = Ex-proof proportional directional valves, direct
DLKZA = size 10

TES = on-board driver and LVDT transducer

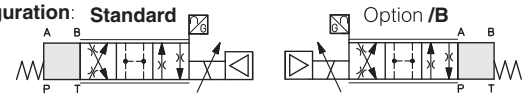
Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401: **0** = 06 **1** = 10

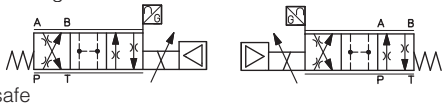
Configuration: **Standard** Option **/B**

40 =



with fail safe configuration 1 or 3

60 =



without fail safe

Spool type, regulating characteristics:

L = linear

V = progressive

T = not linear **(1)**

D = differential-linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

DT = differential-not linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Hydraulic options (2):
B = solenoid with integral electronics and position transducer at side of port A **(3)**
Y = external drain

Electronic options (2):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)

Cable entrance threaded connection:
M = M20x1,5

Fail safe configuration, see section 18 :

1 =

3 =

Note: select **1** for configuration **60** even without fail safe

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

Series number

Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZA =	4	7	8	14	-	20	28	40
DLKZA =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) Only for configuration **40** **(2)** For possible combined options, see section 16

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

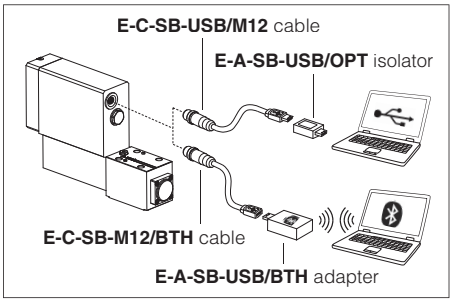
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

5 ALTERNATED P/Q CONTROLS - see tech. table FX500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

6 AXIS CONTROLLER - see tech. table FX610

Digital servoproportional with integral electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. Alternated pressure or force closed loop control can be set by software additionally to the position control.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DLHZA												DLKZA						
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y)												ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y)						
Spool type		**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Nominal flow [l/min]																				
Δp P-T	at Δp = 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
	at Δp = 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
	max permissible flow	5	9	16	18	26	32		50			50÷28		70		100			100÷50	
Δp max P-T [bar]		120	120	120	120	120	100		100			100		90		70			70	
Leakage [cm³/min] at P = 100 bar **(1)**		<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time [ms] **(2)**		≤ 13												≤ 20						
Hysteresis [% of max regulation]		≤ 0,1												≤ 0,1						
Repeatibility [% of max regulation]		± 0,1												± 0,1						
Thermal drift		zero point displacement < 1% at ΔT = 40°C																		

(1) referred to spool in neutral position and 50°C oil temperature
(2) 0-100% step signal

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type	DLHZA, DLKZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-TES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-31 EN 60079-1	IEC 60079-0 IEC 60079-31 IEC 60079-1	
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only for **SP, SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

16 POSSIBLE COMBINED OPTIONS

For SN: /BI, /BY, /IY

For SP, SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

17 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

17.1 Regulation diagrams

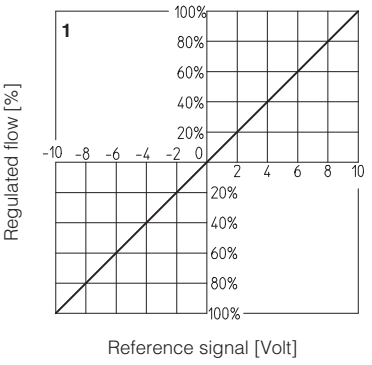
1 = Linear spools L
2 = Differential - linear spool D7

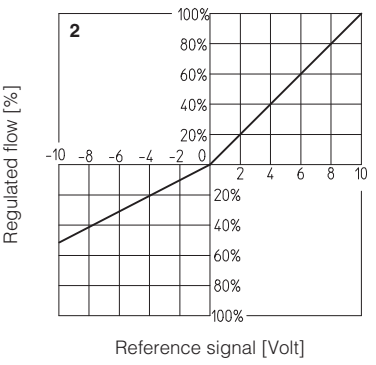
3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZA)

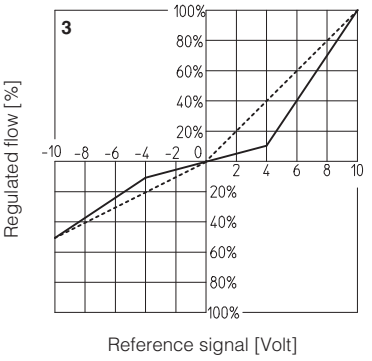
5 = Non linear spool T3 (only for DLKZA) and T7
6 = Progressive spool V

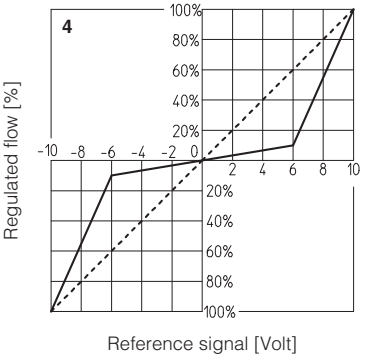
T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2









Note

Hydraulic configuration vs. reference signal:

Standard

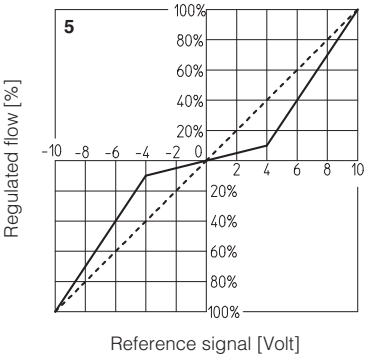
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

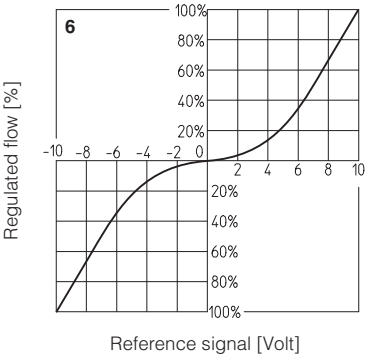
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

option /B

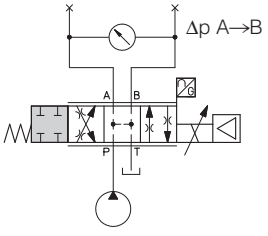
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → B / A → T

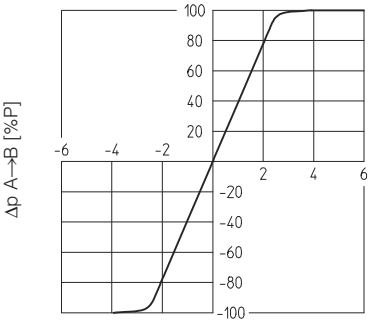
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → A / B → T





17.2 Pressure gain



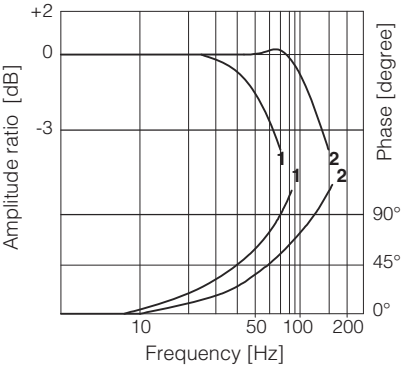


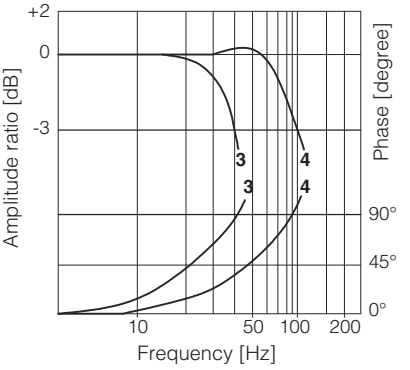
17.3 Bode diagrams

Stated at nominal hydraulic conditions

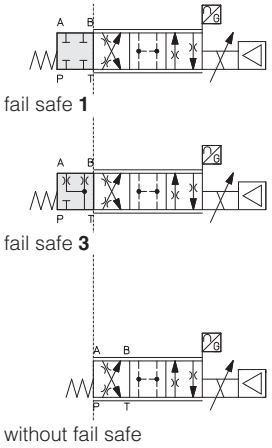
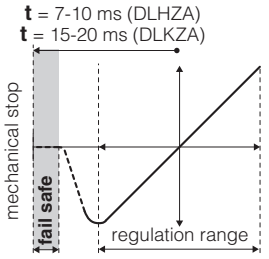
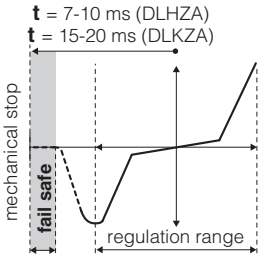
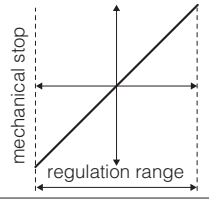
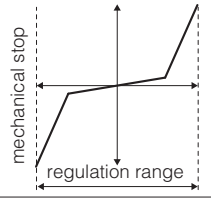
DLHZA:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZA:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke





18 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
		
		

t = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar

Fail safe connections		**P → A**	**P → B**	**A → T**	**B → T**
Leakage [cm³/min] at P = 100 bar **(1)**	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] **(2)** DLHZA	Fail safe 3	-	-	15÷30	10÷20
Flow [l/min] **(2)** DLKZA	Fail safe 3	-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature **(2)** Referred to spool in fail safe position at Δp = 35 bar per edge

19 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.4 Pressure or force reference input signal (F_INPUT+) - only **SP, SF, SL**

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

19.6 Pressure or force monitor output signal (F_MONITOR) - only for **SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

19.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

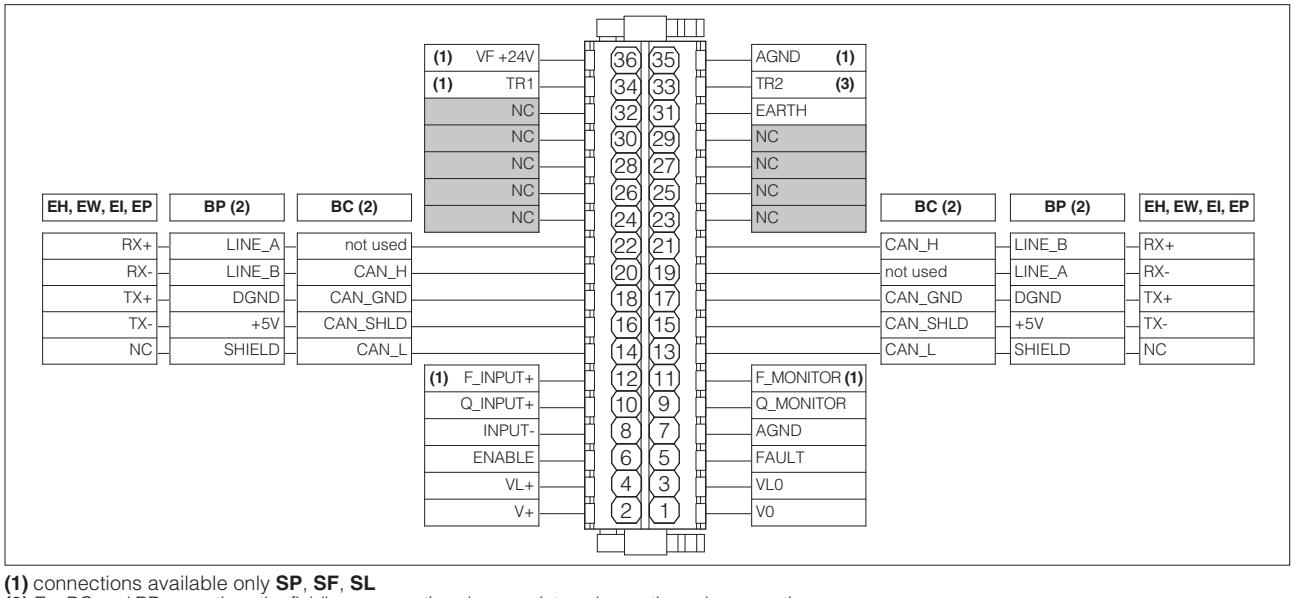
19.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

19.9 Remote pressure/force transducer input signal - only for **SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see table FX500).

20 TERMINAL BOARD OVERVIEW



(1) connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) connection available only **SF**

21 ELECTRONIC CONNECTIONS

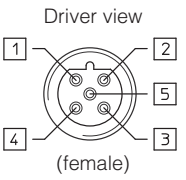
21.1 Main connections signals

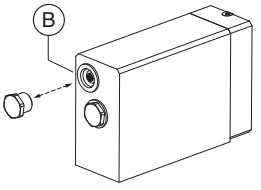
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

21.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





21.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

21.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

21.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

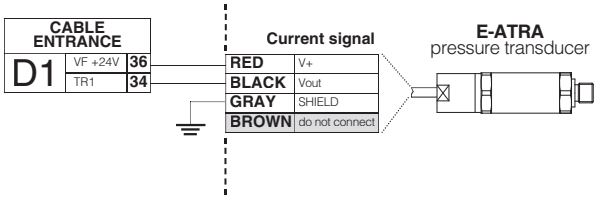
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

21.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SP, SL - Single transducer (1)		SF - Double transducers (1)	
					Voltage	Current	Voltage	Current
D1	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
D2	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

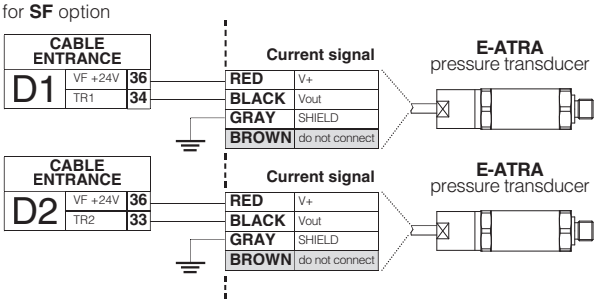
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



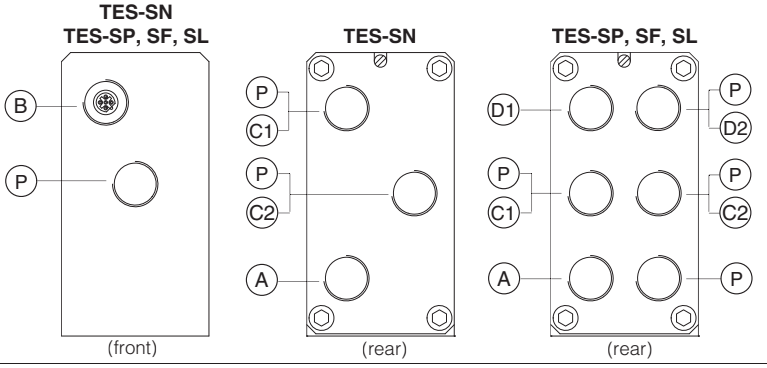
Connect the transducers cables to the terminal board of the electronic driver

22 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

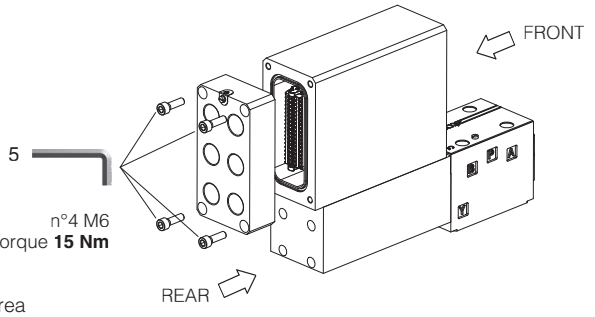
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



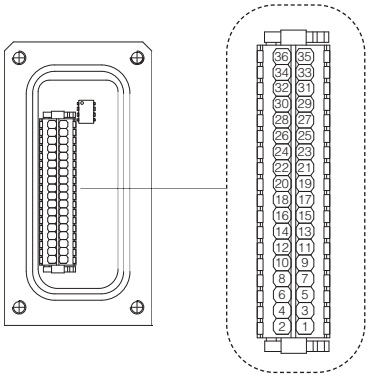
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

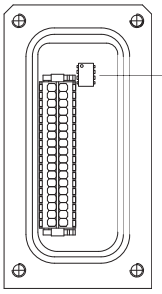


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 20

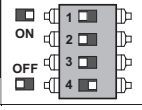


Fieldbus terminator only for BC and BP executions **(1)**



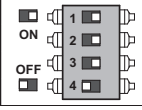
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

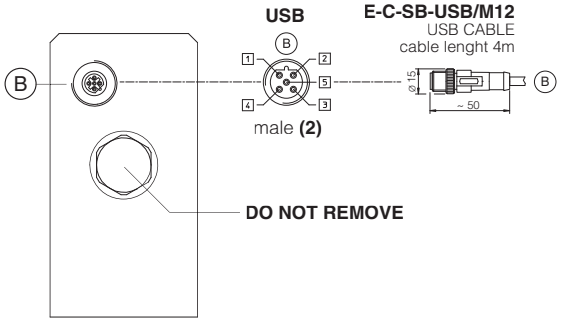


BP - PROFIBUS DP setting:

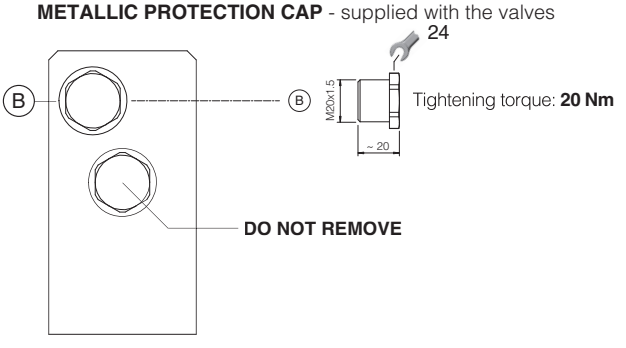
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

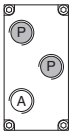
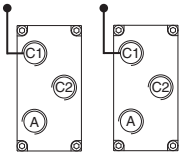
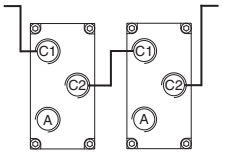


METALLIC PROTECTION CAP - supplied with the valves

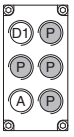
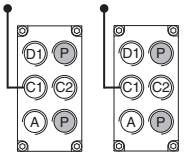
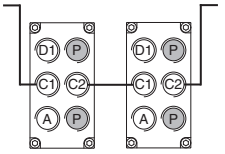


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

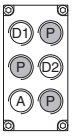
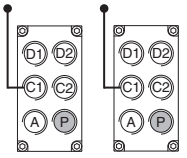
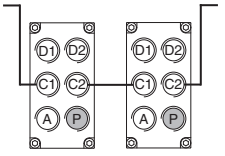
22.1 Cable glands and threaded plug for TES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

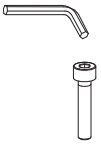
22.2 Cable glands and threaded plug for TES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

22.3 Cable glands and threaded plug for TES-SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

23 FASTENING BOLTS AND SEALS

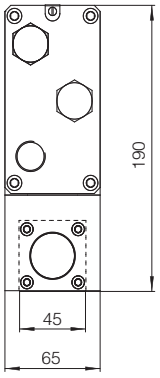
	DLHZA	DLKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

24 INSTALLATION DIMENSIONS [mm]

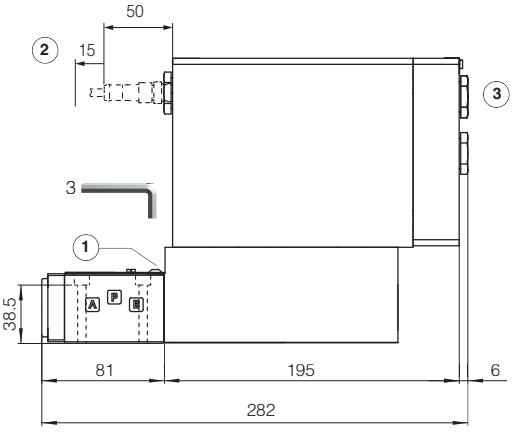
DLHZA-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface: 4401-03-03-0-05 without port X)

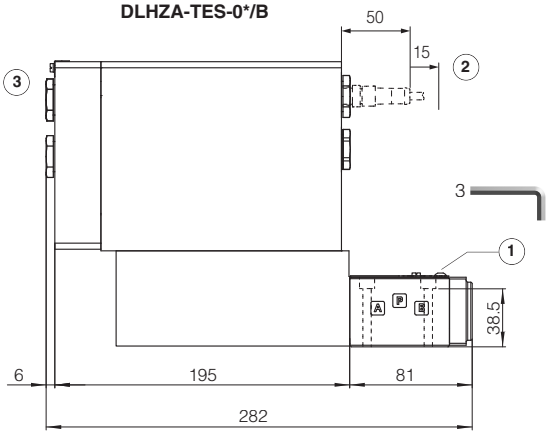
Mass [kg]	
DLHZA-TES	7,2



DLHZA-TES-0*



DLHZA-TES-0*/B



(1) = Air bleed off

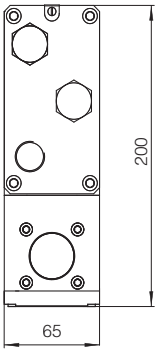
(2) = Space to remove the USB connector

(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

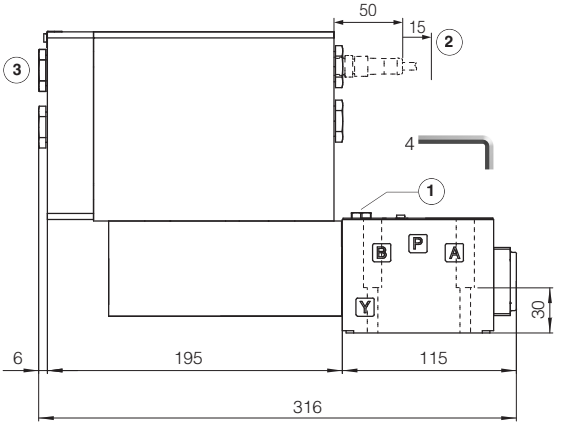
DLKZA-TES

ISO 4401: 2000
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

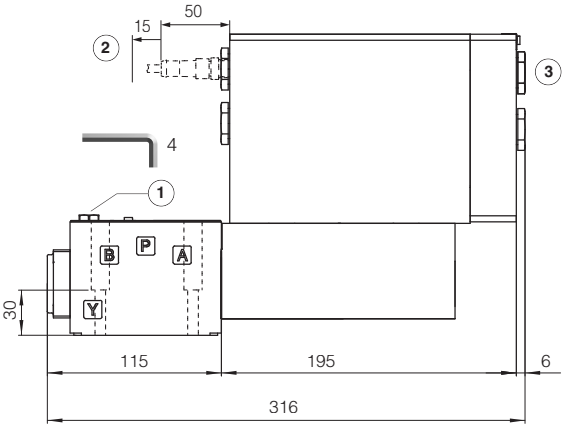
Mass [kg]	
DLKZA-TES	9



DLKZA-TES-1*



DLKZA-TES-1*/B



(1) = Air bleed off

(2) = Space to remove the USB connector

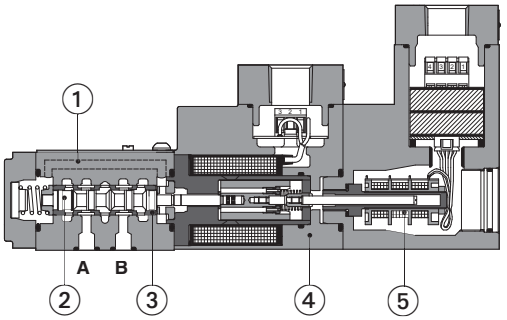
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

25 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX500	Ex-proof digital proportionals with P/Q control	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX610	Ex-proof servoproportionals with on-board axis card	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof servoproportional directional valves **sleeve execution**

direct, with LVDT transducer and zero spool overlap - **ATEX, IECEx, EAC, PESO** or **cULus**



DLHZA-T-040

① valve body
② spool
③ sleeve
④ ex-proof solenoid
⑤ ex-proof LVDT transducer

DLHZA-T, DLKZA-T

Ex-proof servoproportional directional valves, direct, sleeve execution, with LVDT position transducer and zero spool overlap for best performances in any position closed loop control.
They are equipped with ex-proof proportional solenoids and LVDT transducer certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoids are also designed to limit the surface temperature within the classified limits.

DLHZA:
Size: **06** - ISO 4401
Max flow: **50 l/min**
Max pressure: **350 bar**

DLKZA:
Size: **10** - ISO 4401
Max flow: **100 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DLHZA	/	*	-	T	-	0	40	-	L	7	3	/	M	/	*	*	/	*

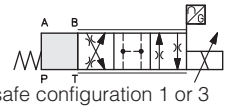
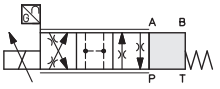
DLHZA / **DLKZA**
Ex-proof proportional directional valves direct
DLHZA = size 06
DLKZA = size 10

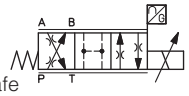
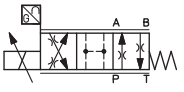
Certification:
Multicertification
ATEX, IECEx,EAC, PESO:
- = omit for Group II 2G IID **(1)**
M = Group I (mining)
North American Certification:
UL = cULus

T = with LVDT transducer

Valve size ISO 4401:
0 = 06 **1** = 10

Configuration: **Standard** Option **/B**

40 =


with fail safe configuration 1 or 3

60 =


without fail safe

Spool type, regulating characteristics:


L = linear


V = progressive


T = not linear **(2)**


D = differential-linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q


DT = differential-not linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(3)**

Series number

Options (4):
B = solenoid and position transducer at side of port A **(5)**
C = position transducer with current feedback 4÷20 mA
Y = external drain

Solenoid and transducer threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (6)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Fail safe configuration, see section 12 :

1 = 
3 = 

Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZA =	4	7	8	14	-	20	28	40
DLKZA =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization)
(2) Only for configuration **40** **(3)** Not for multicertification **M** group I (mining) **(4)** Possible combined options: /BC, /BY, /CY, /BCY
(5) In standard configuration the solenoid and position transducer are at side of port B **(6)** Approved only for the Italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-TEB-* /A	E-BM-TES-* /A	Z-BM-TEZ-* /A
Type	digital	digital	digital
Format	DIN-rail panel		
Data sheet	GS230	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DLHZA**											**DLKZA**						
Pressure limits [bar]		ports **P, A, B** = 350; **T** = 210 (250 with external drain /Y)											ports **P, A, B** = 315; **T** = 210 (250 with external drain /Y)						
Spool type		**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Max flow [l/min]																				
Δp P-T	at Δp = 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
	at Δp = 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
	max permissible flow	5	9	16	18	26	32		50			50÷28		70		100			100÷50	
Δp max P-T [bar]		120	120	120	120	120	100		100			100		90		70			70	
Leakage [cm³/min] at P = 100 bar **(1)**		<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time **(2)** [ms]		≤ 13												≤ 20						
Hysteresis [% of max regulation]		≤ 0,1												≤ 0,1						
Repeatibility [% of max regulation]		± 0,1												± 0,1						
Thermal drift		zero point displacement < 1% at ΔT = 40°C																		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2
(1) Referred to spool in neutral position and 50°C oil temperature **(2)** 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

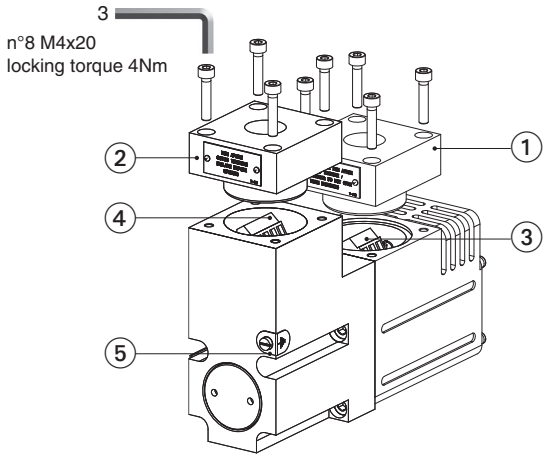
Valve type	DLHZA, DLKZA		DLHZA**/M**, DLKZA**/M**	DLHZA**/UL**, DLKZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-T**		**OZAM-T**	**OZA-T/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30 CSA 22.2 n°139	
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

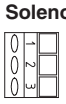
8 EX PROOF SOLENOIDS AND LVDT TRANSDUCER WIRING

Multicertification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

Solenoid wiring



1 = Coil
2 = GND
3 = Coil

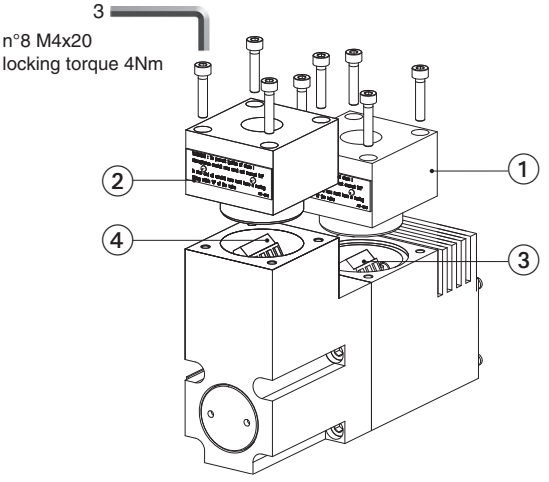
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

Position transducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

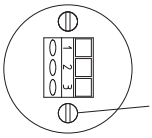
cULus certification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring

Solenoid wiring

⚠ **Pay attention to respect the polarity**

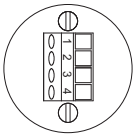


1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1

alternative GND screw terminal connected to solenoid housing

Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	-	90 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

10 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

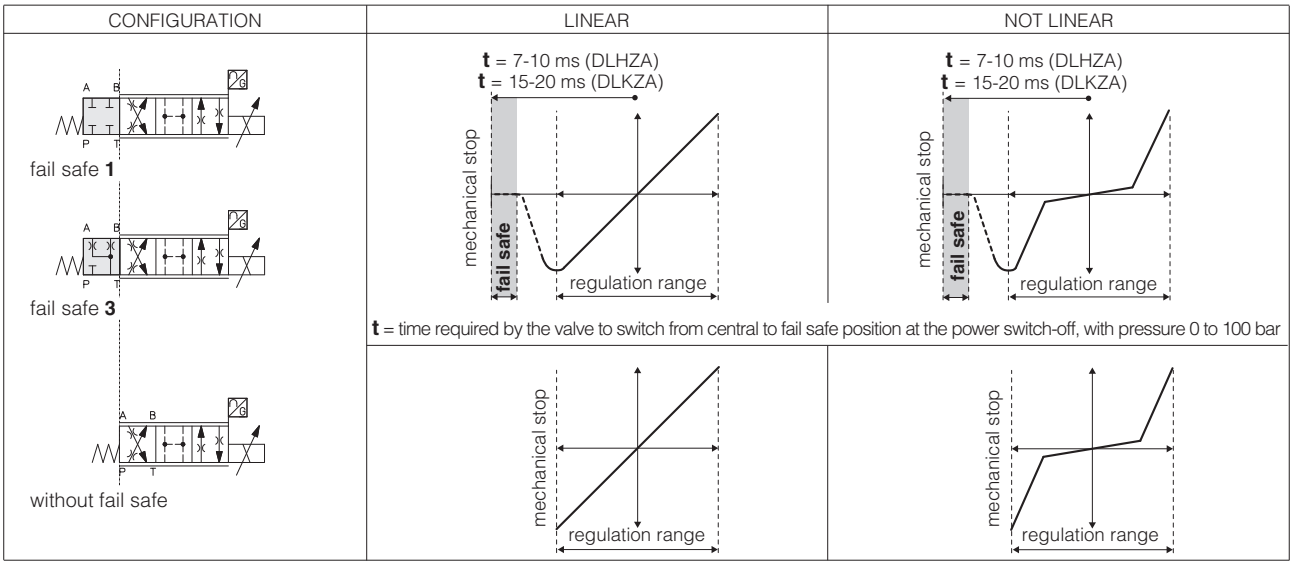
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 OPTIONS

B = Solenoid and position transducer at side of port A of the main stage
C = Position transducer with current feedback 4÷20 mA, suggested in case of long distance between the electronic driver and the proportional valve
Y = External drain, to be selected if the pressure at T port is higher than the max allowed limits

11.1 Possible combined options: /BC, /BY, /CY, /BCY

12 FAIL SAFE POSITION



Fail safe connections		P → A	P → B	A → T	B → T
Leakage [cm³/min] at P = 100 bar **(1)**	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] **(2)** DLHZA	Fail safe 3	-	-	15÷30	10÷20
Flow [l/min] **(2)** DLKZA	Fail safe 3	-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature

(2) Referred to spool in fail safe position at Δp = 35 bar per edge

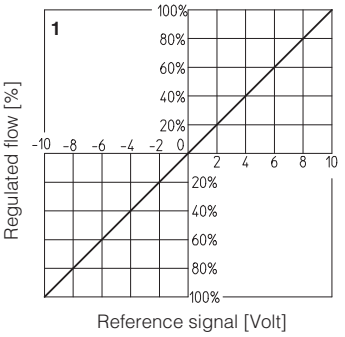
13 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

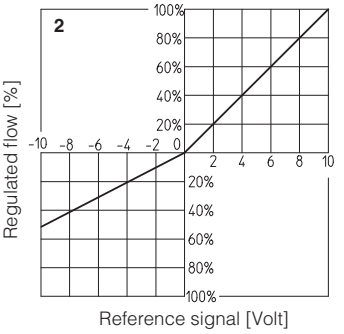
13.1 Regulation diagrams

1 = Linear spools L
2 = Differential - linear spool D7

3 = Differential non linear spool DT7
4 = Non linear spool, T5 (only for DLHZA)

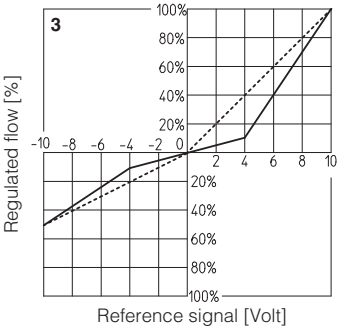
5 = Non linear spool, T3 (only for DLKZA) and T7
6 = Progressive spool V

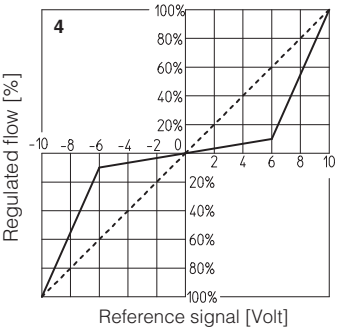




T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2





Note:
Hydraulic configuration vs. reference signal:
Standard:

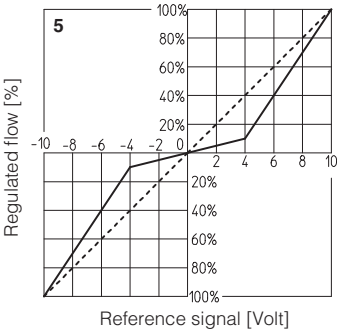
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

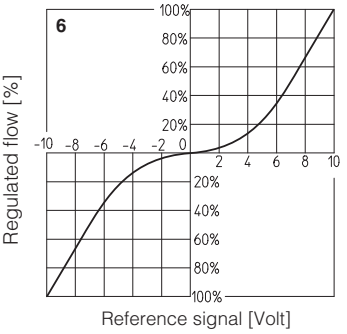
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

option /B:

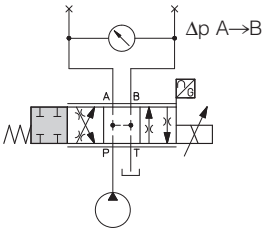
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → B / A → T

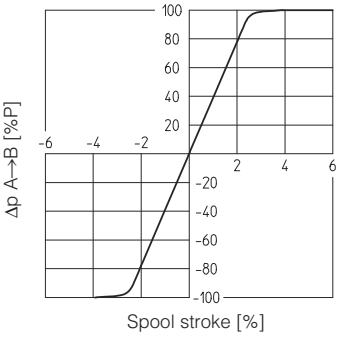
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → A / B → T



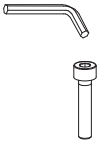


13.2 Pressure gain





14 FASTENING BOLTS AND SEALS

	DLHZA	DLKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

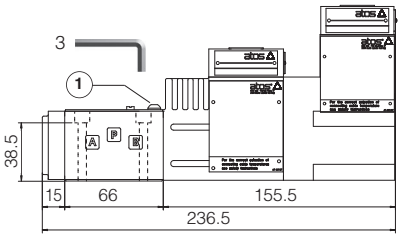
15 INSTALLATION DIMENSIONS [mm]

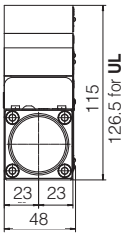
DLHZA

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(for /Y surface: 4401-03-03-0-05 without port X)

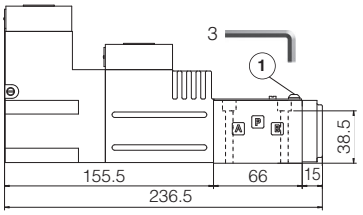
Mass [kg]	
DLHZA-T-*	4,0

DLHZA-T-*





DLHZA-T-*/B

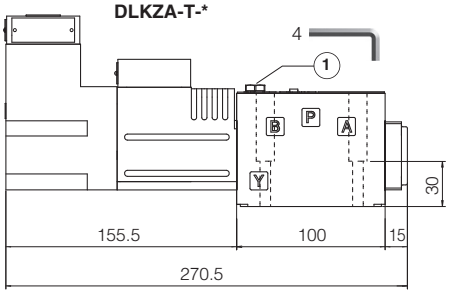


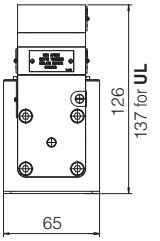
DLKZA

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-05-04-0-05
(for /Y surface: 4401-05-05-0-05 without port X)

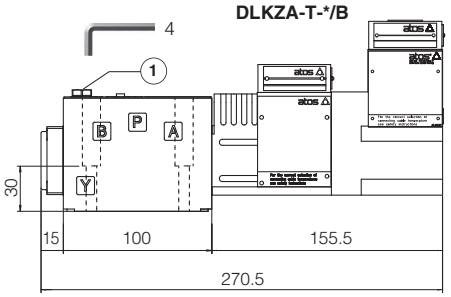
Mass [kg]	
DLKZA-T-*	6,1

DLKZA-T-*





DLKZA-T-*/B



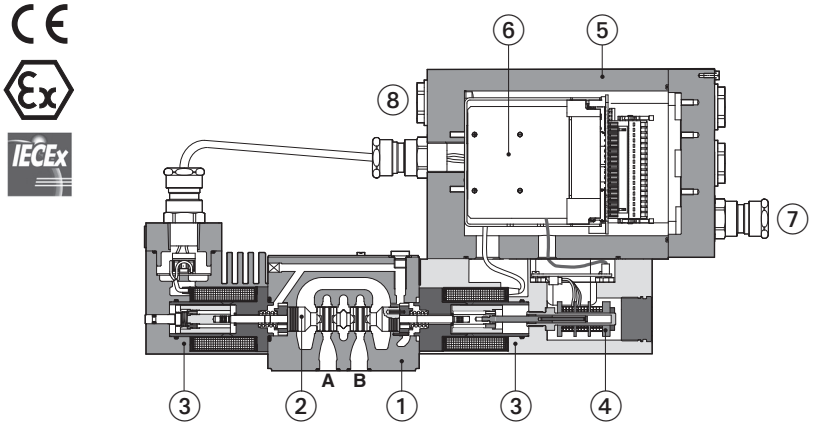
(1) = Air bleed off

16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportional directional valves

direct, with on-board driver, LVDT transducer and zero spool overlap - **ATEX and IECEx**



DKZA-TES-SN-NP-170*

① valve body
② spool
③ ex-proof solenoid
④ ex-proof LVDT transducer
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

DHZA-TES, DKZA-TES

Ex-proof digital servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for position closed loop controls. The double solenoid construction involves larger flows and spool safety rest position.

They are equipped with ex-proof on-board digital driver, LVDT transducer and solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment. The driver and solenoid are also designed to limit the surface temperature within the classified limits.

TEZ execution includes valve driver plus axis card to perform position control (see section 6).

DHZA:
Size: **06** -ISO 4401
Max flow: **60 l/min**
Max pressure: **350 bar**

DKZA:
Size: **10** -ISO 4401
Max flow: **150 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DHZA	-	TES	-	SN	-	NP	-	0	70	-	L	5	/	M	/	*	*	/	*

Ex-proof proportional directional valves, direct
DHZA = size 06
DKZA = size 10

TES = on-board driver and LVDT transducer

Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401: **0** = 06 **1** = 10

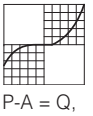
Configuration: **Standard** Option **/B**

70 =

Spool type, regulating characteristics:

L = linear

D = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Spool size: **3** (L) **5** (L,D)
DHZA = 18 28
DKZA = 45 75
Nominal flow (l/min) at Δp 10 bar P-T

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (1):
B = solenoid with integral digital electronics at side of port A **(2)**
Y = external drain

Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)

Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

(1) For possible combined options, see section 16
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

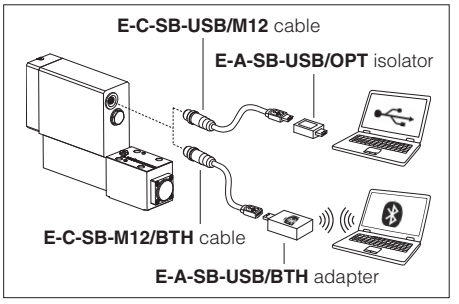
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

5 ALTERNATED P/Q CONTROLS - see tech. table **FX500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

6 AXIS CONTROLLER - see tech. table **FX620**

Digital servoproportional with integral electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. Alternated pressure or force closed loop control can be set by software additionally to the position control.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DHZA			DKZA		
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y); **Y** = 10			ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y); **Y** = 10		
Spool type		**L3**	**L5**	**D5**	**L3**	**L5**	**D5**
Nominal flow							
[l/min]	at Δp= 10 bar	18	28	28	45	75	75
Δp P-T	at Δp= 30 bar	30	50	50	80	130	130
	max permissible flow	40	60	60	90	150	150
Δp max P-T [bar]		70	50	50	40	40	40
Response time [ms] **(1)**		≤ 18			≤ 25		
Leakage [cm³]		<500 (at P = 100 bar); <1500 (at P = 350 bar)			<800 (at P = 100 bar); <2500 (at P = 315 bar)		
Hysteresis		≤ 0,2 [% of max regulation]					
Repeatability		± 0,1 [% of max regulation]					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) 0-100% step signal

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching;protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type		DHZA, DKZA				
Certifications		Multicertification Group II **ATEX IECEx**				
Solenoid certified code		**OZA-TES**				
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X		
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db		
Temperature class	Single solenoid valve	**T6**	**-**	**T5**	**T4**	**-**
	Double solenoid valve	**-**	**T4**	**-**	**-**	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards		EN 60079-0 EN 60079-31 EN 60079-1		IEC 60079-0 IEC 60079-31 IEC 60079-1		
Cable entrance: threaded connection		**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only for **SP, SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

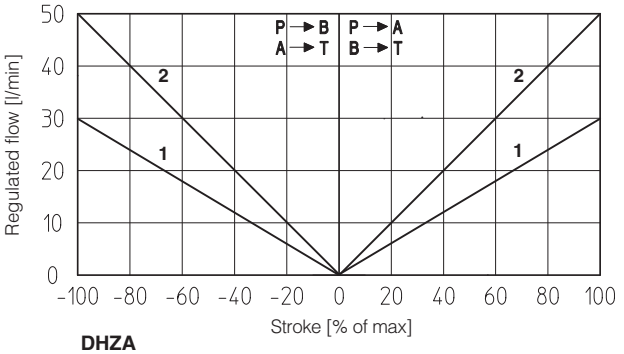
16 POSSIBLE COMBINED OPTIONS

For SN: /BI, /BY, /IY

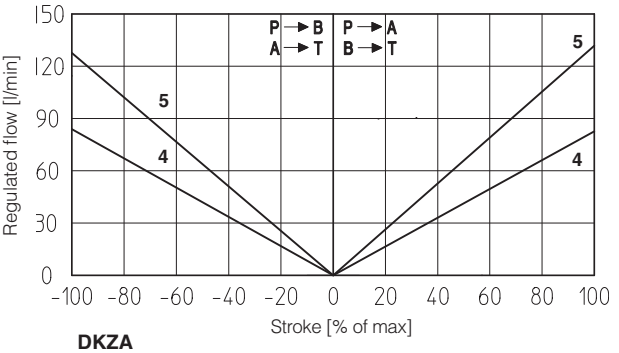
For SP, SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

17 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

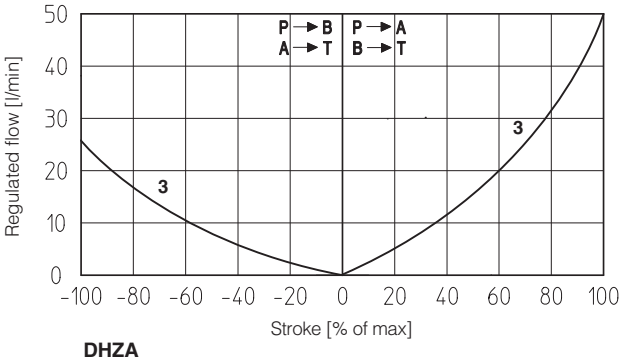
17.1 Regulation diagrams (values measure at Δp 30 bar P-T)



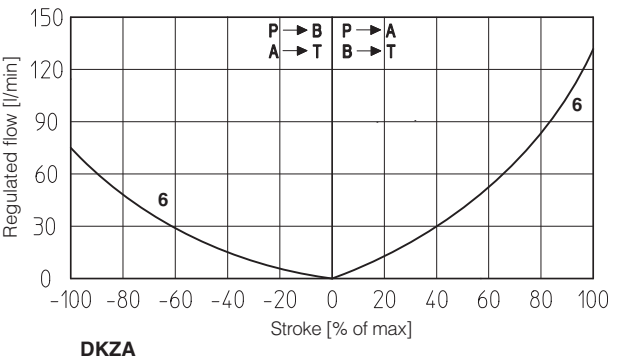
DHZA
1 = L3 **2** = L5



DKZA
4 = L3 **5** = L5



DHZA
3 = D5



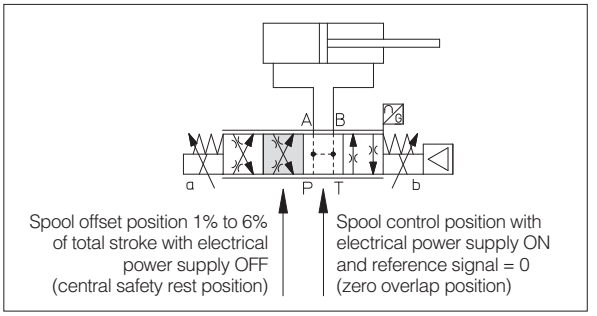
DKZA
6 = D5

Note:
Hydraulic configuration vs. reference signal for configurations 71 and 73 (standard and option /B)

Reference signal $\left.\begin{matrix}0 \div +10\ V\\12 \div 20\ mA\end{matrix}\right\}$ P → A / B → T Reference signal $\left.\begin{matrix}0 \div -10\ V\\12 \div 4\ mA\end{matrix}\right\}$ P → B / A → T

17.2 Spool safety rest position

In absence of electric power supply (+24 VDC), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.
This is specifically designed to avoid that in case of accidental interruption of the electrical power supply to the valve, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.4 Pressure or force reference input signal (F_INPUT+) - only **SP, SF, SL**

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

19.6 Pressure or force monitor output signal (F_MONITOR) - only for **SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

18.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

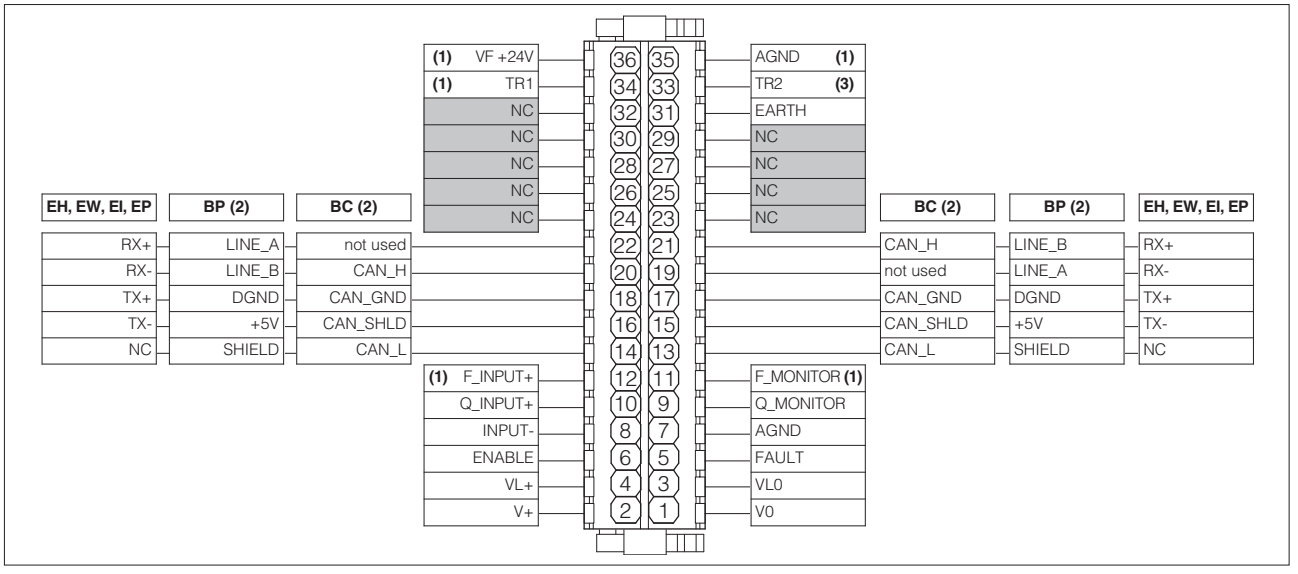
18.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

18.9 Remote pressure/force transducer input signal - only for **SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see table FX500).

19 TERMINAL BOARD OVERVIEW



(1) connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) connection available only **SF**

20 ELECTRONIC CONNECTIONS

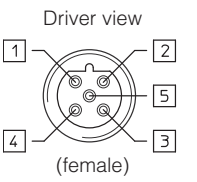
20.1 Main connections signals

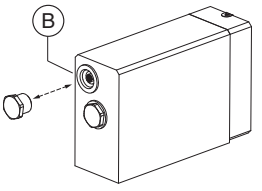
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

20.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





20.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

20.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

20.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

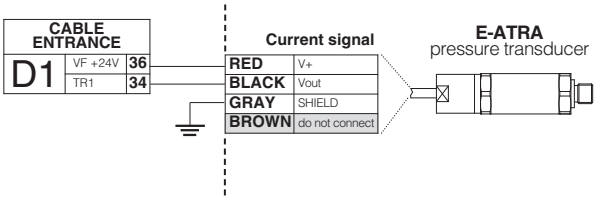
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

20.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SP, SL - Single transducer (1)		SF - Double transducers (1)	
					Voltage	Current	Voltage	Current
D1	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
D2	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

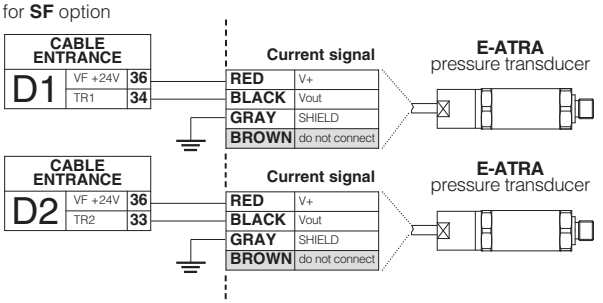
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



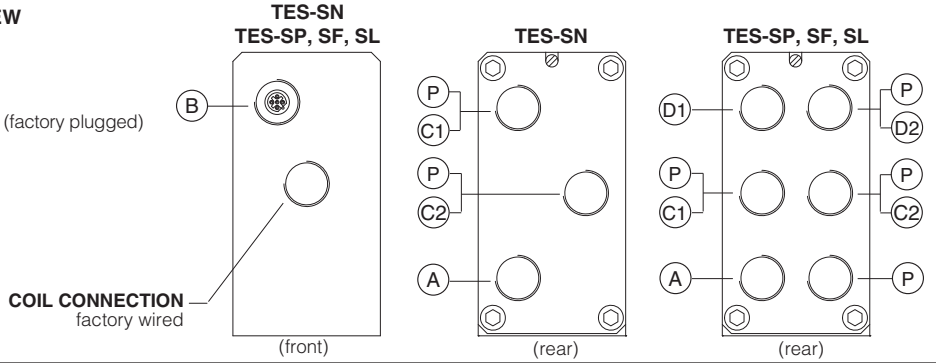
Connect the transducers cables to the terminal board of the electronic driver

21 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

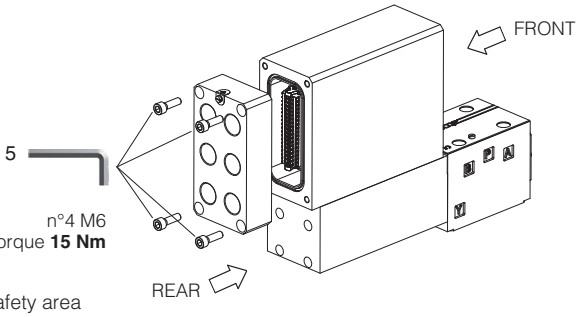
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



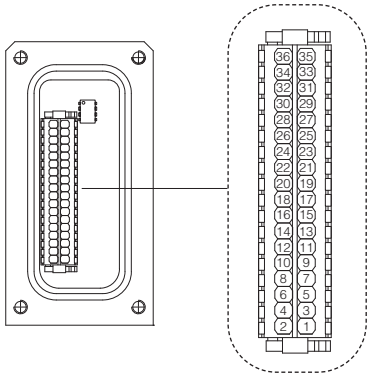
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

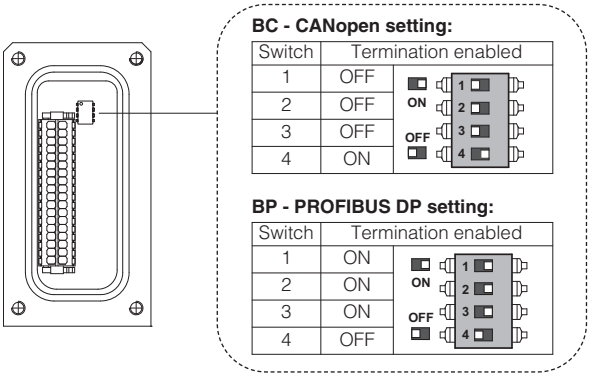


⚠ **WARNING:** the above operation must be performed in a safety area

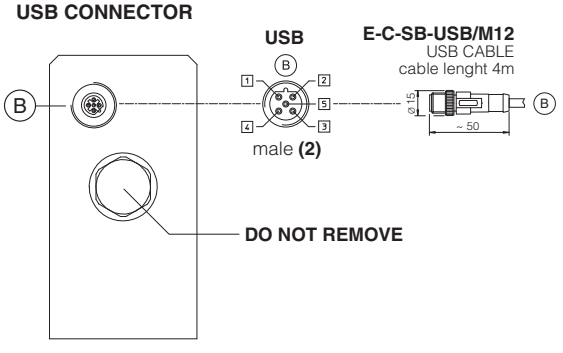
Terminal board - see section 19



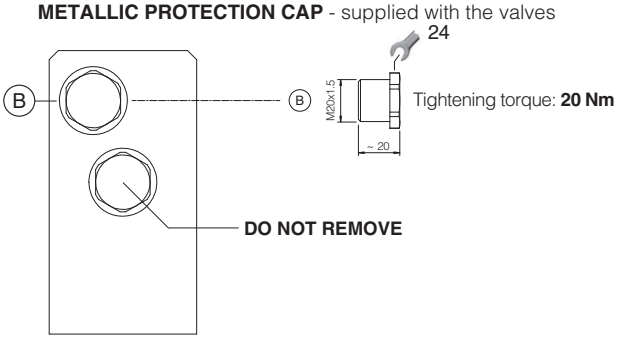
Fieldbus terminator only for BC and BP executions **(1)**



USB CONNECTOR

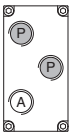
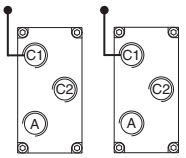
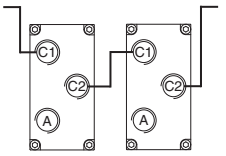


METALLIC PROTECTION CAP - supplied with the valves

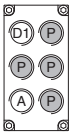
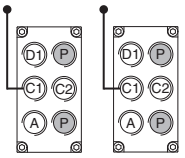
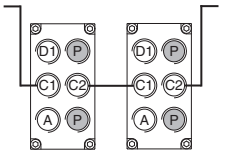


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

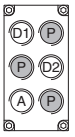
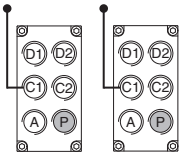
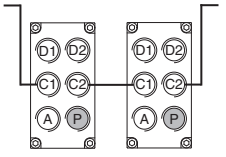
21.1 Cable glands and threaded plug for TES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

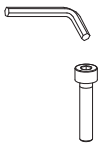
21.2 Cable glands and threaded plug for TES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

21.3 Cable glands and threaded plug for TES-SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

22 FASTENING BOLTS AND SEALS

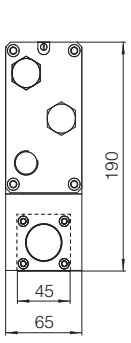
	DHZA	DKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

23 INSTALLATION DIMENSIONS [mm]

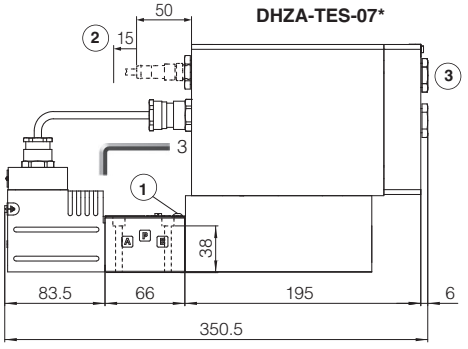
DHZA-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface: 4401-03-03-0-05 without port X)

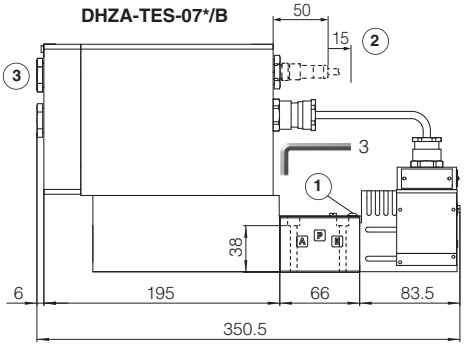
Mass [kg]	
DHZA-TES-07	8,9



DHZA-TES-07*



DHZA-TES-07*/B

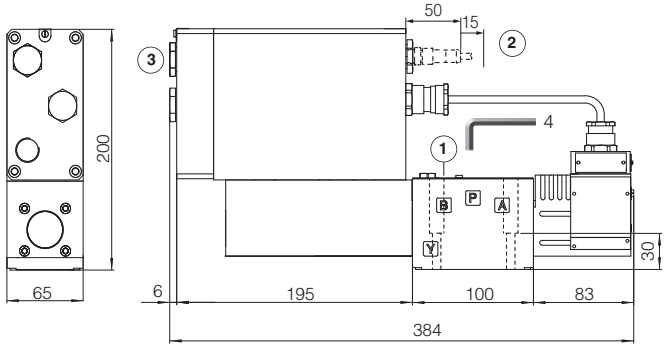


DKZA-TES

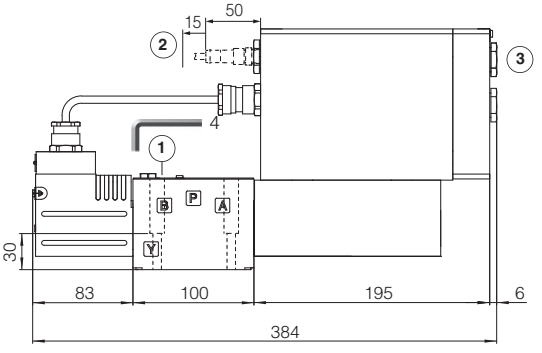
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface: 4401-05-05-0-05 without port X)

Mass [kg]	
DKZA-TES-17	10,7

DKZA-TES-17*



DKZA-TES-17*/B



(1) = Air bleed off

(2) = Space to remove the USB connector

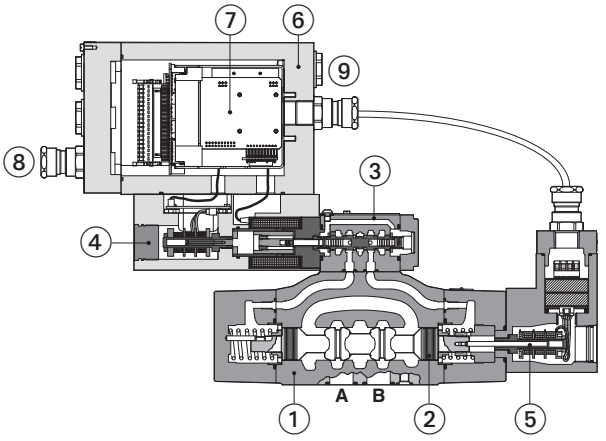
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

24 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX500	Ex-proof digital proportionals with P/Q control	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX620	Ex-proof servoproportionals with on-board axis c	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportional directional valves

piloted, with on-board driver, two LVDT transducers and zero spool overlap - **ATEX and IECEx**



DPZA-LES-SN-NP-27*

① valve body
② spool
③ proportional ex-proof pilot valve
④ ex-proof solenoid with integral LVDT transducer
⑤ ex-proof LVDT transducer
⑥ ex-proof electronics housing
⑦ on-board digital driver
⑧ ex-proof cable glands (to be ordered separately)
⑨ USB port always present (factory plugged)

DPZA-LES

Ex-proof digital servoproportional directional valves, piloted with two LVDT position transducers (pilot valve and main stage) and zero spool overlap for position closed loop controls.

They are equipped with ex-proof on-board digital driver, LVDT transducer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducers, prevents the propagation of accidental internal sparks or fire to the external environment. The driver and solenoid are also designed to limit the surface temperature within the classified limits.

LEZ execution includes valve driver plus axis card to perform position control (see section 6).

Size: **10** ÷ **27** -ISO4401

Max flow: **180** ÷ **800 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPZA	-	LES	-	SN	-	NP	-	2	70	-	L	5	/	M	/	*	*	/	*

DPZA — Ex-proof proportional directional valve, piloted

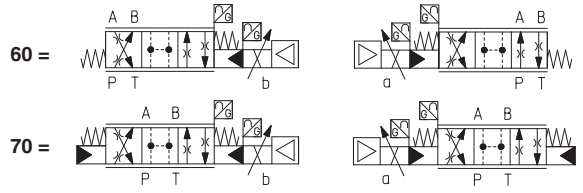
LES = on-board driver and two LVDT transducers

Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27

Configuration: **Standard** Option **/B**



Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (1):
B = solenoid at side of port A **(2)**
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting (standard for size 10)

Electronic options (1):
C = current feedback for pressure transducer 4÷20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Cable entrance threaded connection:
M = M20x1,5

Spool size	**3** (L)	**5** (L,DL)	**5** (T)
DPZA-1 =	-	100	-
DPZA-2 =	130	200	150
DPZA-4 =	-	340	-
DPZA-4M =	-	390	-

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:

L =  linear

T =  non linear **(3)**

DL =  differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) For possible combined options, see section 16
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side A of main stage (side B of pilot valve)
(3) only for configuration 70

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

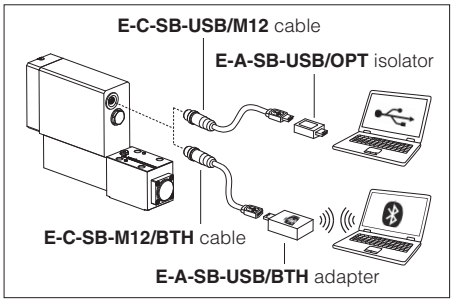
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

5 ALTERNATED P/Q CONTROLS - see tech. table **FX500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

6 AXIS CONTROLLER - see tech. table **FX630**

Digital servoproportional with integral electronics **LEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. Alternated pressure or force closed loop control can be set by software additionally to the position control.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZA-*-1	DPZA-*-2			DPZA-*-4	DPZA-*-4M
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;					
Spool type		**L5, DL5**	**L3**	**L5, DL5**	**T5**	**L5, DL5**	
Nominal flow [l/min]							
Δp P-T	Δp = 10 bar	100	130	200	150	340	390
	Δp = 30 bar	160	220	350	260	590	670
	Max permissible flow	180	320	440	360	680	800
Δp max P-T	[bar]	50	60	60	60	60	60
Piloting pressure	[bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)					
Piloting volume	[cm³]	1,4	3,7			9,0	11,3
Piloting flow **(1)**	[l/min]	1,7	3,7			6,8	8
Leakage	Pilot [cm³/min]	100/300	150/450			200/600	200/600
(2)	Main stage [l/min]	0,4/1,2	0,6/2,5			1,0/4,0	1,0/4,0
Response time **(1)**	[ms]	≤ 30	≤ 30			≤ 35	≤ 40
Hysteresis		≤ 0,1 [% of max regulation]					
Repeatability		± 0,1 [% of max regulation]					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) 0 ÷100 % step signal and pilot pressure 100 bar
(2) at P = 100/350 bar

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; spool position control (SN) or pressure/force control (SP, SF, SL) P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type	DPZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-LES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-31 EN 60079-1	IEC 60079-0 IEC 60079-31 IEC 60079-1	
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com

(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port B of the main stage.

D and **E** = Pilot and drain configuration can be modified as shown in section 21 .
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:

Option /D Internal drain.

Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:

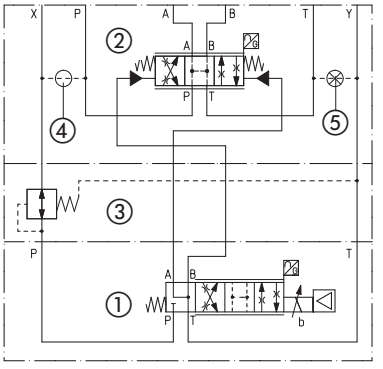
DPZA-2 = 28 bar

DPZA-1, -4 and -4M = 40 bar

It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

Pressure reducing valve is standard for DPZA-1, for other sizes add **/G** option.

FUNCTIONAL SCHEME - example of configuration 70



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only for **SP, SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

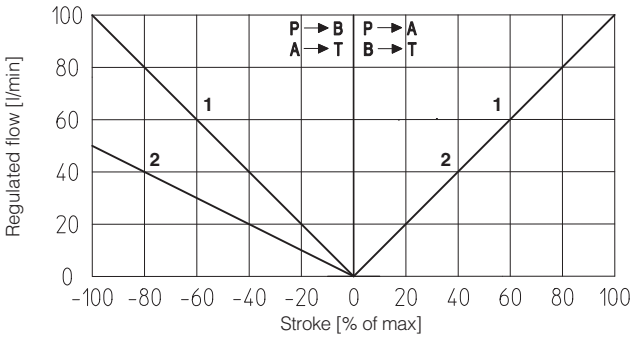
16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

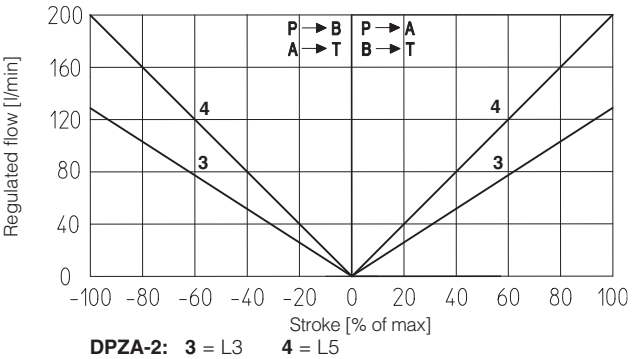
Electronics options: /CI (only for **SP, SF, SL**)

17 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

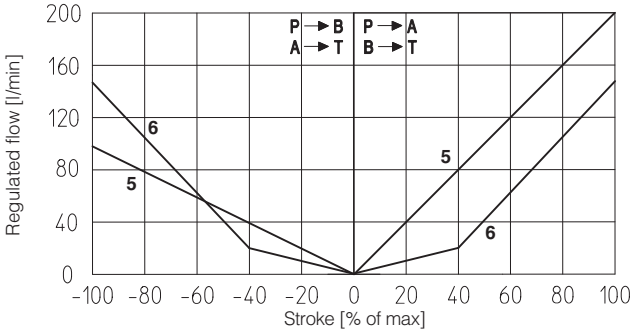
17.1 Regulation diagrams (values measure at Δp 10 bar P-T)



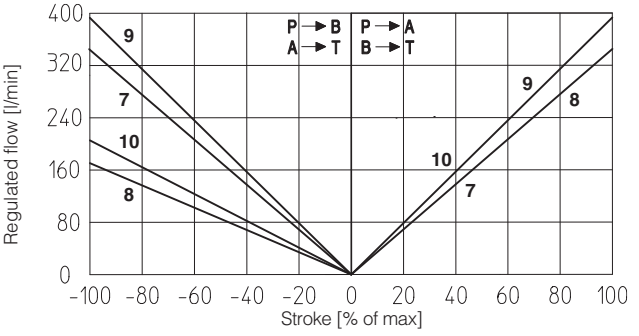
DPZA-1: **1** = L5 **2** = DL5



DPZA-2: **3** = L3 **4** = L5



DPZA-2: **5** = DL5 **6** = T5



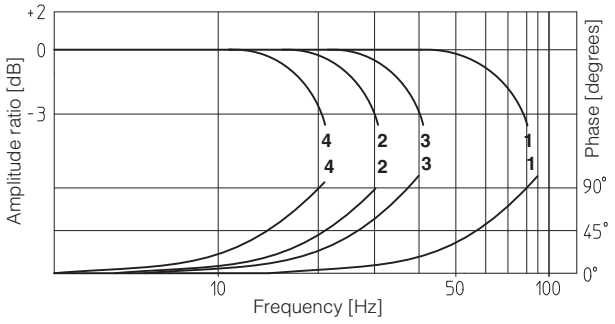
DPZA-4: **7** = L5 **8** = DL5 **DPZA-4M:** **9** = L5 **10** = DL5

Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option /B)

Reference signal $\begin{matrix}0 \div +10\ V\\ 12 \div 20\ mA\end{matrix}\}$ P → A / B → T Reference signal $\begin{matrix}0 \div -10\ V\\ 4 \div 12\ mA\end{matrix}\}$ P → B / A → T

17.2 Bode diagrams

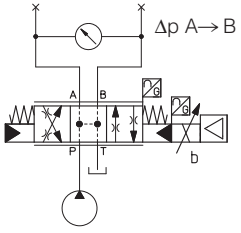
Stated at nominal hydraulic conditions.

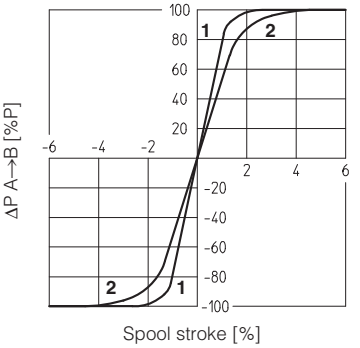


1 = DPZA-1, DPZA-2 } ± 5% **2** = DPZA-1, DPZA-2 } ± 100%

3 = DPZA-4, DPZA-4M } ± 5% **4** = DPZA-4, DPZA-4M } ± 100%

17.3 Pressure gain



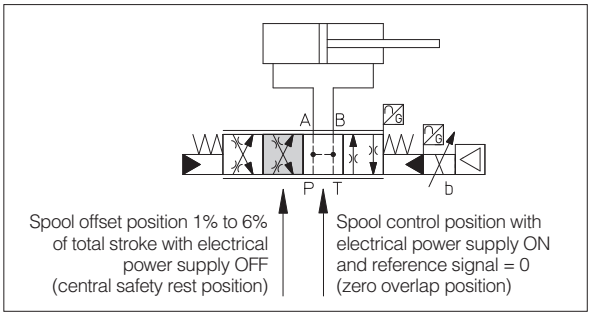


1 = DPZA-1

2 = DPZA-2
DPZA-4
DPZA-4M

17.4 Safety rest position - configuration 70

In absence of electric power supply (+24 VDC), the valve main spool is moved by the springs force to the **central safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.
This is specifically designed to avoid that in case of accidental interruption of the electrical power supply to the valve, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **central safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.
The main spool moves to the closed loop control position (zero overlap) when the pilot pressure is activated, the valve is fed with power supply +24 VDC and reference input = 0V (or 12 mA for option /I) is applied to the driver.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.4 Pressure or force reference input signal (F_INPUT+) - only **SP, SF, SL**

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

18.6 Pressure or force monitor output signal (F_MONITOR) - only for **SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

18.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

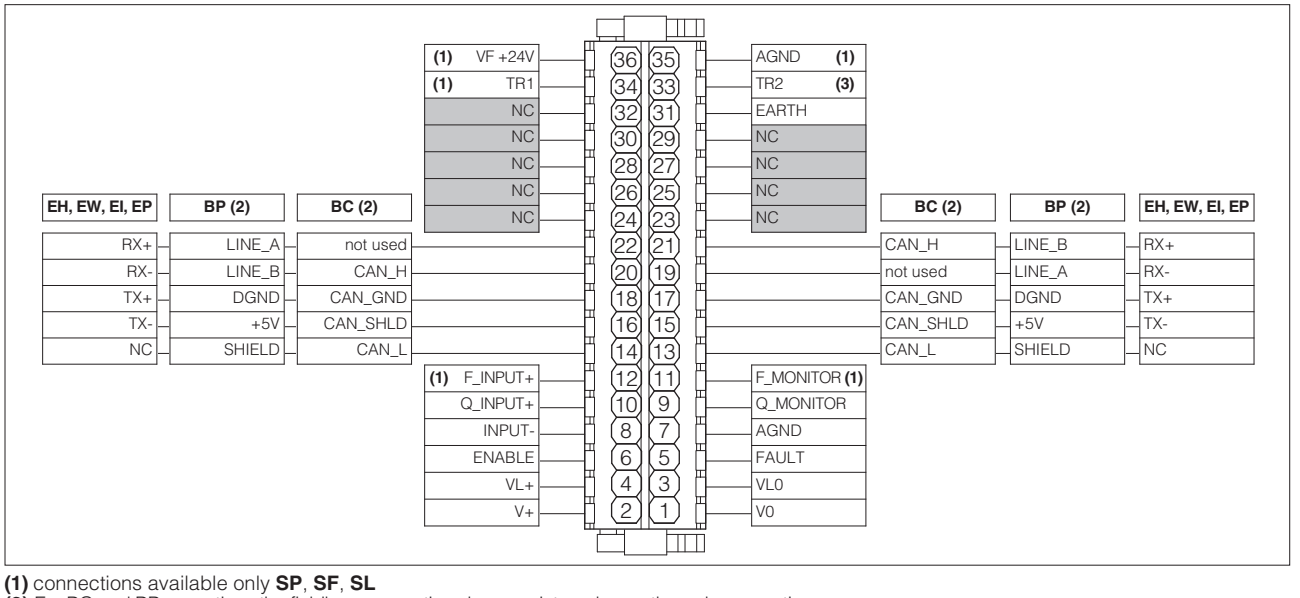
18.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

18.9 Remote pressure/force transducer input signal - only for **SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see table FX500).

19 TERMINAL BOARD OVERVIEW



(1) connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) connection available only **SF**

20 ELECTRONIC CONNECTIONS

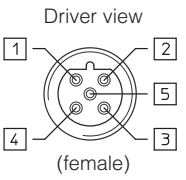
20.1 Main connections signals

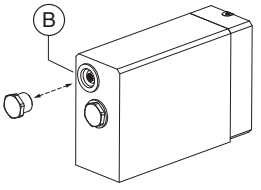
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

20.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





20.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

20.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

20.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

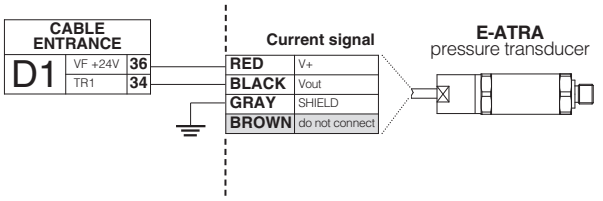
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

20.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SP, SL - Single transducer (1)		SF - Double transducers (1)	
					Voltage	Current	Voltage	Current
D1 D2	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

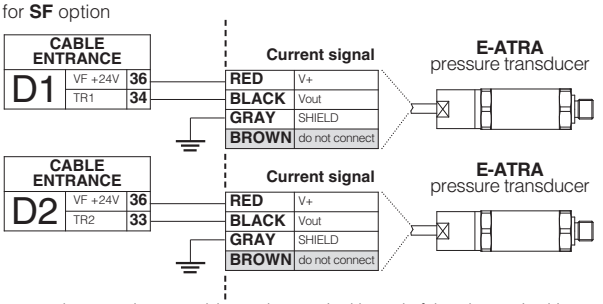
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



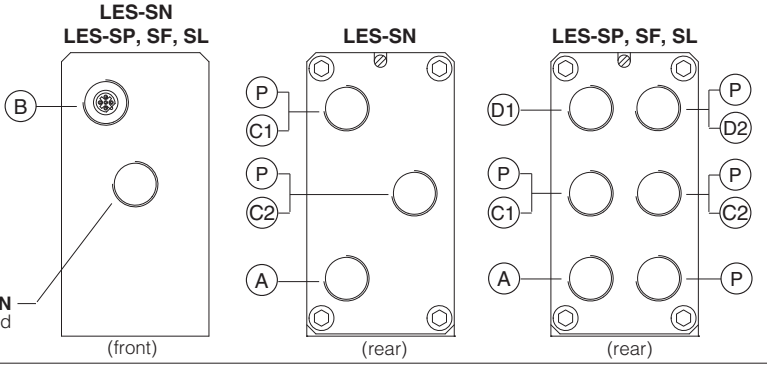
Connect the transducers cables to the terminal board of the electronic driver

21 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

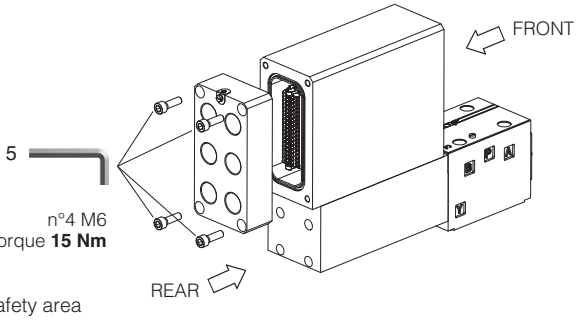
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



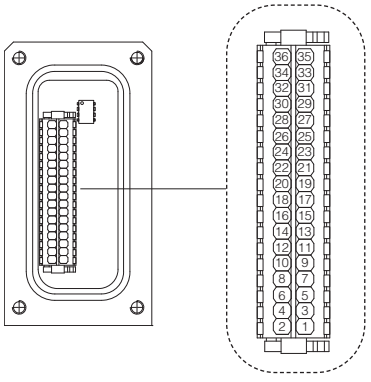
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

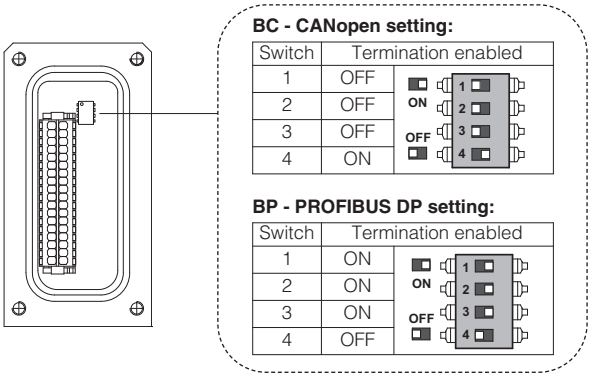


⚠ **WARNING:** the above operation must be performed in a safety area

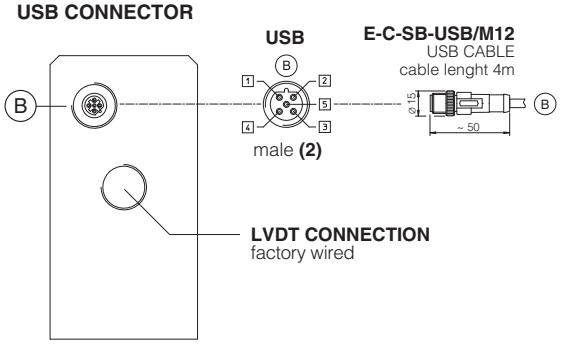
Terminal board - see section 19



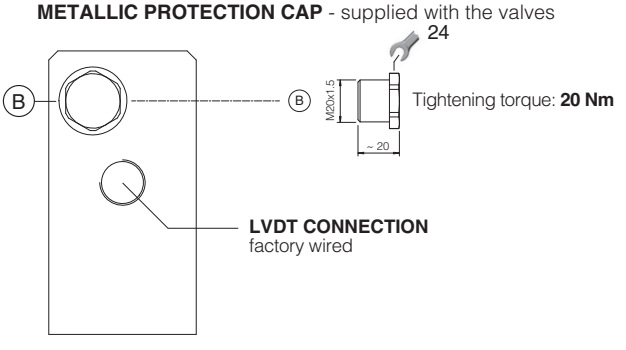
Fieldbus terminator only for BC and BP executions **(1)**



USB CONNECTOR

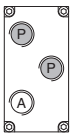
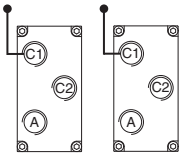
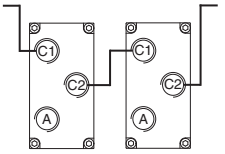


METALLIC PROTECTION CAP - supplied with the valves

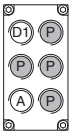
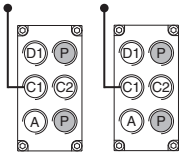
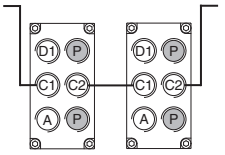


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

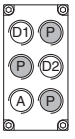
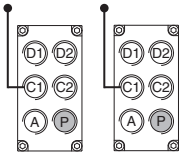
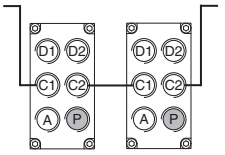
21.1 Cable glands and threaded plug for LES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

21.2 Cable glands and threaded plug for LES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

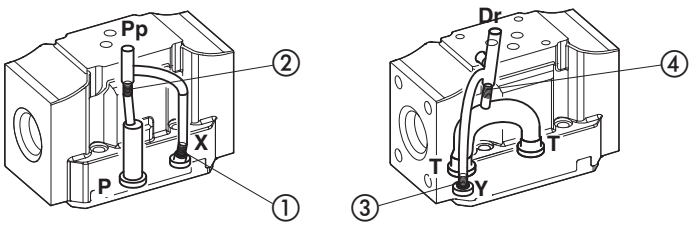
21.3 Cable glands and threaded plug for LES-SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

22 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

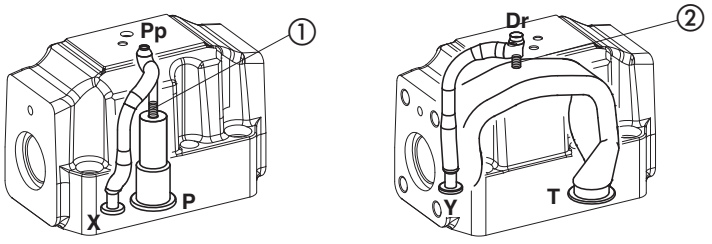
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZA-1 **Pilot channels** **Drain channels**



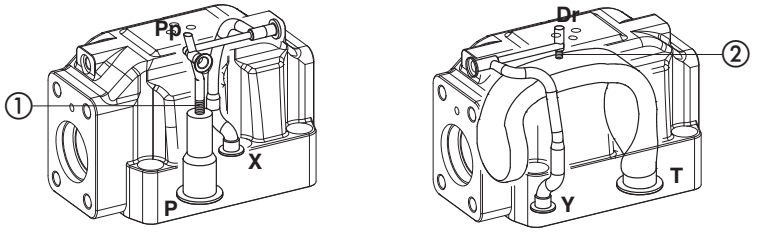
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 **Pilot channels** **Drain channels**



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4 **Pilot channels** **Drain channels**



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

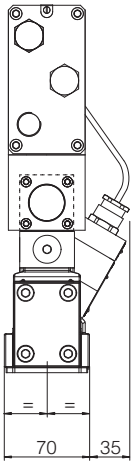
23 FASTENING BOLTS AND SEALS

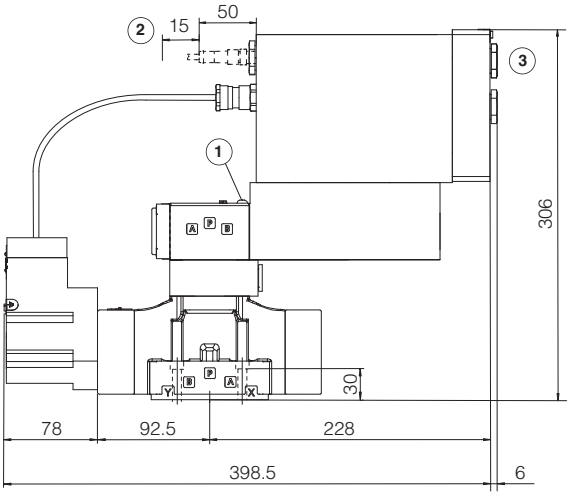
Type	Size	Fastening bolts	Seals
DPZA	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

DPZA-LES-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)

Mass [kg]	
DPZA-*-17*	13,7
Option /G	+0,9

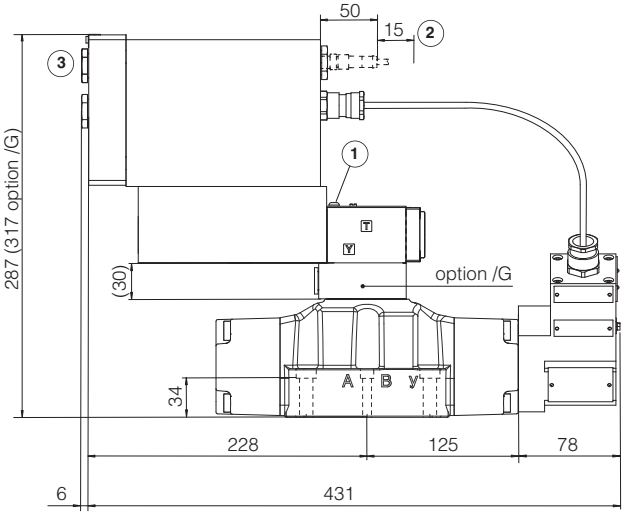


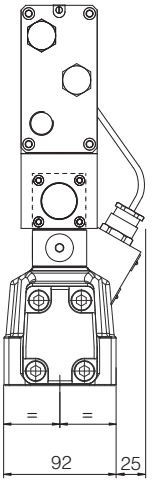


DPZA-LES-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
(see table P005)

Mass [kg]	
DPZA-*-27*	17,9
Option /G	+0,9





(1) = Air bleed off

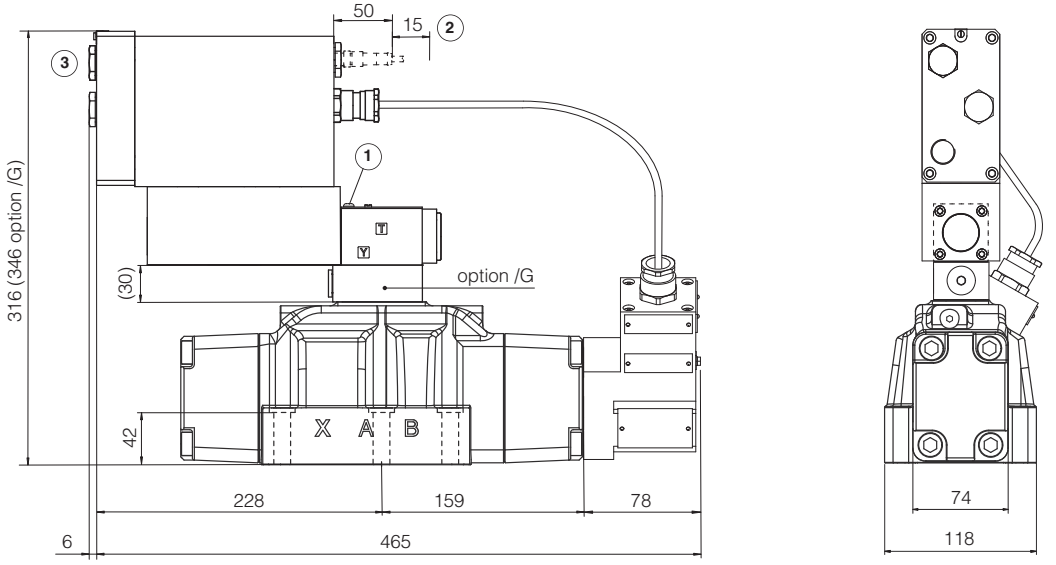
(2) = Space to remove the USB connector

(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

DPZA-LES-*-4
DPZA-LES-*-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
(see table P005)

Mass [kg]	
DPZA-*-4*	23,1
DPZA-*-4M*	23,1
Option /G	+0,9



(1) = Air bleed off

(2) = Space to remove the USB connector

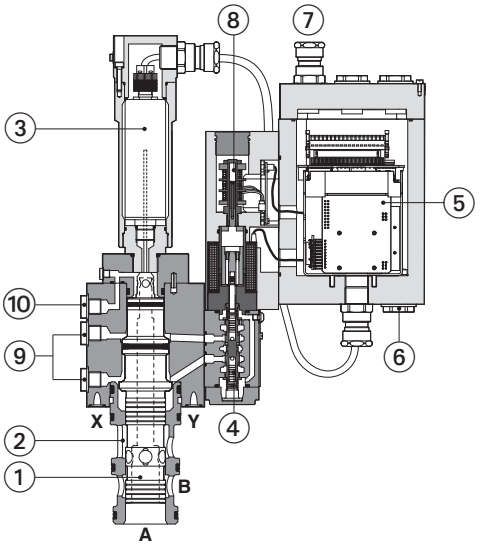
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

25 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX500	Ex-proof digital proportionals with P/Q control	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX630	Ex-proof servoproportionals with on-board axis card	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportional 3-way cartridges

piloted, with on-board driver and two LVDT transducers - **ATEX and IECEx**



LIQZA-LES-SN-NP-323*

① spool
② sleeve
③ ex-proof LVDT position transducer (main stage)
④ proportional ex-proof pilot valve
⑤ ex-proof on-board digital driver
⑥ USB connector
⑦ ex-proof cable gland (to be ordered separately)
⑧ ex-proof solenoid with LVDT position transducer
⑨ air bleeding
⑩ plugged port - do not open

LIQZA-LES

Ex-proof digital servoproportional 3-way cartridges, with two LVDT position transducers (pilot valve and main stage) for best accuracy in directional controls and in not compensated flow regulations.

They are equipped with ex-proof on-board digital driver, LVDT transducers and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.
The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **25** ÷ **80** - not ISO cavity

Max flow: **500** ÷ **5000 l/min**

Max pressure: **420 bar**

1 **MODEL CODE**

LIQZA	- LES	- SN	- NP	- 32	3	L4	/ M	/ *	*	/ *

LIQZA — Ex-proof proportional cartridge

LES = on-board driver and two LVDT transducers

Alternated P/Q controls:
SN = none
SP = pressure control (1 pressure tranducer)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size and nominal flow (l/min) at Δp 5 bar:
25 = 185
32 = 330
40 = 420
50 = 780
63 = 1250
80 = 2100

Spool type ,regulating characteristics:
L4 = linear

Cable entrance threaded connection:
M = M20X1,5

Hydraulic options (1):
A = reversal hydraulic configuration of main spool: P-A in rest position

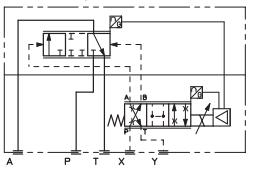
Electronic options (1):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) only for **SP, SL**
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Series number

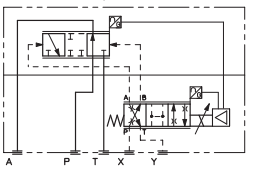
Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

Configuration: **3** = 3 way

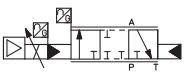
functional symbol: **Standard**



option **/A**



simplified symbol: **Standard**



option **/A**

(1) For possible combined options, see section 15

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

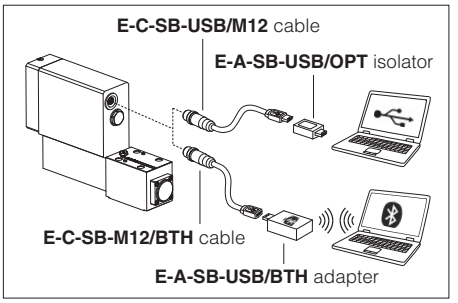
WARNING: the below operation must be performed in a safety area

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

USB or Bluetooth connection



WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: Bluetooth adapter is available only for European, USA and Canadian markets!
Bluetooth adapter is certified according RED (Europe), FCC (USA) and ISED (Canada) directives

4 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - see tech. table **FX500**

S* options add the closed loop control of pressure (**SP**) or force (**SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

		25	**32**	**40**	**50**	**63**	**80**
Max regulated flow	[l/min]						
Δp P-A or A-T at Δp = 5 bar		185	330	420	780	1250	2100
Δp P-A or A-T at Δp = 10 bar		260	470	590	1100	1750	3000
Max permissible flow		500	850	1050	2000	3100	5000
Max pressure [bar]		Ports P, A, T = **420** X = 350 Y ≤ 10					
Nominal flow of pilot valve at Δp = 70 bar	[l/min]	4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar	[l/min]	0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure	[bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160					
Piloting volume	[cm³]	2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow **(1)**	[l/min]	6,5	20	25	43	68	76
Response time **(2)**	[ms]	≤ 25	≤ 27	≤ 27	≤ 30	≤ 35	≤ 40
Hysteresis	[% of the max regulation]	≤ 0,1					
Repeatability	[% of the max regulation]	± 0,1					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) 0÷100% step signal **(2)** With pilot pressure = 140 bar

WARNING

The loss of the pilot pressure causes the undefined position of the main spool.
The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A).
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/force transducer power supply (only for SP, SL)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; spool position control (SN) or pressure/force control (SP, SL) by P.I.D. with rapid solenoid switching;protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Components type	Pilot valve solenoid and LVDT transducer			LVDT main stage transducer
Certifications	Multicertification **ATEX IECEx**			
Components Certified code	**OZA-LES**			**ETHA-15**
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X • IECEx: IECEx TPS 19.0004X			• ATEX: TUV IT 16 ATEX 053 X • IECEx: IECEx TPS 16.0003X
Method of protection	• ATEX Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**	**T6**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C	≤ 85 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			factory wired

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver solenoid and LVDT transducers are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

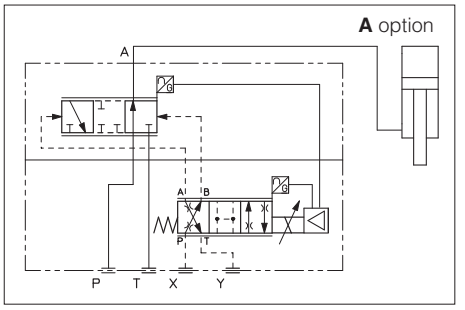
12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS

A = The standard valve version provides the hydraulic configuration A-T of main spool in absence of electric power supply to the valve.
The option /A provides the reverse configuration P-A of main spool in absence of electric power supply to the valve.
This execution is particularly requested in vertical presses for safety reasons, because in case of electric power breakdown the P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.



14 ELECTRONICS OPTIONS

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only for **SP**, **SL**
This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

For SN: /AI
For SP, SL: /AC, AI, /CI, /ACI

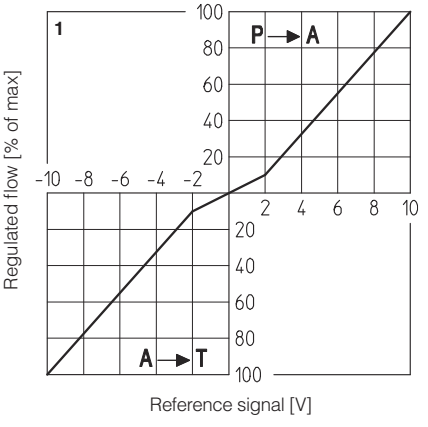
16 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

16.1 Regulation diagrams, see note

1 = LIQZA (all sizes)

Hydraulic configuration vs. reference signal:

		standard	option /A
Reference signal	0 ÷+10 V 12÷20 mA	P → A	A → T
Reference signal	0 ÷-10 V 4÷12 mA	A → T	P → A



17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only **SP, SL**

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for **SP, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

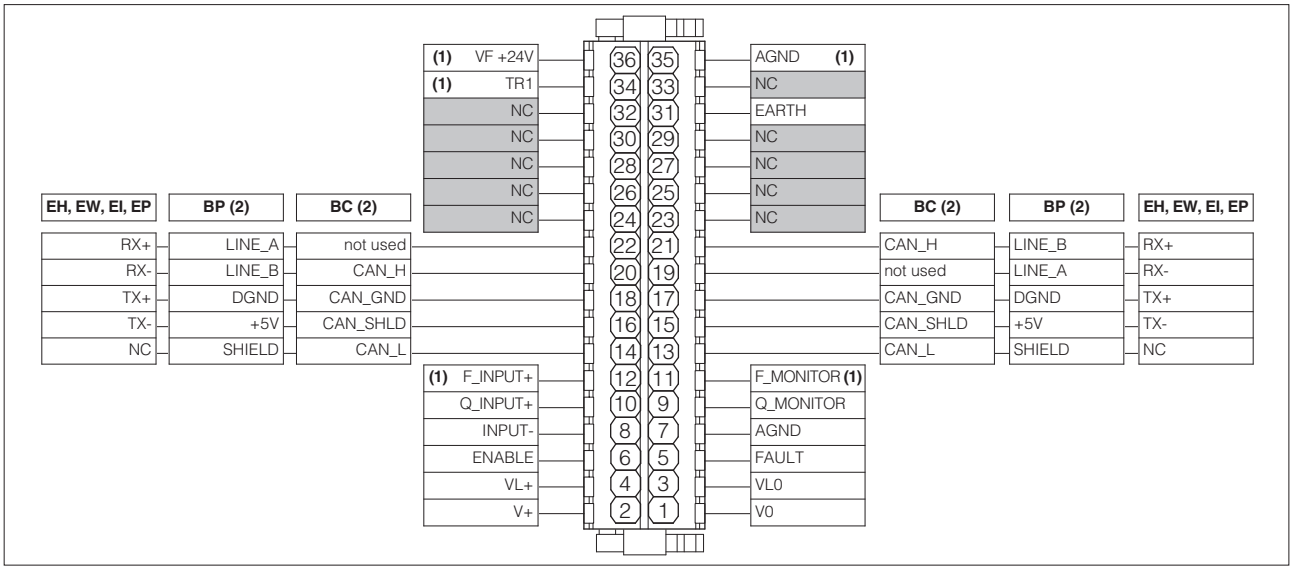
17.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.9 Remote pressure/force transducer input signal - only for **SP, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see table FX500).

18 TERMINAL BOARD OVERVIEW



(1) Connections available only **SP**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

19 ELECTRONIC CONNECTIONS

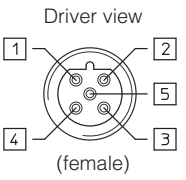
19.1 Main connections signals

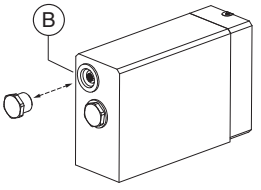
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SL**

19.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





19.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

19.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

19.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

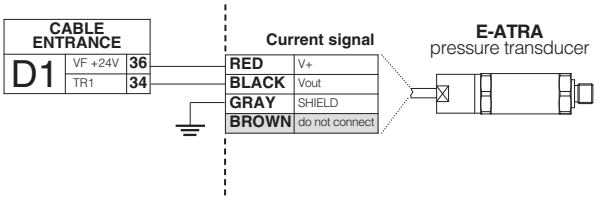
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19.6 Remote pressure transducer connector - only for **SP**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SP, SL - Single transducer (1)		SF - Double transducers (1)	
					Voltage	Current	Voltage	Current
D1	34	**TR1**	1st ignal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



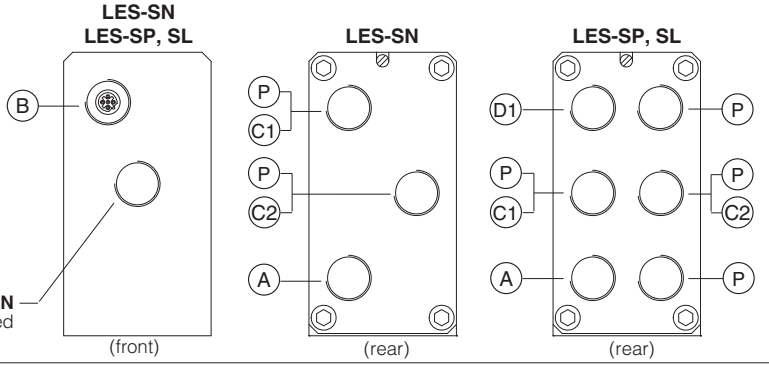
Connect the transducer cable to the terminal board of the electronic driver

20 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

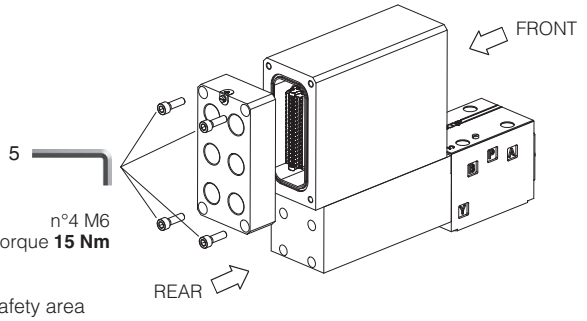
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer
- (P) threaded plug



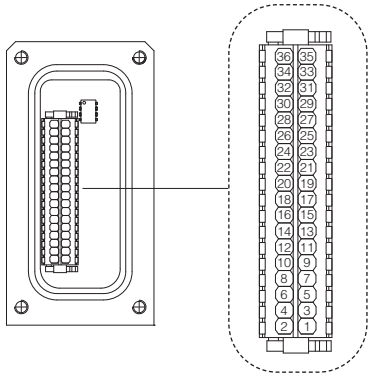
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

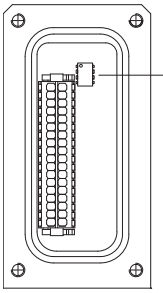


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 18



Fieldbus terminator only for BC and BP executions **(1)**



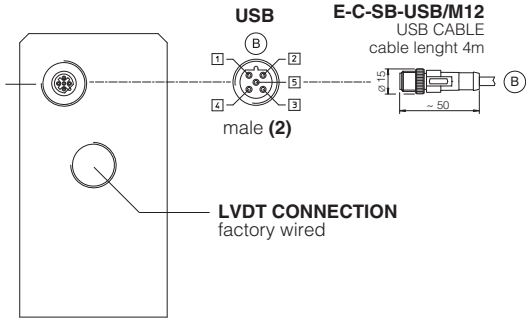
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

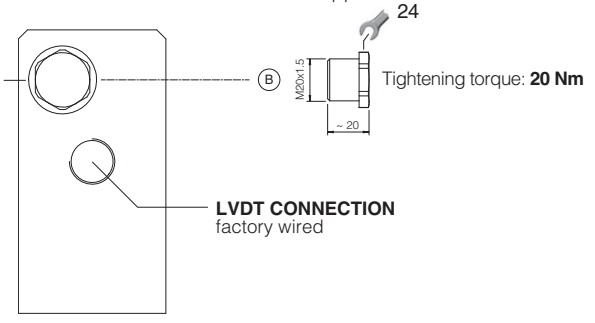
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

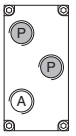
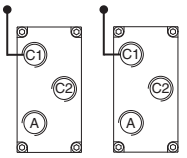
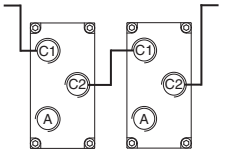


METALLIC PROTECTION CAP - supplied with the valves

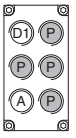
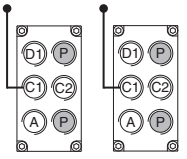
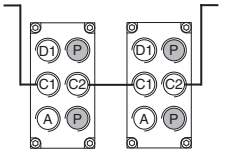


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

20.1 Cable glands and threaded plug for LES-SN - see tech table **KX800**

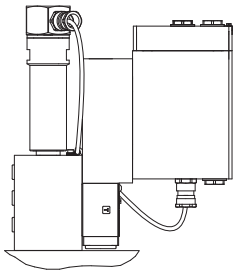
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

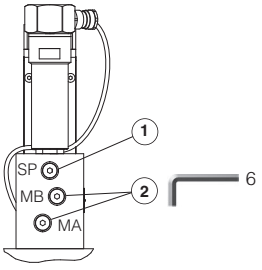
20.2 Cable glands and threaded plug for LES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

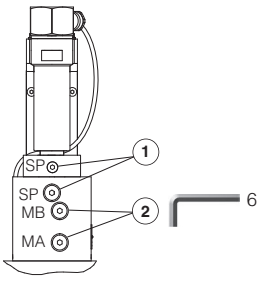
21 AIR BLEEDING

Size 25

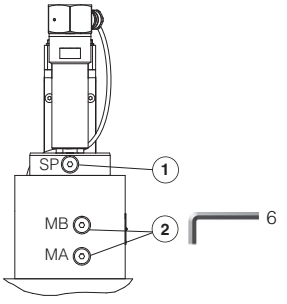




Sizes 32, 40



Sizes 50 to 80



(1) **Plugged port - do not open**

(2) **Air bleeding (MA, MB):**

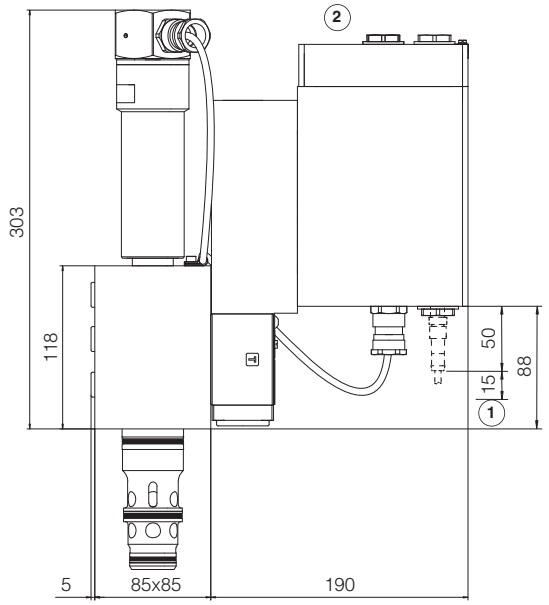
N° 2 plugs G1/4"

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

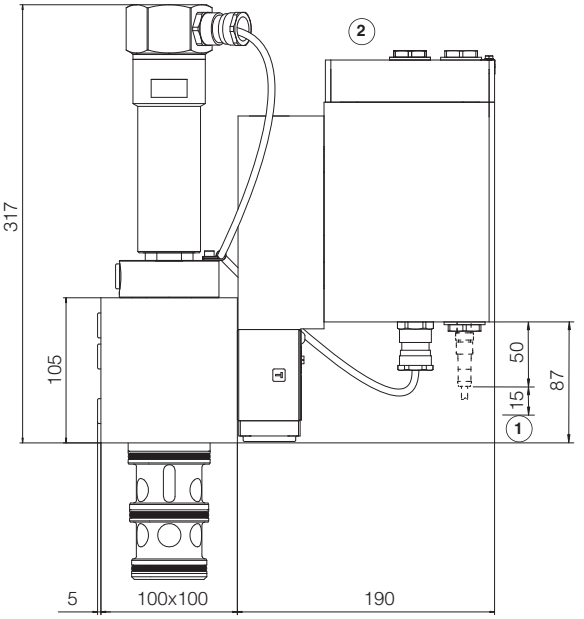
Operate the valve for few seconds at low pressure and then lock the plugs.

22 INSTALLATION DIMENSIONS [mm]

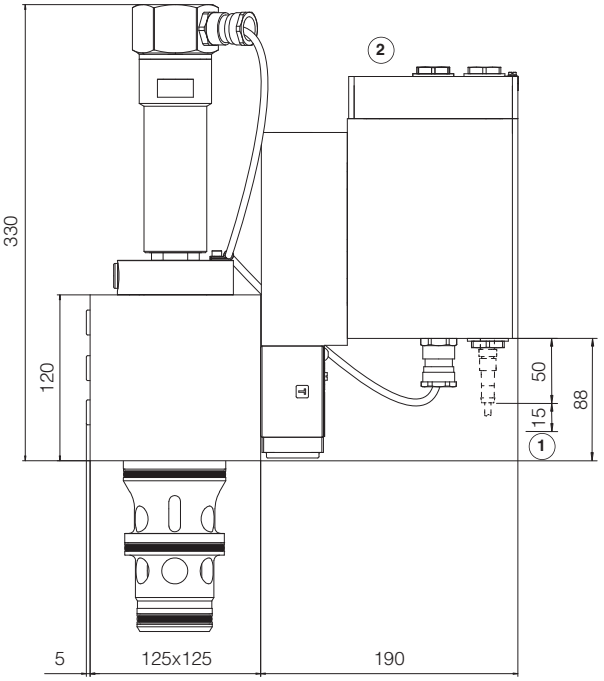
LIQZA-LES-253



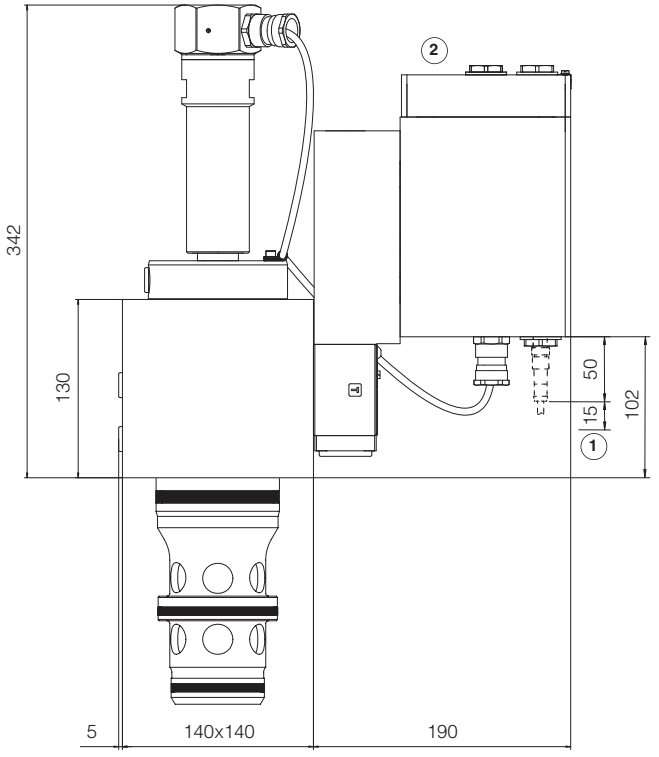
LIQZA-LES-323



LIQZA-LES-403



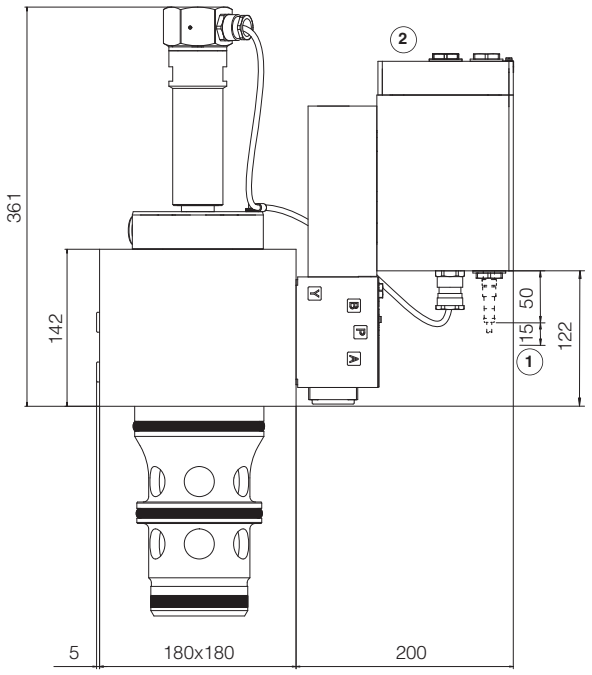
LIQZA-LES-503



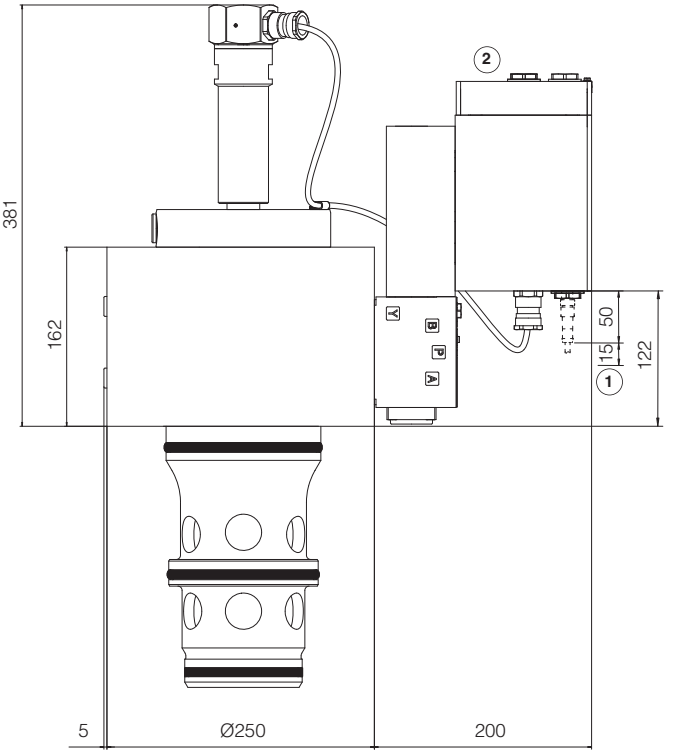
(1) = Space to remove the USB connector

(2) = The dimensions of all cable glands must be considered (see tech. table KX800)

LIQZA-LES-633



LIQZA-LES-803



(1) = Space to remove the USB connector

(2) = The dimensions of cable glands must be considered (see tech table **KX800**)

23 FASTENING BOLTS AND VALVE MASS

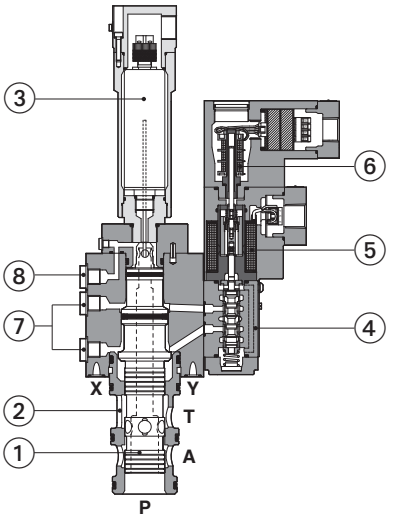
Type	Size	**Fastening bolts (1)** supplied with the valve	Mass [kg]
LIQZA	**25**	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	15,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	18,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	23,7
	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	31,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	51,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	79,2

24 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX500	Ex-proof digital proportionals with P/Q control
FX900	Operating and manintenance information for ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
GX800	Ex-proof pressure transducer type E-ATRA-7
KX800	Cable glands for ex-proof valves
P006	Mounting surfaces and cavities for cartridge valves

Ex-proof servoproportional 3-way cartridges

piloted, with two LVDT transducers - **ATEX and IECEx**



① poppet
② sleeve
③ ex-proof LVDT position transducer (main stage)
④ proportional ex-proof pilot valve
⑤ ex-proof solenoid
⑥ ex-proof LVDT position transducer (pilot valve)
⑦ air bleeding
⑧ plugged port - do not open

LIQZA-L-SN-NP-323*

LIQZA-L

Ex-proof digital servoproportional 3-way cartridges, with two LVDT position transducers (pilot valve and main stage) for best accuracy in not compensated flow regulations.

They are equipped with ex-proof proportional solenoid and LVDT transducers certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)

The flameproof enclosure of solenoid and transducers prevent the propagation of accidental internal sparks or fire to the external environment.
They are also designed to limit the surface temperature within the classified limits.

Size: **25** ÷ **80** - not ISO cavity

Max flow: **500** ÷ **5000 l/min**

Max pressure: **420 bar**

1 MODEL CODE

LIQZA	/	*	-	L	-	25	3	L4	/	M	/	*	*	/	*

LIQZA: Ex-proof proportional cartridge

Certification:
Multicertification ATEX, IECEx:
- = omit for Group II 2G
M = Group I (mining)

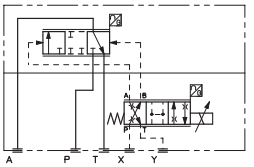
L = with two LVDT transducers

Valve size and nominal flow (l/min) at Δp 5 bar:
25 = 185
32 = 330
40 = 420
50 = 780
63 = 1250
80 = 2100

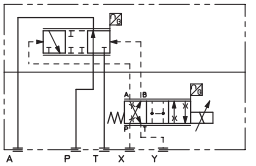
3

Configuration: 3 = 3 way

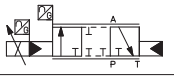
functional symbol: **Standard**



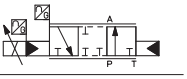
option **/A**



simplified symbol: **Standard**



option **/A**



L4

Poppet type, regulating characteristics:

L4 = linear

M

Solenoid and transducer (main stage and pilot valve) **threaded connection** for cable gland fitting:
GK = GK-1/2" **(1)**
M = M20x1,5
NPT = 1/2" NPT

*****

Options:
A = reversal hydraulic configuration of main spool: P-A in rest position

*****

Series number

*****

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Approved only for the italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-LEB-* /A	E-BM-LES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	GS230	GS240

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size		**25**	**32**	**40**	**50**	**63**	**80**
Max regulated flow	[l/min]						
Δp P-A or A-T	at Δp = 5 bar	185	330	420	780	1250	2100
	at Δp = 10 bar	260	470	590	1100	1750	3000
Max permissible flow		500	850	1050	2000	3100	5000
Max pressure [bar]		Ports P, A, T = **420** X = 350 Y ≤ 10					
Nominal flow of pilot valve at Δp = 70 bar	[l/min]	4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar	[l/min]	0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure	[bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160					
Piloting volume	[cm³]	2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow **(1)**	[l/min]	6,5	20	25	43	68	76
Response time **(2)**	[ms]	≤ 25	≤ 27	≤ 27	≤ 30	≤ 35	≤ 40
Hysteresis	[% of the max regulation]	≤ 0,1					
Repeatability	[% of the max regulation]	± 0,1					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) 0÷100% step signal **(2)** With pilot pressure = 140 bar

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree	IP66/67 to DIN EN60529 with relevant cable glandraintight enclosure, UL approved
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

⚠ **WARNING**

The loss of the pilot pressure causes the undefined position of the main poppet.
The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet.
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

7 CERTIFICATION DATA

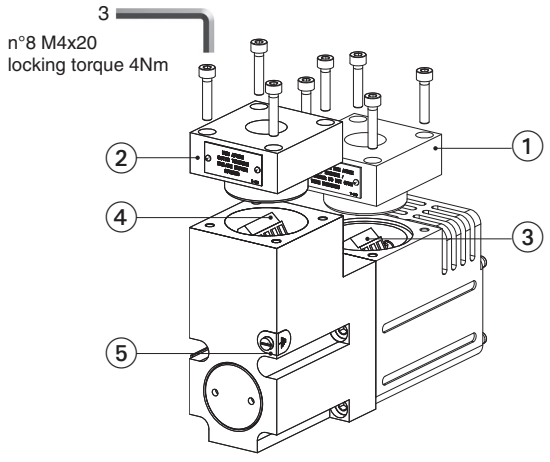
Valve type	LIQZA		LIQZA**/M**	LIQZA, LIQZA**/M**
Component type	Pilot solenoid and LVDT transducer			LVDT main stage transducer
Certifications	Multicertification Group II **ATEX IECEx**		Multicertification Group I **ATEX IECEx**	Multicertification Group I and II **ATEX IECEx**
Solenoid certified code	**OZA-T**		**OZAM-T**	**ETHA-15**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	ATEX: TUV IT 16 ATEX 053X ICEX: IECEX TPS 16.0003X
Method of protection	• ATEX Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T85°C/T200°C Db		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• ATEX Ex II 2G Ex db IIC T6 Gb Ex II 2D Ex tb IIIC T85°C Db Ex I M2 Ex db IMb • IECEx Ex db IIC T6 Gb Ex tb IIIC T85°C Db Ex db IMb
Temperature class	**T4**	**T3**	**-**	**T6**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 85 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +70 °C **(3)**
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code
(3) For Group I (mining) the temperaturerange is -20°C ÷ +70°C

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX PROOF SOLENOIDS AND LVDT TRANSDUCER WIRING

Pilot valve solenoid and LVDT transducer



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

Solenoid wiring

1 = Coil
2 = GND
3 = Coil

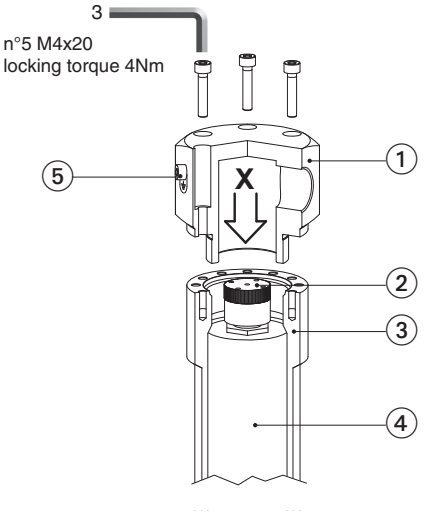
PCB 3 poles terminal board
suitable for wires cross sections
up to 2,5 mm² (max AWG14)

Position transdducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

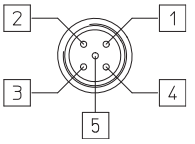
PCB 4 poles terminal board
suitable for wires cross sections
up to 2,5 mm² (max AWG14)

LVDT main stage transducer



① transducer cover with threaded connection for cable gland fitting
② transducer terminal board for cables wiring
③ ex-proof protection for LVDT transducer
④ LVDT transducer
⑤ screw terminal for additional equipotential grounding

Transducer wiring - view from **X**



1 = Do not connect
2 = Supply +15 V
3 = GND
4 = Output signal
5 = Supply -15 V

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	-	90 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

10 CABLE GLANDS

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

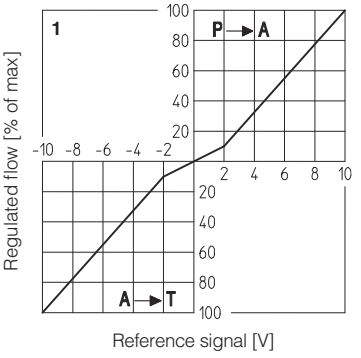
11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

11.1 Regulation diagrams, see note

1 = LIQZA (all sizes)

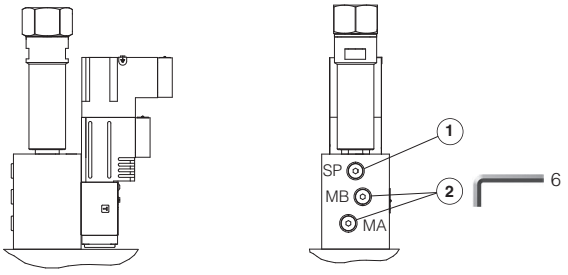
Hydraulic configuration vs. reference signal:

		standard	option /A
Reference signal	0 ÷+10 V 12÷20 mA	P → A	A → T
Reference signal	0 ÷-10 V 4÷12 mA	A → T	P → A

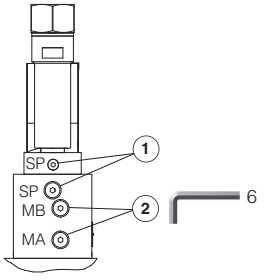


12 AIR BLEEDING

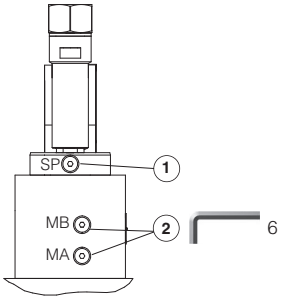
Size 25



Sizes 32, 40



Sizes 50 to 80



(1) **Plugged port - do not open**

(2) **Air bleeding (MA, MB):**

N° 2 plugs G1/4"

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

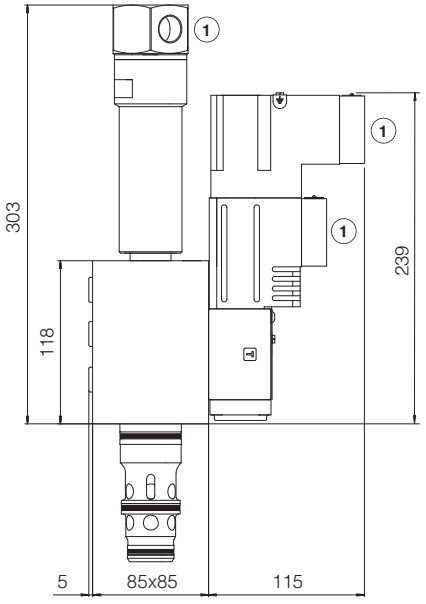
Operate the valve for few seconds at low pressure and then lock the plugs.

13 FASTENING BOLTS AND VALVE MASS

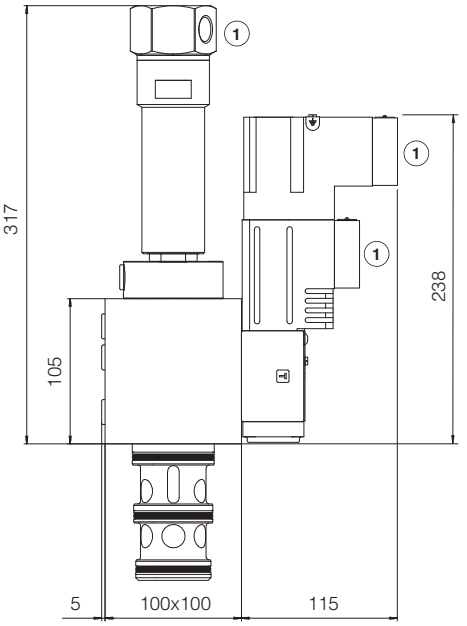
Type	Size	**Fastening bolts (1)** supplied with the valve	Mass [kg]
LIQZA	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	15,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	18,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	23,7
	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	31,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	51,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	79,2

14 INSTALLATION DIMENSIONS [mm]

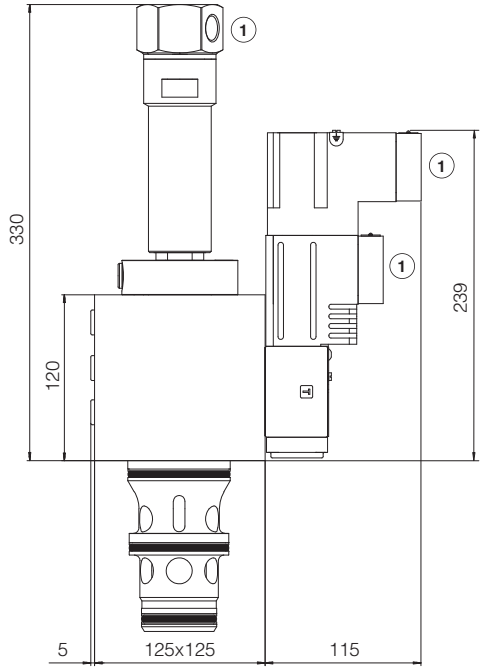
LIQZA-LES-253



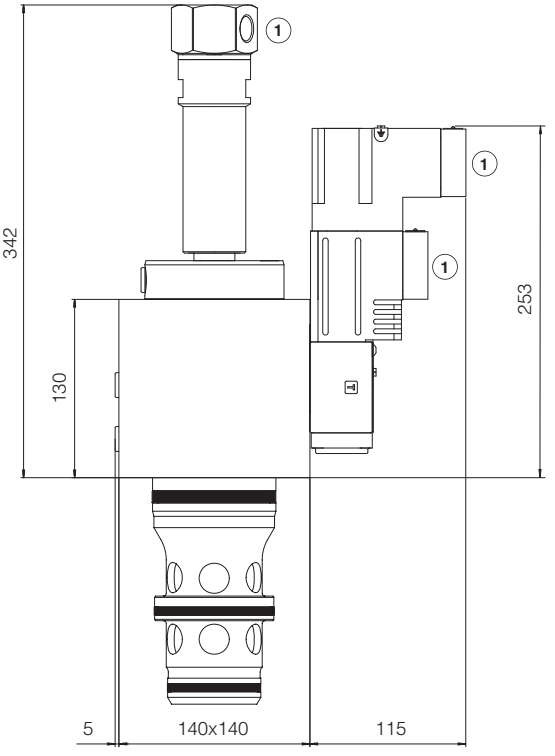
LIQZA-LES-323



LIQZA-LES-403



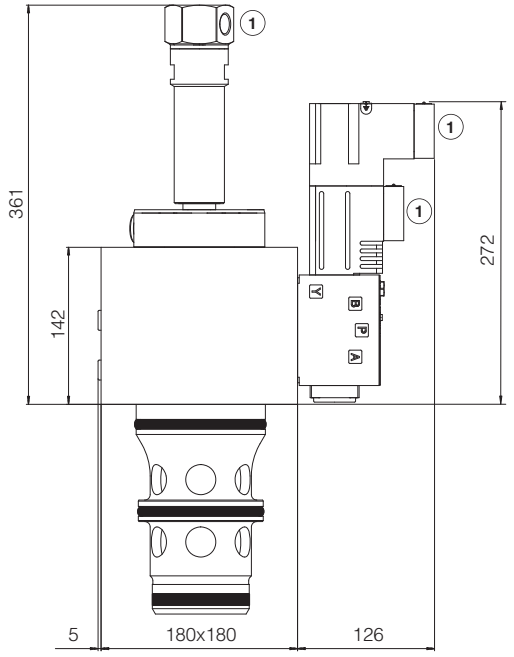
LIQZA-LES-503



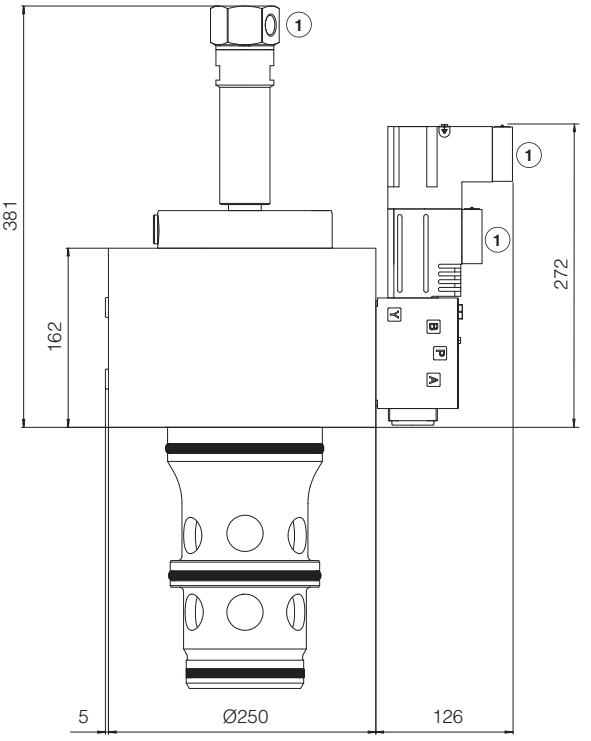
(1) = The dimensions of all cable glands must be considered (see tech. table **KX800**)

Note: for mounting surface and cavity dimensions, see table P006

LIQZA-LES-633



LIQZA-LES-803



(1) = The dimensions of all cable glands must be considered (see tech. table **KX800**)

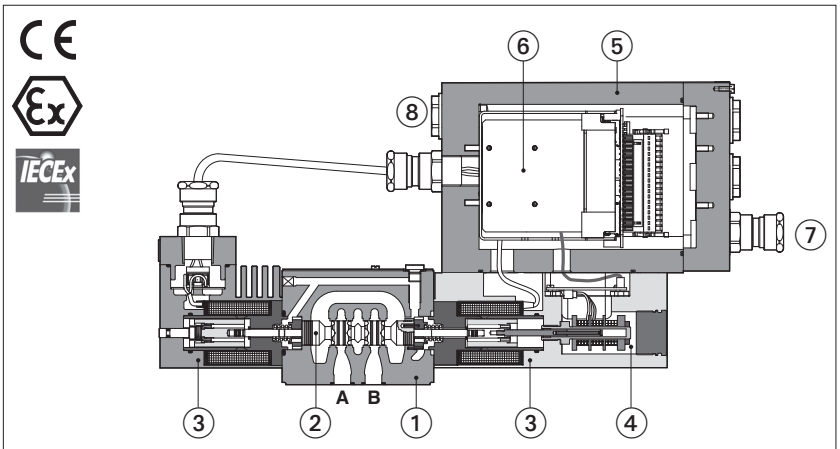
Note: for mounting surface and cavity dimensions, see table P006

15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**KX800**	Cable glands for ex-proof valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**P006**	Mounting surfaces and cavities for cartridge valves
FX900	Operating and manintenance information for ex-proof proportional valves		

Ex-proof digital proportional directional valves high performance

direct, with on-board driver, LVDT transducer and positive spool overlap - **ATEX and IECEx**



DKZA-TES-SN-NP-17*

① valve body
② spool
③ ex-proof solenoid
④ ex-proof LVDT transducer
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

DHZA-TES, DKZA-TES

Ex-proof digital high performances proportional valves, direct, with LVDT position transducer and positive spool everlap for best dynamics in directional controls and not compensated flow regulations.

They are equipped with ex-proof on-board digital driver, with LVDT transducer and proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

DHZA:
Size: **06** - ISO 4401
Max flow: **60 l/min**
Max pressure: **350 bar**

DKZA:
Size: **10** - ISO 4401
Max flow: **150 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DHZA	-	TES	-	SN	-	NP	-	0	71	-	L	5	/	M	/	*	*	/	*

DHZA
Ex-proof proportional directional valves, direct
DHZA = size 06
DKZA = size 10

TES = on-board driver and LVDT transducer

Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401: **0** = 06 **1** = 10

Configuration: **Standard** Option **/B**

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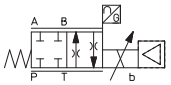
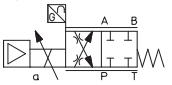

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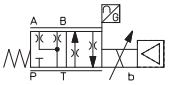
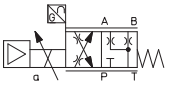

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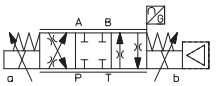
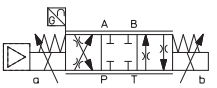

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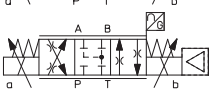
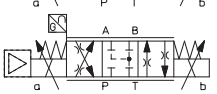

(1)

(1)

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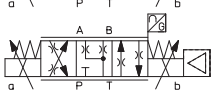
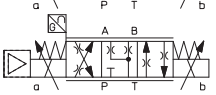



Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (2):
B = solenoid with integral digital electronics at side of port A **(3)**
Y = external drain

Electronic options (2):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Cable entrance threaded connection:
M = M20x1,5

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D,Q)
DHZA =	1	4,5	8	18	28
DKZA =	-	-	-	45	75

Nominal flow (l/min) at Δp 10 bar P-T

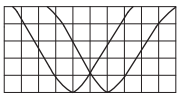
Spool type, regulating characteristics:

L = linear


S = progressive


D = differential-progressive

P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Q = for P/Q controls


(1) Only for **DKZA-*-S5** the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas **(2)** For possible combined options, see section 15
(3) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

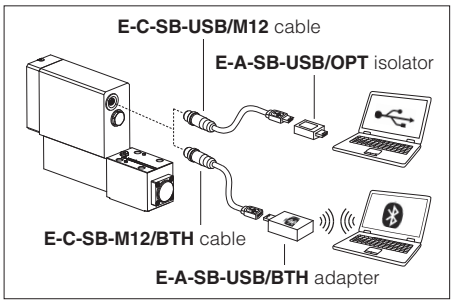
WARNING: the below operation must be performed in a safety area

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

USB or Bluetooth connection



WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

5 ALTERNATED P/Q CONTROLS - see tech. table **FX500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DHZA					DKZA		
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10					ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10		
Configuration		**51, 53, 71, 73**					**51, 53, 71, 73**		**72**
Spool Type		**L14**	**L1**	**S2**	**L3, S3, D3**	**L5, S5, D5, Q5**	**L3, S3, D3**	**L5, S5, D5, Q5**	**S5**
Nominal flow									
[l/min]	at Δp= 10 bar	1	4,5	8	18	28	45	75	75
Δp P-T	at Δp= 30 bar	1,7	8	14	30	50	80	130	130
	max permissible flow	2,6	12	21	40	60	90	150	150
Δp max P-T [bar]		70	70	70	50	50	40	40	40
Leakage [cm³/min]		<30 (at p = 100 bar); <135 (at p = 350 bar)					<80 (at p = 100 bar); <600 (at p = 315 bar)		
Response time **(1)** [ms]		≤ 20					≤ 25		
Hysteresis		≤ 0,2 [% of max regulation]							
Repeatibility		± 0,1 [% of max regulation]							
Thermal drift		zero point displacement < 1% at ΔT = 40°C							

(1) (0-100% step signal)

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type		DHZA, DKZA				
Certifications		Multicertification Group II **ATEX IECEx**				
Solenoid certified code		**OZA-AES**				
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X		
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db		
Temperature class	Single solenoid valve	**T6**	**-**	**T5**	**T4**	**-**
	Double solenoid valve	**-**	**T4**	**-**	**-**	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards		EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31	
Cable entrance: threaded connection		**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com - catalog on line, **technical information** section
(2) The solenoids **Group II** are certified for minimum ambient temperature -40°C

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only for **SP, SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

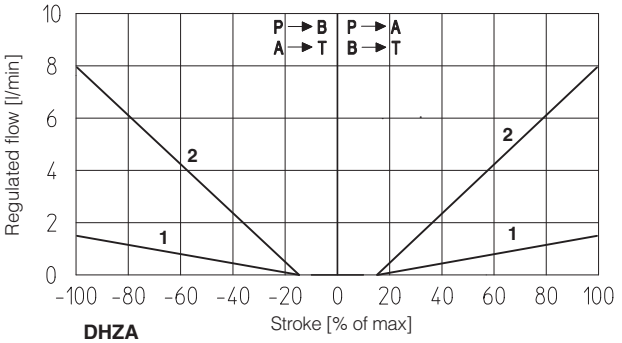
15 POSSIBLE COMBINED OPTIONS

For SN: /BI, /BY, /IY

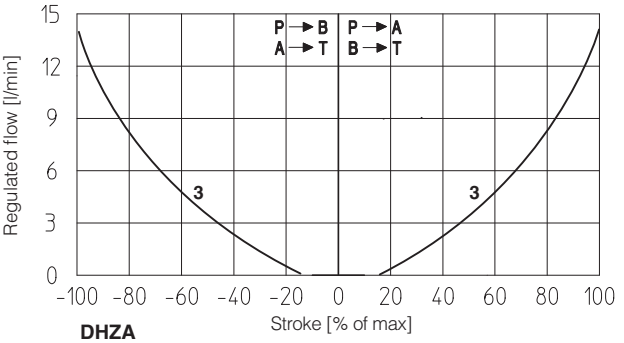
For SP, SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

16 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

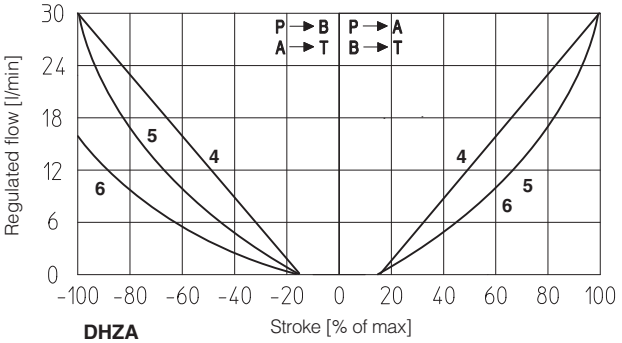
16.1 Regulation diagrams - values measure at Δp 30 bar P-T



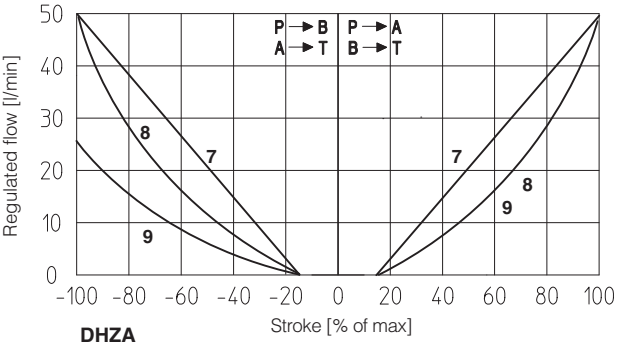
DHZA
1 = L14 **2** = L1



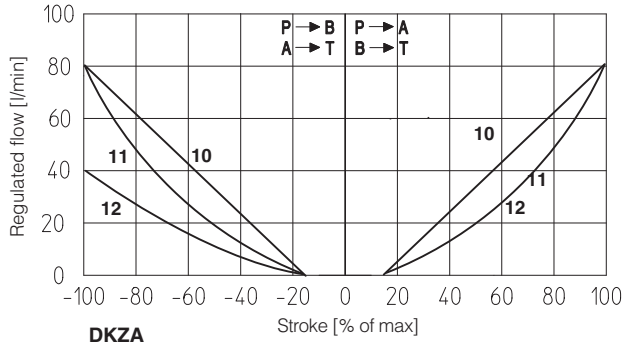
DHZA
3 = S2



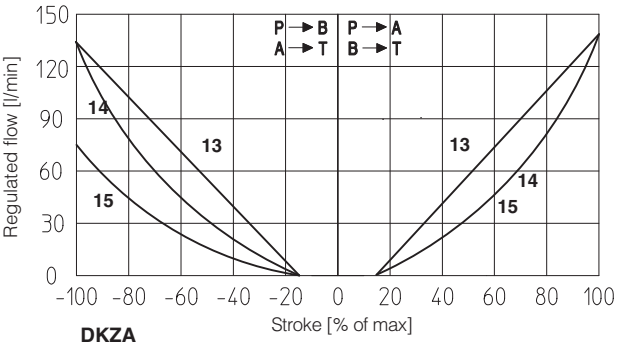
DHZA
4 = L3 **5** = S3 **6** = D3



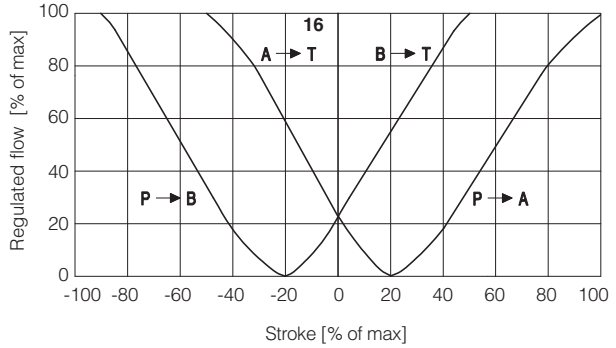
DHZA
7 = L5 **8** = S5 **9** = D5



DKZA
10 = L3 **11** = S3 **12** = D3



DKZA
13 = L5 **14** = S5 **15** = D5



16 = **Q5**

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FX500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.

Note:
Hydraulic configuration vs. reference signal for configurations 71 and 73 (standard and option /B)

Reference signal $\begin{matrix}0 \div +10\ V\\ 12 \div 20\ mA\end{matrix}\Big\}$ P → A / B → T Reference signal $\begin{matrix}0 \div -10\ V\\ 12 \div 4\ mA\end{matrix}\Big\}$ P → B / A → T

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only **SP, SF, SL**

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for **SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

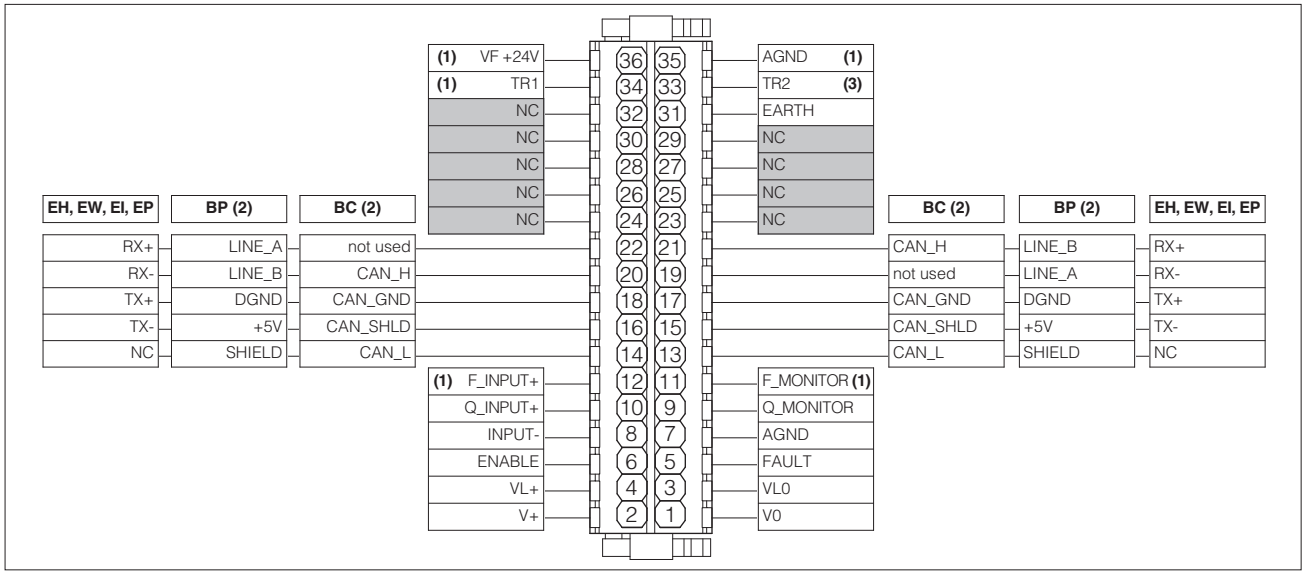
17.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.9 Remote pressure/force transducer input signal - only for **SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see table FX500).

18 TERMINAL BOARD OVERVIEW



(1) Connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) Connection available only **SF**

19 ELECTRONIC CONNECTIONS

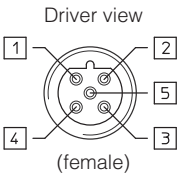
19.1 Main connections signals

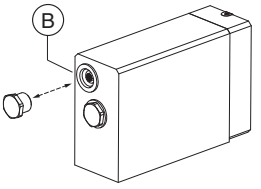
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

19.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





19.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

19.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

19.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

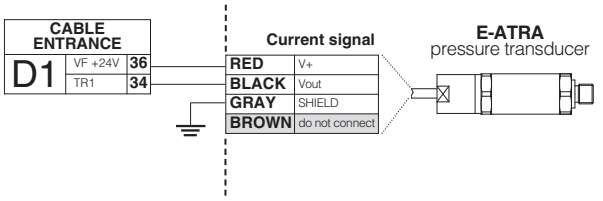
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SP, SL - Single transducer (1)		SF - Double transducers (1)	
					Voltage	Current	Voltage	Current
D1	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
D2	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

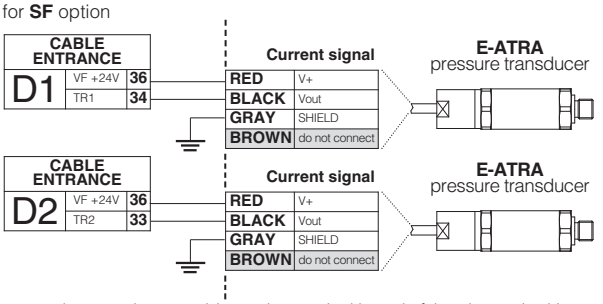
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



Connect the transducers cables to the terminal board of the electronic driver

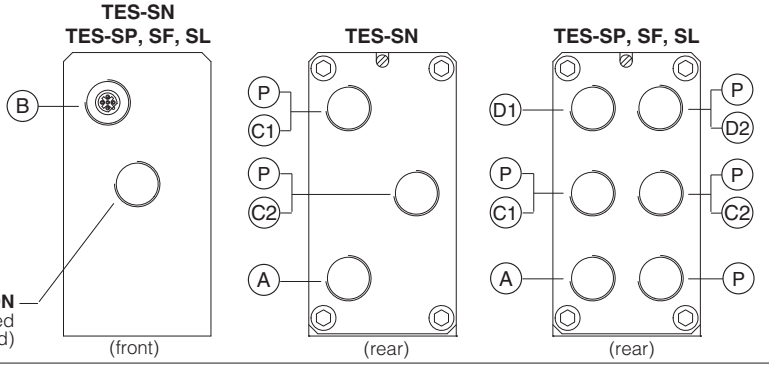
20 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

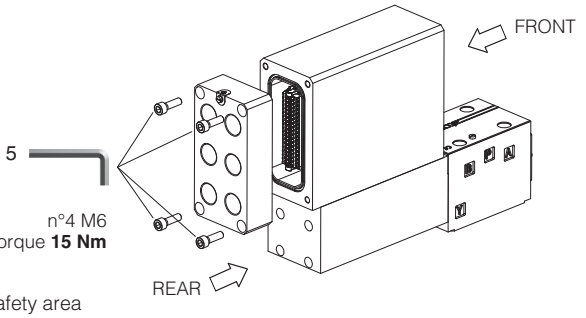
- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug

COIL CONNECTION
only for double solenoid version - factory wired
(for single solenoid version - factory plugged)



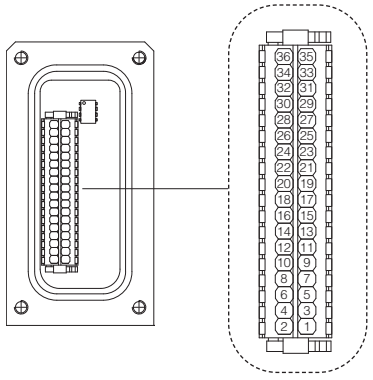
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

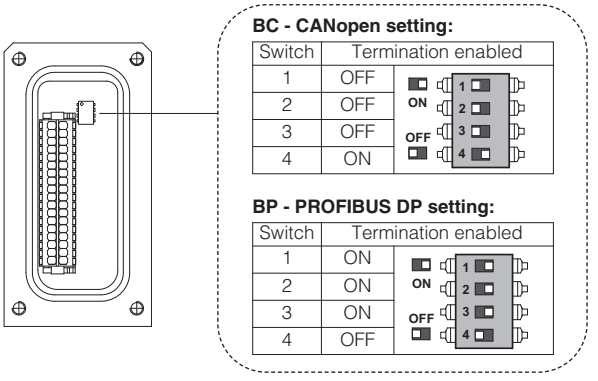


⚠ **WARNING:** the above operation must be performed in a safety area

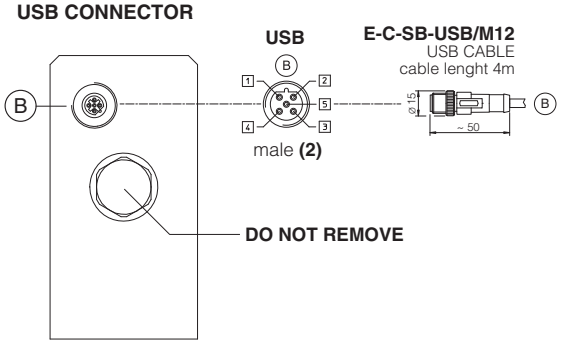
Terminal board - see section 18



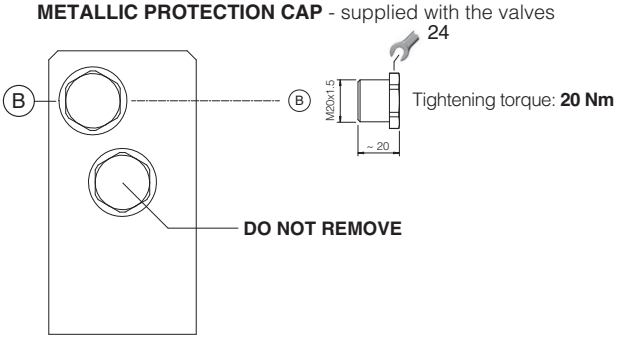
Fieldbus terminator only for BC and BP executions **(1)**



USB CONNECTOR

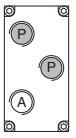
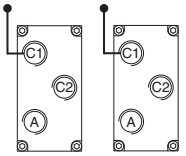
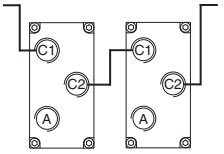


METALLIC PROTECTION CAP - supplied with the valves

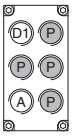
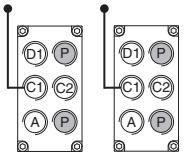
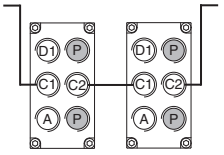


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

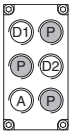
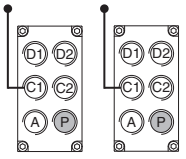
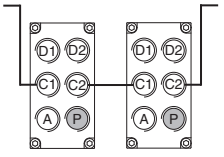
20.1 Cable glands and threaded plug for TES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

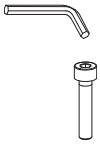
20.2 Cable glands and threaded plug for TES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

20.3 Cable glands and threaded plug for TES-SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

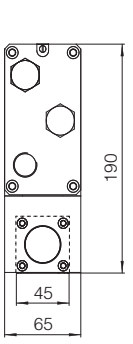
21 FASTENING BOLTS AND SEALS

	DHZA	DKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

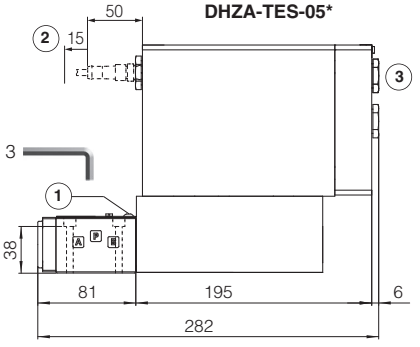
22 INSTALLATION DIMENSIONS FOR DHZA [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface: 4401-03-03-0-05 without port X)

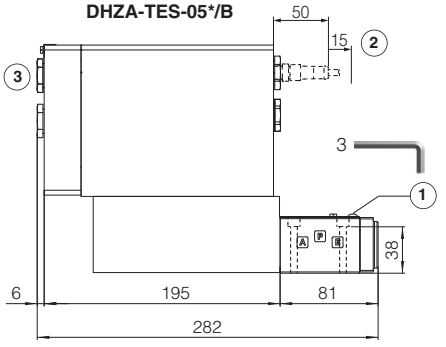
Mass [kg]	
DHZA-TES-05	7,2
DHZA-TES-07	8,9



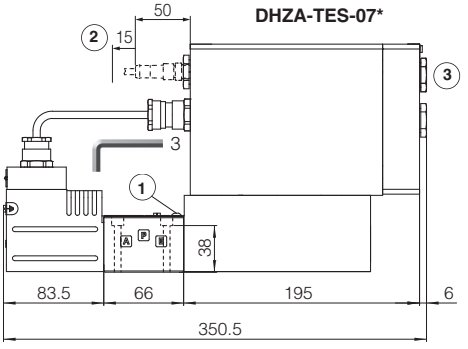
DHZA-TES-05*



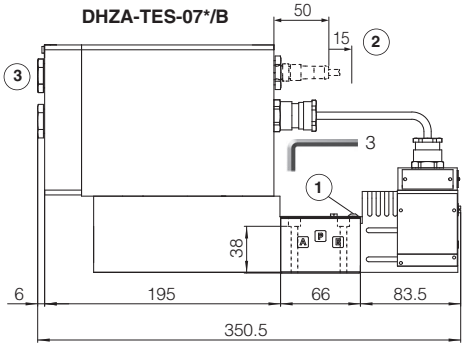
DHZA-TES-05*/B



DHZA-TES-07*



DHZA-TES-07*/B



(1) = Air bleed off

(2) = Space to remove the USB connector

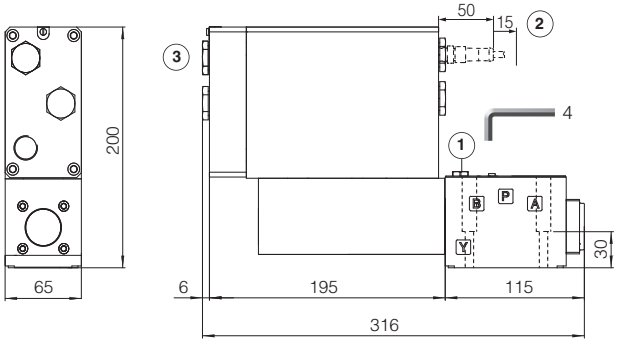
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

23 INSTALLATION DIMENSIONS FOR DKZA [mm]

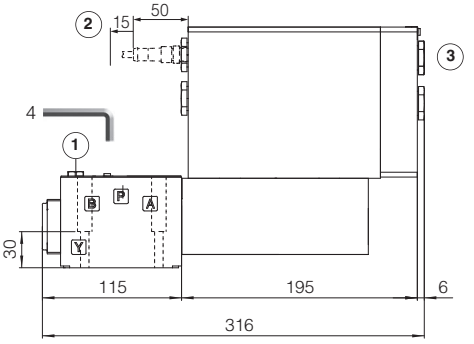
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface: 4401-05-05-0-05 without port X)

Mass [kg]	
DKZA-TES-15	9
DKZA-TES-17	10,7

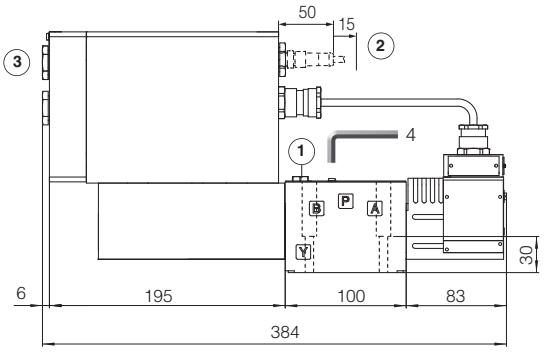
DKZA-TES-15*



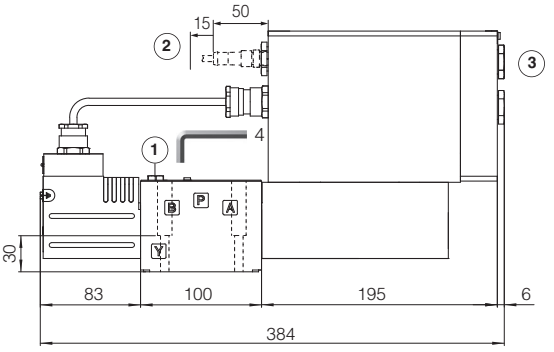
DKZA-TES-15*/B



DKZA-TES-17*



DKZA-TES-17*/B



(1) = Air bleed off

(2) = Space to remove the USB connector

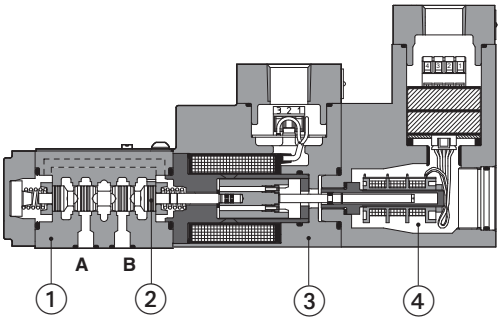
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

24 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX900	Operating and manintenance norms for ex-proof proportional valves	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX500	Ex-proof for digital proportionals with P/Q control	**KX800**	Cable glands for ex-proof valves
		P005	Mounting surfaces for electrohydraulic valves

Ex-proof proportional directional valves **high performance**

direct, with LVDT transducer and positive spool overlap - **ATEX, IECEx, EAC, PESO** or **cULus**



DHZA-T-05*

① valve body
② spool
③ ex-proof solenoid
④ ex-proof LVDT transducer

DHZA-T, DKZA-T

Ex-proof high performance proportional valves direct, with LVDT position transducer and positive spool overlap, for best dynamics in directional controls and not compensated flow regulations.
They are equipped with ex-proof proportional solenoids and LVDT transducer certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoids are also designed to limit the surface temperature within the classified limits.

DHZA:
Size: **06** - ISO 4401
Max flow: **60 l/min**
Max pressure: **350 bar**

DKZA:
Size: **10** - ISO 4401
Max flow: **150 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DHZA	/	*	-	T	-	0	71	-	L	5	/	M	/	*	/	*	*	/	*

DHZA / ***** - **T** - **0** | **71** - **L** | **5** / **M** / ***** / ***** | ***** / | *****

DHZA / ***** - **T** - **0**

Ex-proof proportional directional valves, direct
DHZA = size 06
DKZA = size 10

Certification type:
Multicertification ATEX, IECEx, EAC,PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group I (mining)
North American Certification:
UL = cULus

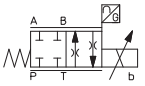
T = with LVDT transducer

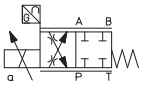
Valve size ISO 4401:
0 = 06 **1** = 10

71 - **L** | **5** / **M** / ***** / ***** | ***** / | *****

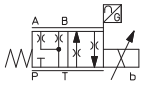
Configuration: **Standard** Option **/B**

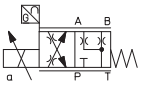
51 =



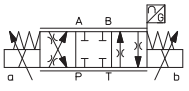


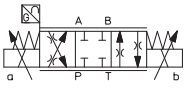
53 =



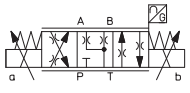


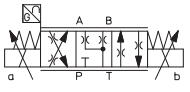
71 =





73 =





5 / **M** / ***** / ***** | ***** / | *****

Spool size:

	14 (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZA =	1	4,5	8	18	28
DKZA =	-	-	-	45	75

Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics:

L = linear 

S = progressive 

D = differential-progressive 

P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

M / ***** / ***** | ***** / | *****

Options (3):
B = solenoid and position transducer at side of port A
C = position transducer with current feedback 4÷20 mA
Y = external drain

Solenoid and transducer threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

***** / | *****

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

***** / | *****

Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /BC, /BY, /CY, /BCY **(4)** Approved only for the Italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-TEB-* /A	E-BM-TES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	GS230	GS240

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DHZA					DKZA	
Pressure limits [bar]		ports P, A, B = 350; T = 210 (250 with external drain /Y) Y = 10					ports P, A, B = 315; T = 210 (250 with external drain /Y) Y = 10	
Configuration		**51, 53, 71, 73**					**51, 53, 71, 73**	
Spool type		**L14**	**L1**	**S2**	**L3, S3, D3**	**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**
Max flow [l/min]								
Δp P-T	Δp = 10 bar	1	4,5	8	18	28	45	75
	Δp = 30 bar	1,7	8	14	30	50	80	130
	max permissible flow	2,6	1	21	40	60	90	150
	Δp max P-T [bar]	70	70	70	50	50	40	40
Leakage [cm³/min]		<30 (at p = 100 bar); <135 (at p = 350 bar)					<80 (at p = 100 bar); <600 (at p = 315 bar)	
Response time **(1)** [ms]		≤ 20					≤ 25	
Hysteresis [% of max regulation]		≤ 0,2						
Repeatibility [% of max regulation]		± 0,1						
Thermal drift		zero point displacement < 1% at ΔT = 40°C						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

6 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

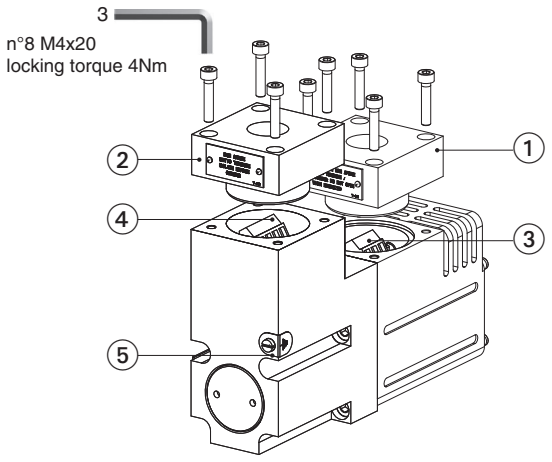
Valve type	DHZA DKZA		DHZA**/M** DKZA**/M**	DHZA**/UL** DKZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid cerified code	**OZA-T**		**OZAM-T**	**OZA-T/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135°C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30 CSA 22.2 n°139-13	
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX PROOF SOLENOIDS WIRING

Multicertification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

Solenoid wiring

1 = Coil
2 = GND
3 = Coil

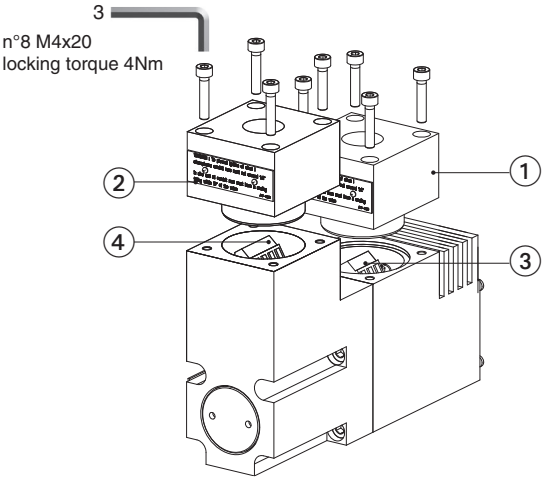
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

Position transducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

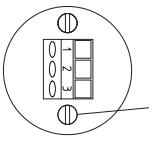
PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring

Solenoid wiring ⚠ **Pay attention to respect the polarity**

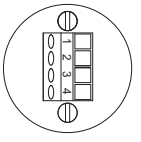


1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1

alternative GND screw terminal connected to solenoid housing

Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	-	90 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

10 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see section 12

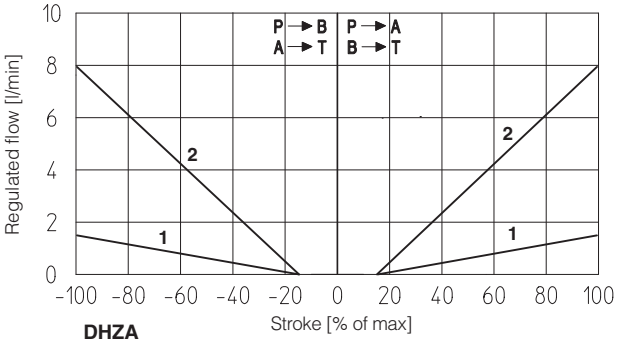
C = Position trasducer with current feedback 4÷20 mA, suggested in case of long distance between the electric driver and the proportional valve

Y = External drain, to be selected if the pressure at T port is higher than the max allowed limits

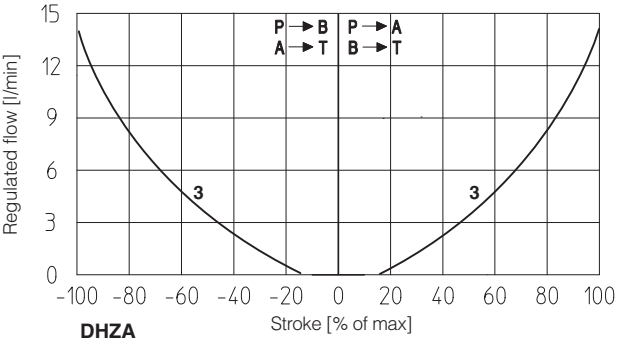
11.1 Possible combined options: /BC, /BY, /CY, /BCY

12 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

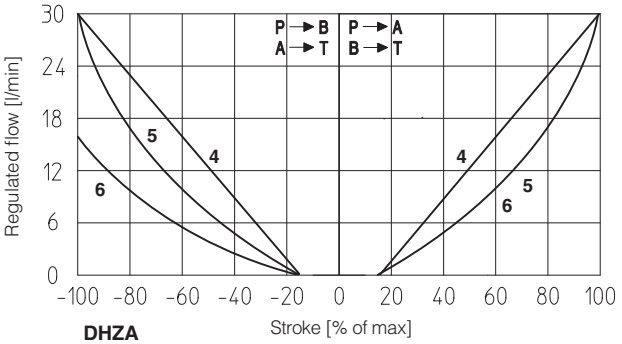
Regulation diagrams of valves with configrations 51, 53, 71, 73 (positive spool overlap) - values measure at Δp 30 bar P-T



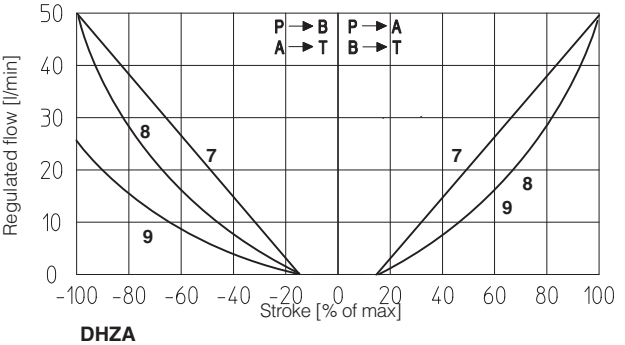
DHZA
1 = L14 **2** = L1



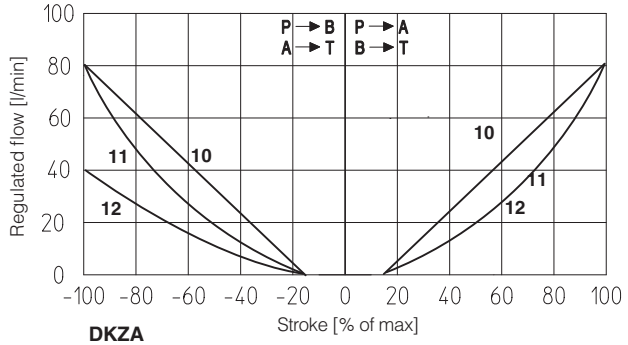
DHZA
3 = S2



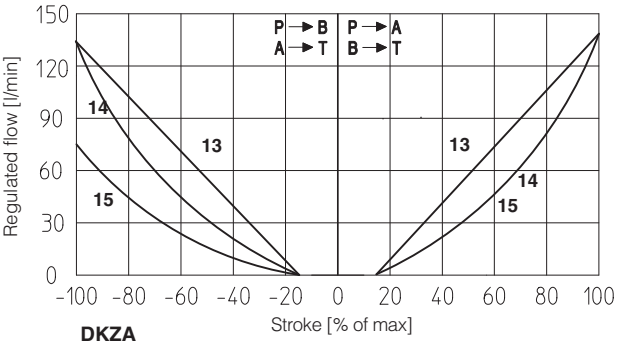
DHZA
4 = L3 **5** = S3 **6** = D3



DHZA
7 = L5 **8** = S5 **9** = D5

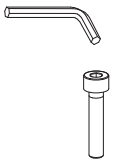


DKZA
10 = L3 **11** = S3 **12** = D3



DKZA
13 = L5 **14** = S5 **15** = D5

13 FASTENING BOLTS AND SEALS

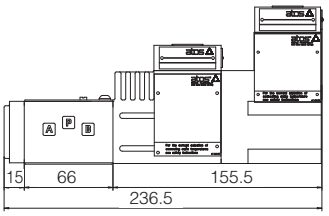
	DHZA	DKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports P, A, B, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports P, A, B, T: Ø 11,5 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

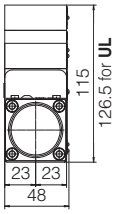
14 INSTALLATION DIMENSIONS FOR DHZA [mm]

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(for /Y surface: 4401-03-03-0-05 without port X)

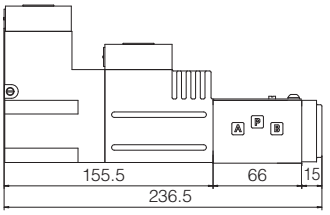
Mass [kg]	
DHZA-T-05	4,0
DHZA-T-07	5,1

DHZA-T-05*

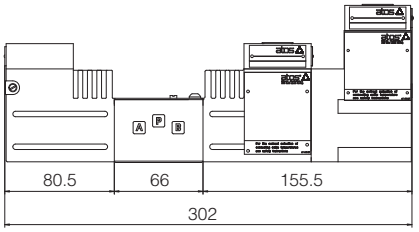




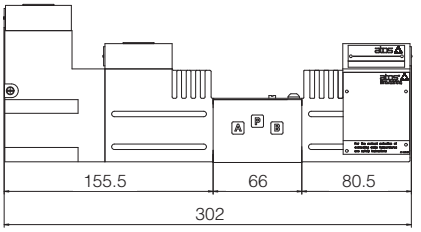
DHZA-T-05*/B



DHZA-T-07*



DHZA-T-07*/B

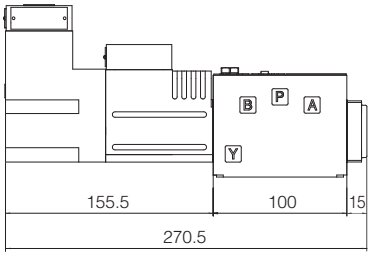


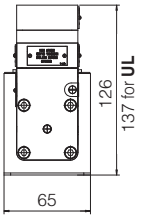
15 INSTALLATION DIMENSIONS FOR DKZA [mm]

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-05-04-0-05
(for /Y surface: 4401-03-03-0-05 without port X)

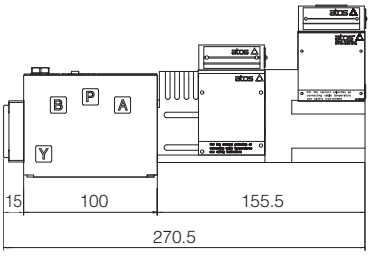
Mass [kg]	
DKZA-T-15	6,2
DKZA-T-17	7,8

DKZA-T-15*

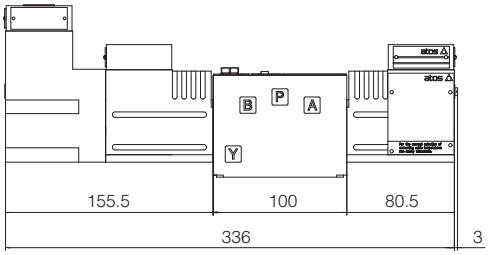




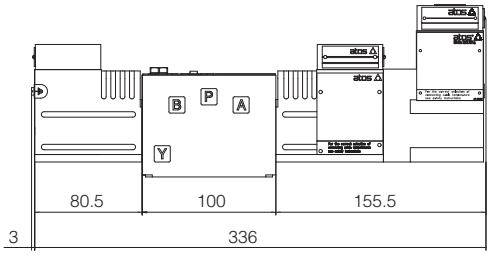
DKZA-T-15*/B



DKZA-T-17*



DKZA-T-17*/B

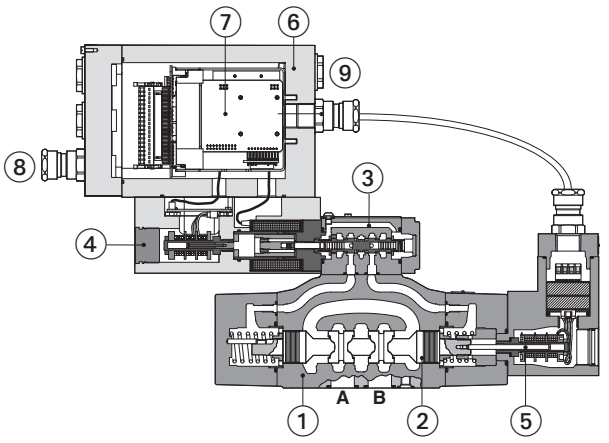


16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional directional valves high performance

piloted, with on-board driver, two LVDT transducers and positive spool overlap - **ATEX and IECEx**



DPZA-LES-SN-NP-27*

① valve body
② spool
③ proportional ex-proof pilot valve
④ ex-proof solenoid with integral LVDT transducer
⑤ ex-proof LVDT transducer
⑥ ex-proof electronics housing
⑦ on-board digital driver
⑧ ex-proof cable glands (to be ordered separately)
⑨ USB port always present (factory plugged)

DPZA-LES

Ex-proof digital high performances proportional valves, piloted with two LVDT position transducers (pilot valve and main stage) and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

They are equipped with ex-proof on-board digital driver,LVDT transducer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and trasducers, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **10** ÷ **27** - ISO 4401

Max flow: **180** ÷ **800 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPZA	-	LES	-	SN	-	NP	-	2	71	-	L	5	/	M	/	*	*	/	*

DPZA — Ex-proof proportional directional valve, piloted

LES = on-board driver and two LVDT transducers

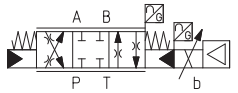
Alternated P/Q controls - see section 5:
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

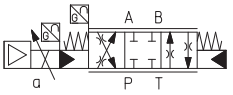
Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27

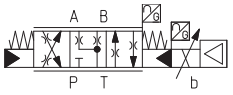
Configuration: **Standard** Option **/B**

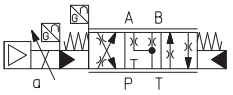
71 =





73 =





Series number

Seals material, see sect. 9:
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (1):
B = solenoid at side of port A **(2)**
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting (standard for size 10)

Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Cable entrance threaded connection:
M = M20x1,5

Spool size:

	3 (L,S,D)	**5** (L,DL,S,D,Q)
DPZA-1 =	-	100
DPZA-2 =	130	200
DPZA-4 =	-	340
DPZA-4M =	-	390

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:

L = linear

S = progressive

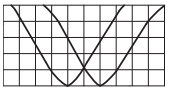
D = differential-progressive

P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

DL = differential-linear

P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Q = for P/Q controls



(1) For possible combined options, see section 15
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side A of main stage (side B of pilot valve)

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

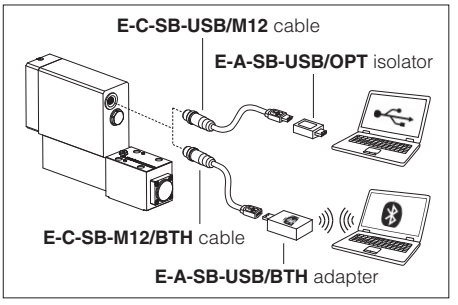
WARNING: the below operation must be performed in a safety area

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

USB or Bluetooth connection



WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

5 ALTERNATED P/Q CONTROLS - see tech. table **FX500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZA-*-1	DPZA-*-2		DPZA-*-4	DPZA-*-4M
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type		**L5, DL5, S5, D5, Q5**	**L3, S3, D3**	**L5, DL5, S5, D5, Q5**		
Nominal flow [l/min]						
Δp P-T	Δp = 10 bar	100	130	200	340	390
	Δp = 30 bar	160	220	350	590	670
	Max permissible flow	180	320	440	680	800
Δp max P-T	[bar]	50	60	60	60	60
Piloting pressure	[bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)				
Piloting volume	[cm³]	1,4	3,7		9,0	11,3
Piloting flow **(1)**	[l/min]	1,7	3,7		6,8	8
Leakage **(2)**	Pilot [cm³/min]	100/300	100/300		200/500	200/600
	Main stage [l/min]	0,15/0,5	0,2/0,6		0,3/1,0	0,3/1,0
Response time **(1)**	[ms]	≤ 55	≤ 65		≤ 85	≤ 90
Hysteresis		≤ 0,1 [% of max regulation]				
Repeatability		± 0,1 [% of max regulation]				
Thermal drift		zero point displacement < 1% at ΔT = 40°C				

(1) 0 ÷100 % step signal and pilot pressure 100 bar
(2) at P = 100/350 bar

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching;protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	DPZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-LES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-31 EN 60079-1	IEC 60079-0 IEC 60079-31 IEC 60079-1	
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port B of the main stage.

D and **E** = Pilot and drain configuration can be modified as shown in section 21.
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:

Option /D Internal drain.

Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:

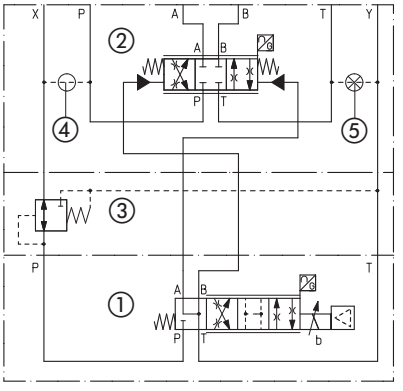
DPZA-2 = 28 bar

DPZA-1, -4 and -4M = 40 bar

It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

Pressure reducing valve is standard for DPZA-1, for other sizes add **/G** option.

FUNCTIONAL SCHEME - example of configuration 71



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

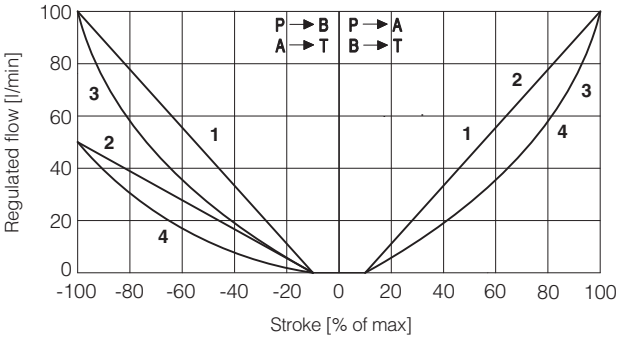
C = Only for **SP, SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

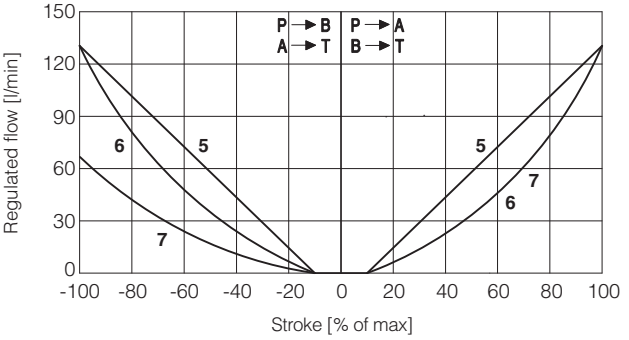
Hydraulic options: all combination possible
Electronics options: /CI (only for **SP, SF, SL**)

16 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

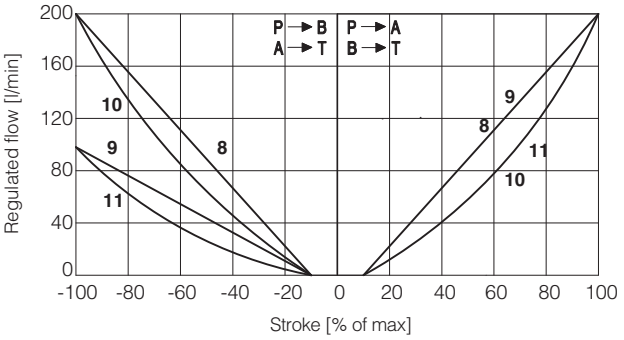
16.1 Regulation diagrams (values measure at Δp 10 bar P-T)



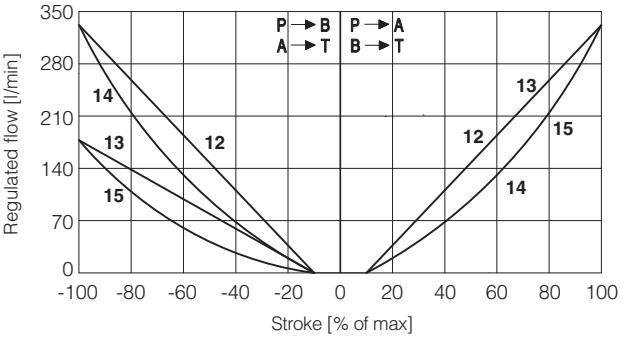
DPZA-1:
1=L5 **2** = DL5
3=S5 **4** = D5



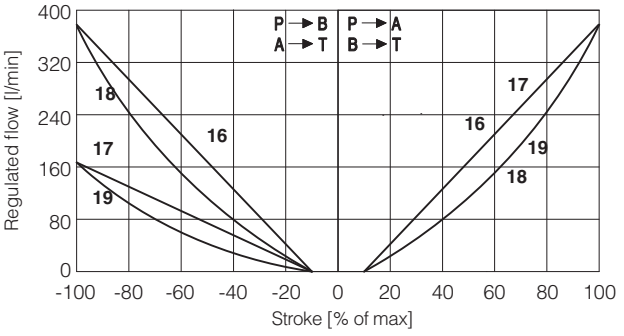
DPZA-2:
5=L3 **6** = S3
7=D3



DPZA-2:
8 = L5 **9** = DL5
10 = S5 **11** = D5



DPZA-4:
12 = L5 **13** = DL5
14 = S5 **15** = D5

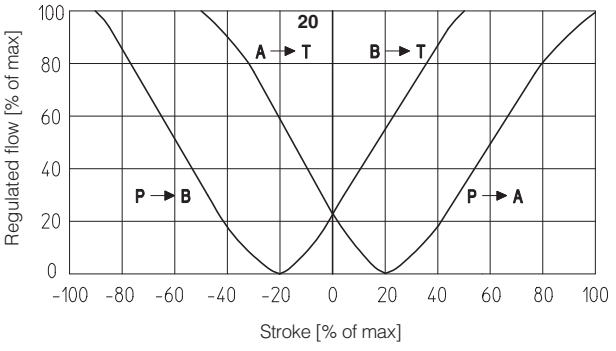


DPZA-4M:
16 = L5 **17** = DL5
18 = S5 **19** = D5

Note: Hydraulic configuration vs. reference signal (standard and option /B)

Reference signal $\left.\begin{matrix}0 \div +10\ V\\ 12 \div 20\ mA\end{matrix}\right\}$ P → A / B → T

Reference signal $\left.\begin{matrix}0 \div -10\ V\\ 12 \div 4\ mA\end{matrix}\right\}$ P → B / A → T



20 = Q5

20 = linear spool **Q5**

Q5 spool type is specific for alternate P/Q controls in combination with /S* option, (see tech. table **FX500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only **SP, SF, SL**

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for **SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

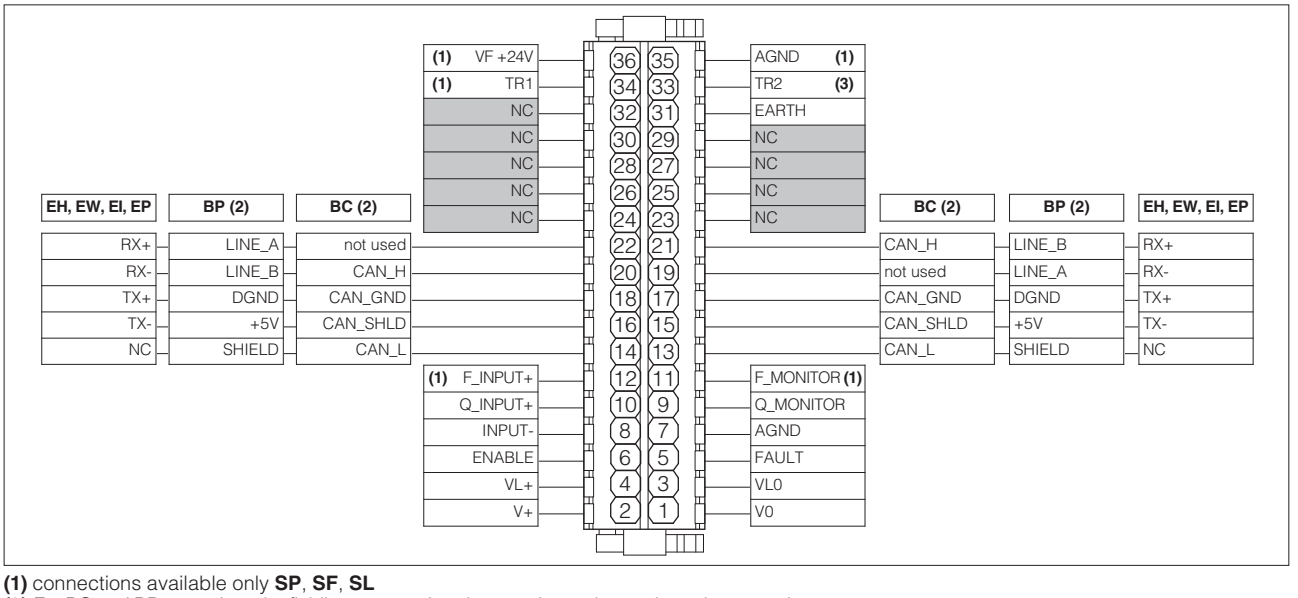
17.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection

17.9 Remote pressure/force transducer input signal - only for **SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see table FX500).

18 TERMINAL BOARD OVERVIEW



(1) connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) connection available only **SF**

19 ELECTRONIC CONNECTIONS

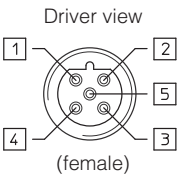
19.1 Main connections signals

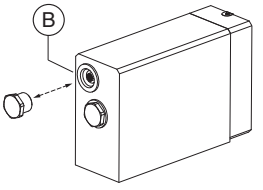
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

19.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





19.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

19.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

19.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

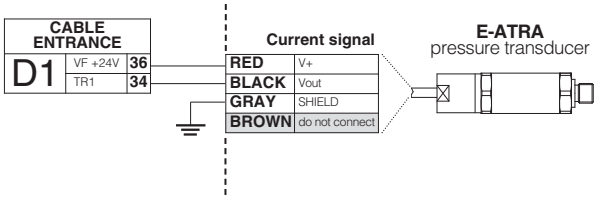
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SP, SL - Single transducer (1)		SF - Double transducers (1)	
					Voltage	Current	Voltage	Current
D1	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
D2	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

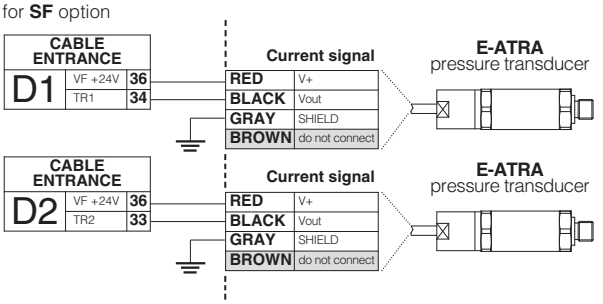
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



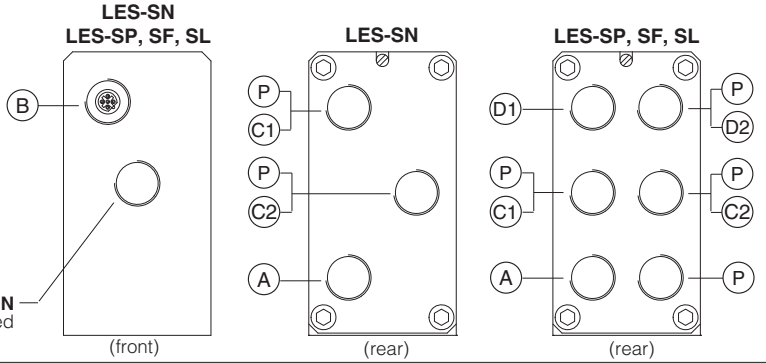
Connect the transducers cables to the terminal board of the electronic driver

20 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

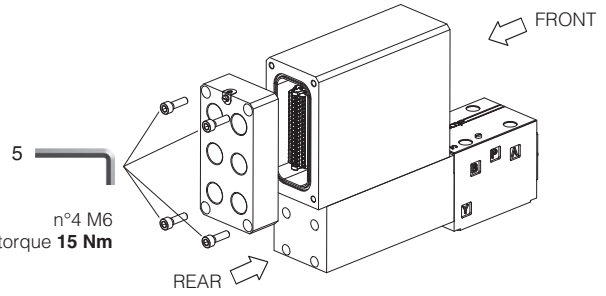
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



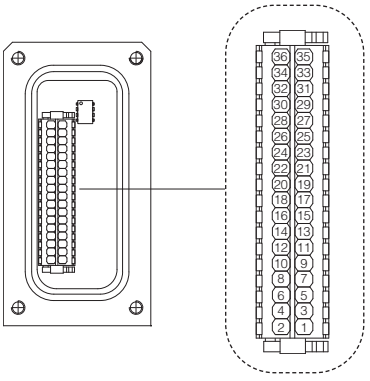
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

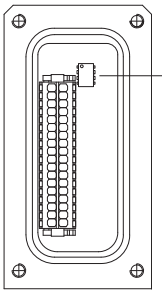


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 18

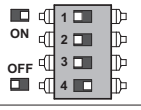


Fieldbus terminator only for BC and BP executions **(1)**



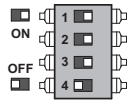
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

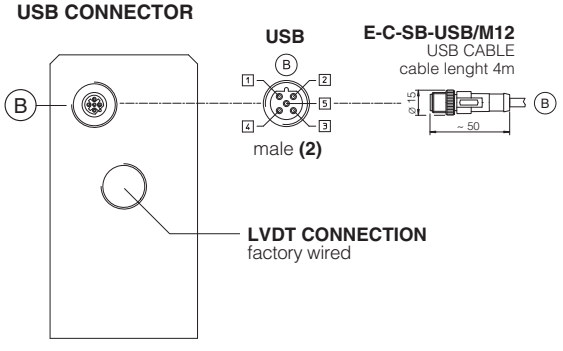


BP - PROFIBUS DP setting:

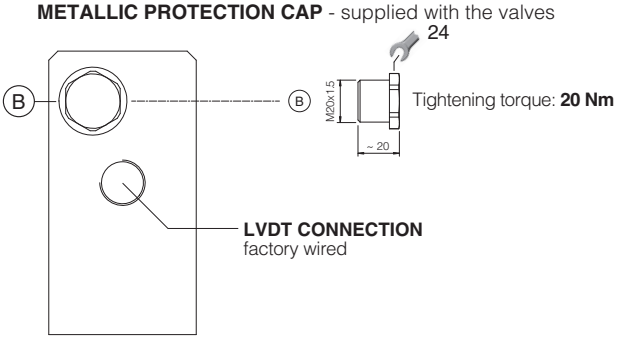
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

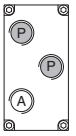
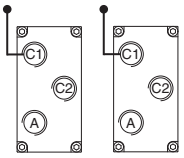
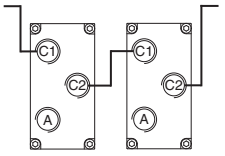


METALLIC PROTECTION CAP - supplied with the valves

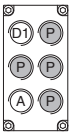
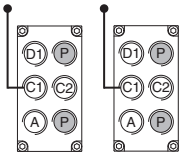
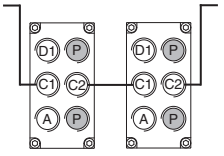


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

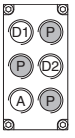
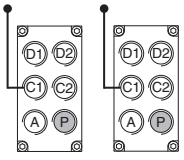
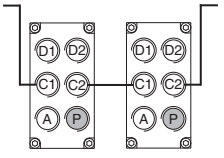
20.1 Cable glands and threaded plug for LES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

20.2 Cable glands and threaded plug for LES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

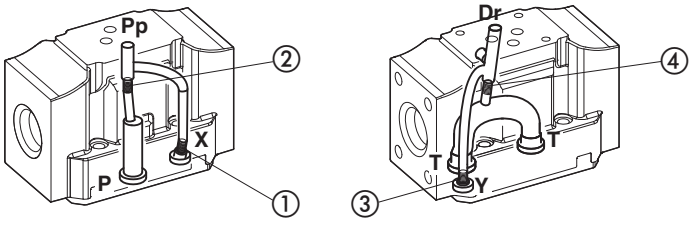
20.3 Cable glands and threaded plug for LES-SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

21 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

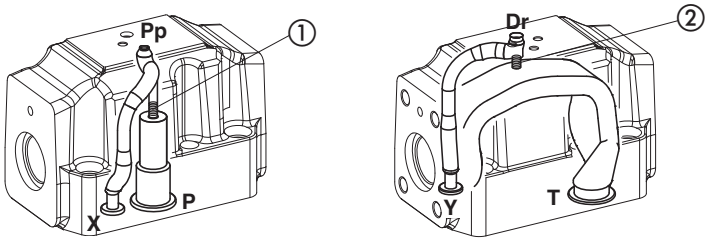
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZA-1 **Pilot channels** **Drain channels**



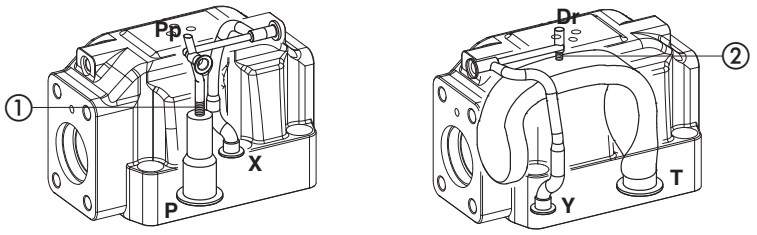
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 **Pilot channels** **Drain channels**



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4 **Pilot channels** **Drain channels**
DPZA-4M



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

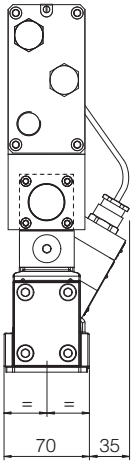
22 FASTENING BOLTS AND SEALS

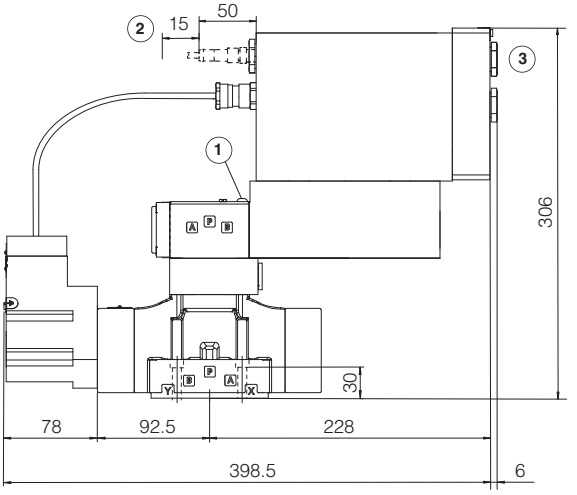
Type	Size	Fastening bolts	Seals
DPZA	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

DPZA-LES-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)

Mass [kg]	
DPZA-*-17*	9,5
Option /G	+0,9

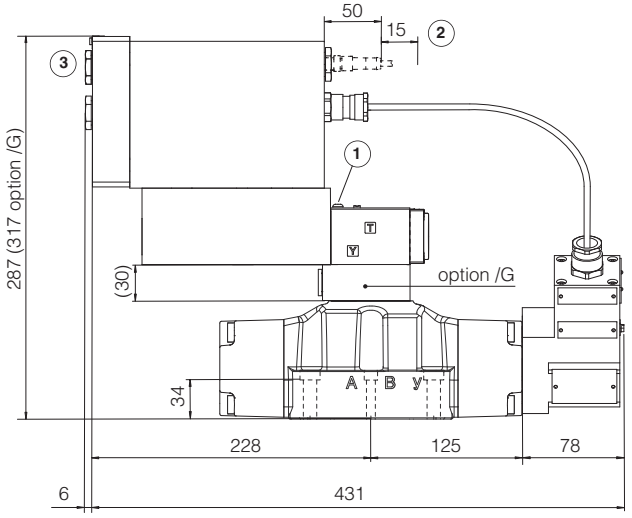


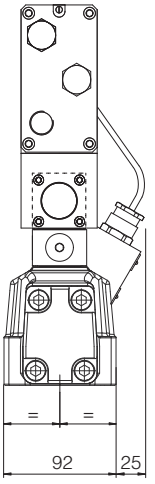


DPZA-LES-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
(see table P005)

Mass [kg]	
DPZA-*-27*	17,9
Option /G	+0,9





(1) = Air bleed off

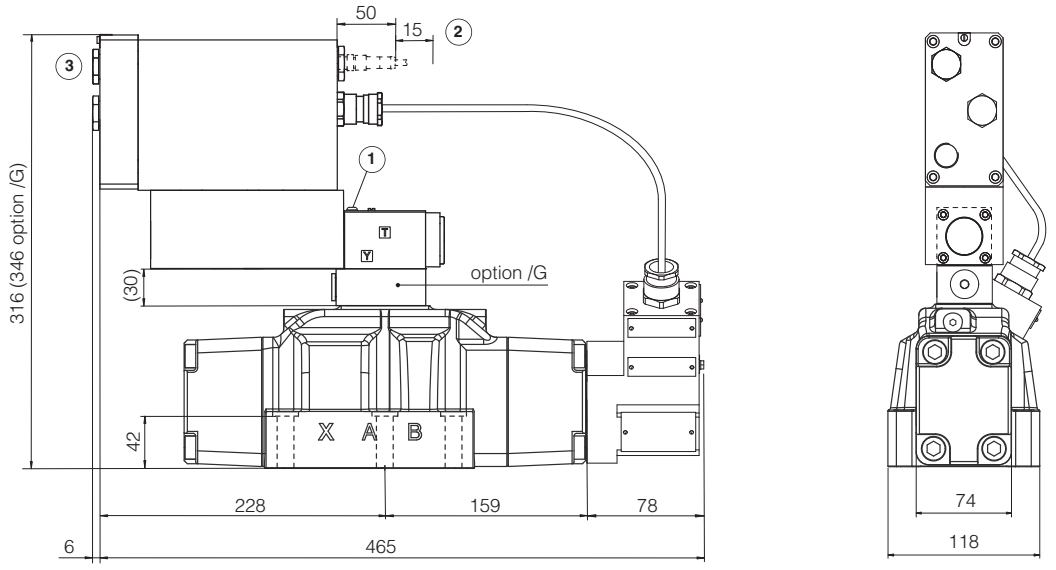
(2) = Space to remove the USB connector

(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

DPZA-LES-*-4
DPZA-LES-*-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
(see table P005)

Mass [kg]	
DPZA-*-4*	23,1
DPZA-*-4M*	23,1
Option /G	+0,9



(1) = Air bleed off

(2) = Space to remove the USB connector

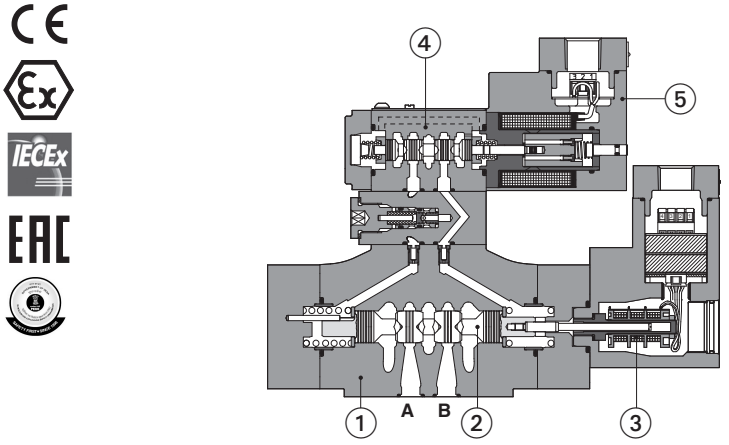
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

24 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX500	Ex-proof digital proportionals with P/Q control	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX900	Operating and manintenance information for ex-proof proportional valves	**KX800**	Cable glands for ex-proof valves
		P005	Mounting surfaces for electrohydraulic valves

Ex-proof proportional directional valves

piloted, with LVDT transducer and positive spool overlap - **ATEX, IECEx, EAC, PESO**



① main stage valve body
② main stage spool
③ ex-proof LVDT transducer
④ pilot valve
⑤ ex-proof solenoid

DPZA-T-15*

DPZA-T

Ex-proof proportional valves, piloted, with LVDT position transducer and positive spool overlap, for directional and not compensated speed controls.
They are equipped with ex-proof proportional solenoid and LVDT transducer, certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)

The flameproof enclosure of solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **10** ÷ **32** - ISO 4401

Max flow: **180** ÷ **1000 l/min**

Max pressure: **350 l/min**

1 **MODEL CODE**

DPZA	/	*	-	T	-	2	71	-	L	5	/	M	/	*	*	/	*

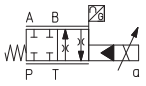
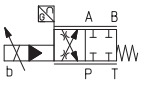
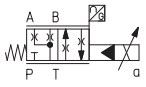
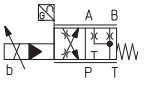
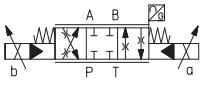
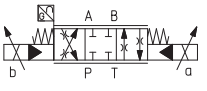
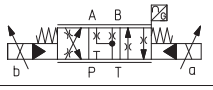
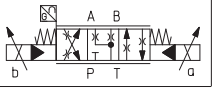
DPZA: Ex-proof proportional directional valve, piloted

Certification type:
Multicertification
ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group IM2 (mining)

T = with LVDT transducer

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration:

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

Solenoid and transducer threaded connection for cable gland fitting:
GK = GK-1/2" **(5)**
M = M20x1,5
NPT = 1/2" NPT ANSI B2.1 (tapered)

Options (4):
B = solenoid and position transducer at side of port A of the main stage **(3)**
C = current feedback for position transducer 4 ÷ 20 mA
D = internal drain
E = external pilot pressure

Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(2)**

Spool size:

	3 (L,S,D)	**5** (L,S,D)
DPZA-1 =	-	100
DPZA-2 =	130	200
DPZA-4 =	-	340
DPZA-6 =	-	400

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:

L = linear 

S = progressive 

D = differential-progressive 

P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** In standard configuration the solenoid and transducer are at side B of the main stage
(4) Possible combined options: /BC, /BD, /BE, /CD, /CE, /DE **(5)** Approved only for the Italian market

⚠ For valve with internal drain (option /D) the pressure at T port makes difficult the manual override operation that can be possible only if the pressure at T port is lower than 50 bar

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.

Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-TEB-* /A	E-BM-TES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	GS230	GS240

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - Salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DPZA-*-1**	**DPZA-*-2**		**DPZA-*-4**	**DPZA-*-6**
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type	standard	**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**	**L5, S5, D5**	**L5, S5, D5**
Nominal flow [l/min]						
Δp P-T	Δp = 10 bar	100	130	200	340	400
	Δp = 30 bar	160	220	350	590	700
	max permissible flow	180	320	440	680	1000
Δp max P-T	[bar]	50	60	60	60	70
Piloting pressure	[bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)				
Piloting volume	[cm³]	1,4	3,7		9,0	21,6
Piloting flow **(1)**	[l/min]	1,7	3,7		6,8	14,4
Leakage **(2)**	Pilot [cm³/min]	100/300	100/300		200/500	900/2800
	Main stage [l/min]	0,15/0,5	0,2/0,6		0,3/1,0	1,0/3,0
Response time **(1)**	[ms]	≤ 70	≤ 85		≤ 100	≤ 130
Hysteresis		≤ 1 [% of max regulation]				
Repeatability		± 0,5 [% of max regulation]				
Thermal drift		zero point displacement < 1% at ΔT = 40°C				

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) 0 ÷100 % step signal and pilot pressure 100 bar **(2)** at Δp = 100/350 bar

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) performance limitations in case of flame resistant fluids with water:
- max operating pressure = 210 bar - max fluid temperature = 50°C

7 CERTIFICATION DATA

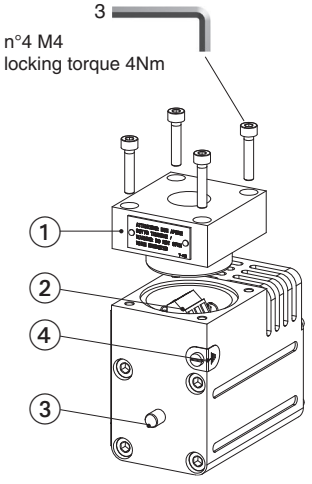
Valve type	DPZA		DPZA**/M**
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**
Solenoid certified code	**OZA-A + ETHA-4**		**OZAM-A + ETHAM**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db •PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb
Temperature class	**T4**	**T3**	**-**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C
Mechanical construction Flameproof enclosure Ex d	EN 60079-0, EN 60079-1		
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT		

(1) The type examinator certificates can be downloaded from www.atos.com

(2) In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX PROOF SOLENOIDS AND TRANSDUCERS WIRING



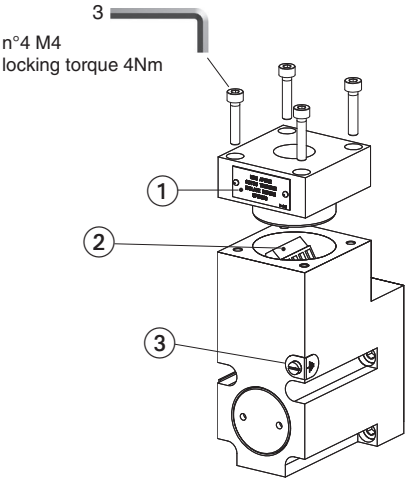
SOLENOID

① cover with threaded connection for vertical cable gland fitting
② terminal board for cables wiring
③ standard manual override
④ screw terminal for additional equipotential grounding

Solenoid wiring

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)



TRANSDUCER

① cover with threaded connection for vertical cable gland fitting
② terminal board for cables wiring
③ screw terminal for additional equipotential grounding

Position transducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

SOLENOID - Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

TRANSDUCER - Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	N.A.	T6	150 °C	85 °C	-	-
70 °C	N.A.	T6	150 °C	85 °C	90 °C	90 °C

10 CABLE GLANDS

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 OPTIONS

B = DPZA-*-*5 = solenoid and integral electronics at side of port B of the main stage.
DPZA-*-*7 = integral electronics at side of port B of the main stage.

C = Position transducer with current feedback 4÷20 mA, suggested in case of long distance between the electronic driver and the proportional valve

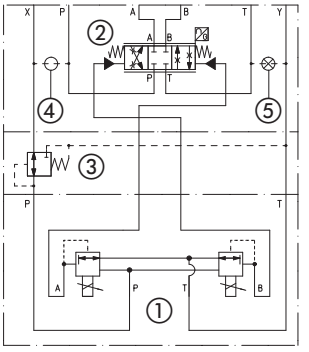
D and **E** = Pilot and drain configuration can be modified as shown in section 13.
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:

Option /D Internal drain.

Option /E External pilot (through port X).

11.1 Possible combined options: /BC, /BD, /BE, /CD, /CE, /DE

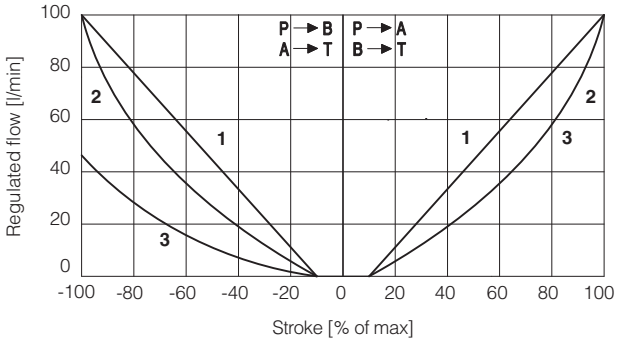
FUNCTIONAL SCHEME
example of configuration 7*
3 positions, spring centered



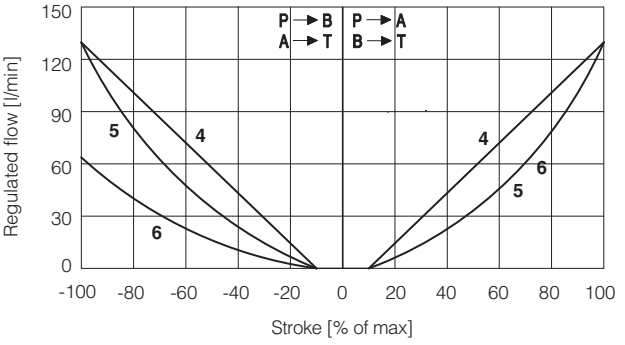
① Pilot valve ② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

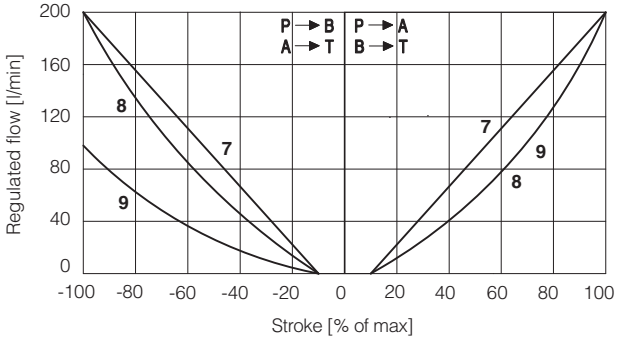
Regulation diagrams (values measure at Δp 10 bar P-T)



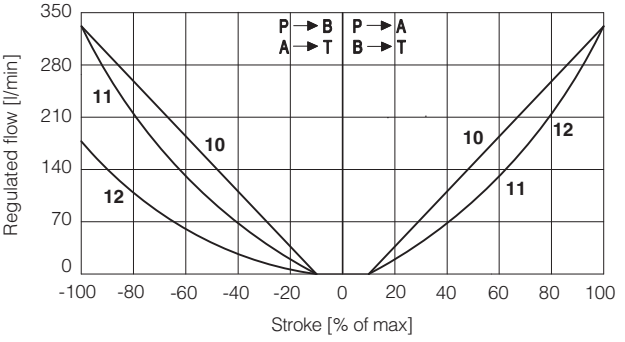
DPZA-1:
1 = L5 **2** = S5 **3** = D5



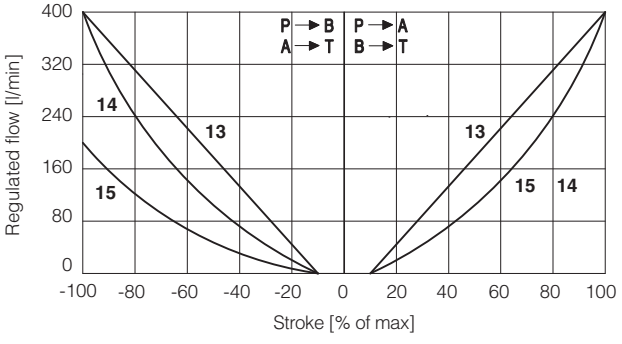
DPZA-2:
4 = L3 **5** = S3 **6** = D3



DPZA-2:
7 = L5 **8** = S5 **9** = D5



DPZA-4:
10 = L5 **11** = S5 **12** = D5



DPZA-6:
13 = L5 **14** = S5 **15** = D5

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

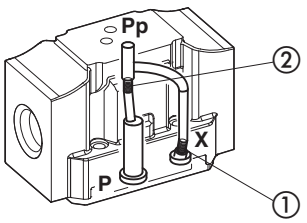
Reference signal $\begin{matrix} 0 \div +10\ V \\ 12 \div 20\ mA \end{matrix}$ } P → A / B → T

Reference signal $\begin{matrix} 0 \div -10\ V \\ 12 \div 4\ mA \end{matrix}$ } P → B / A → T

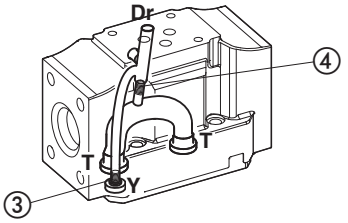
13 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZA-1 Pilot channels

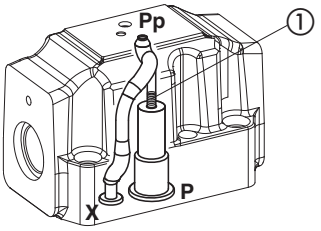


Drain channels

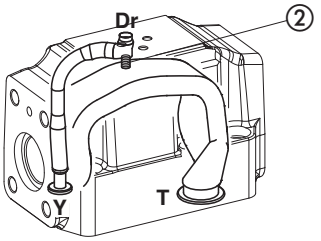


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 Pilot channels

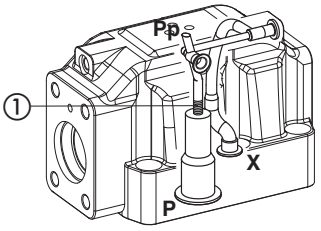


Drain channels

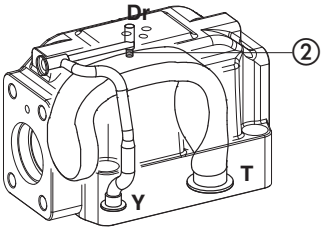


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4 Pilot channels

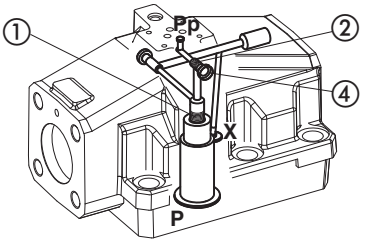


Drain channels

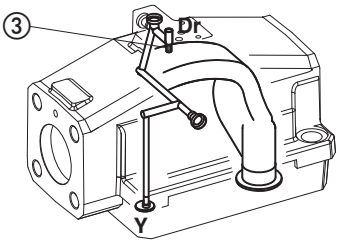


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-6 Pilot channels



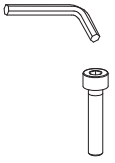
Drain channels



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Add plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orefice ② remove plug ④ = G1/8”

14 FASTENING BOLTS AND SEALS

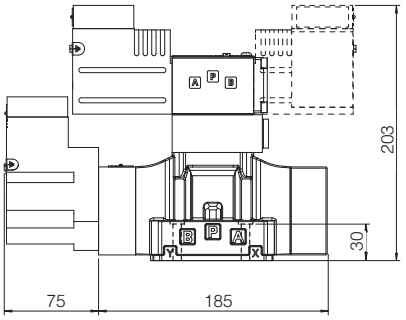
	DPZA-1	DPZA-2	DPZA-4	DPZA-6
	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	**Fastening bolts:** 4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	**Fastening bolts:** 6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm
	**Seals:** 5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø 5 mm (max)	**Seals:** 4 OR 130 Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø 7 mm (max)	**Seals:** 4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)	**Seals:** 4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)

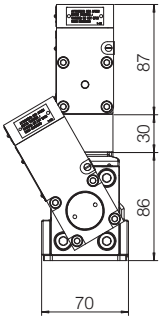
DPZA-1

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-05-05-0-05

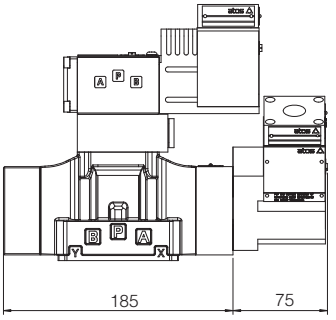
Mass [kg]	
DPZA-*-15*	10,4
DPZA-*-17*	11,8

DPZA-T-15*
DPZA-T-17* (dotted line)





DPZA-T-15* /B

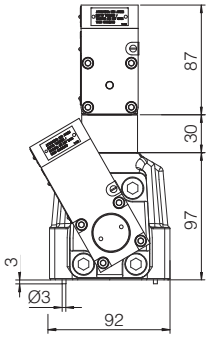


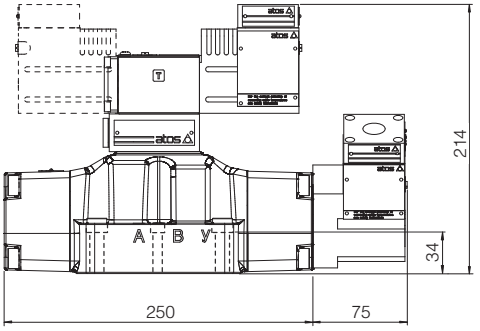
DPZA-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

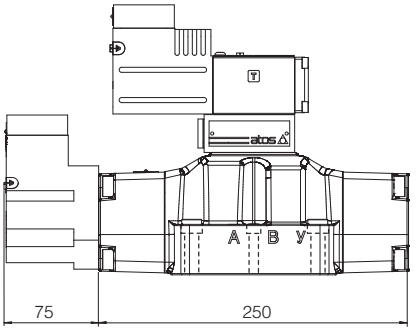
Mass [kg]	
DPZA-*-25*	13,3
DPZA-*-27*	14,7

DPZA-T-25*
DPZA-T-27* (dotted line)





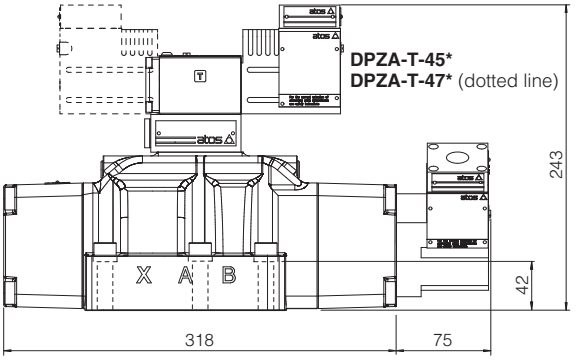
DPZA-T-25* /B

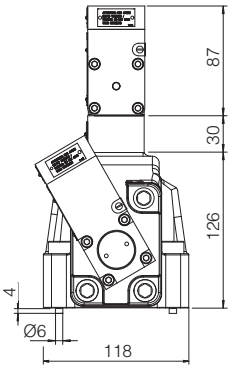


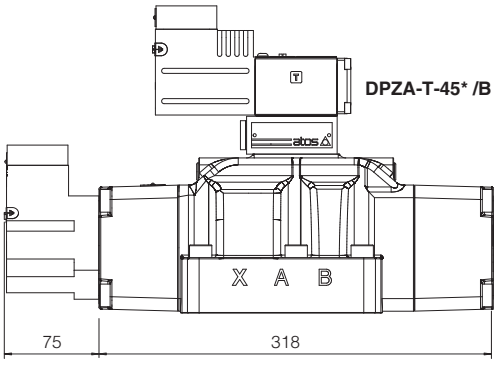
DPZA-4

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-08-08-0-05

Mass [kg]	
DPZA-*-45*	20,8
DPZA-*-47*	22,2



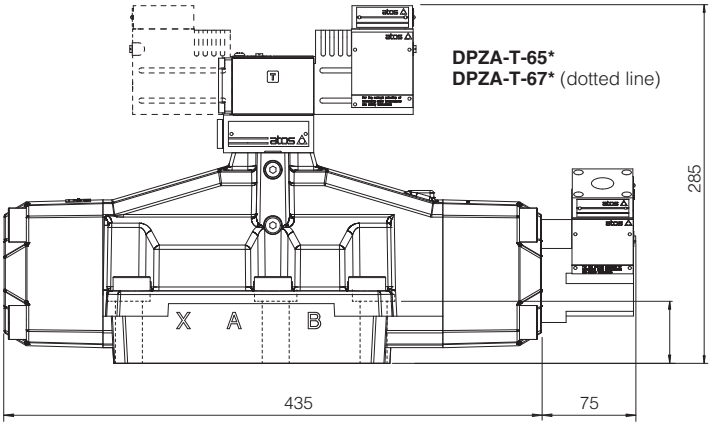


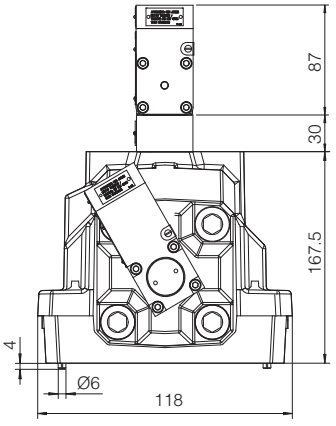


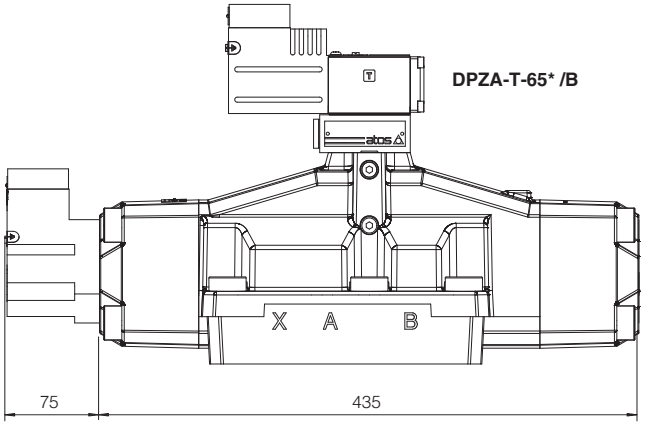
DPZA-6

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-10-09-0-05

Mass [kg]	
DPZA-*-65*	47,3
DPZA-*-67*	48,7





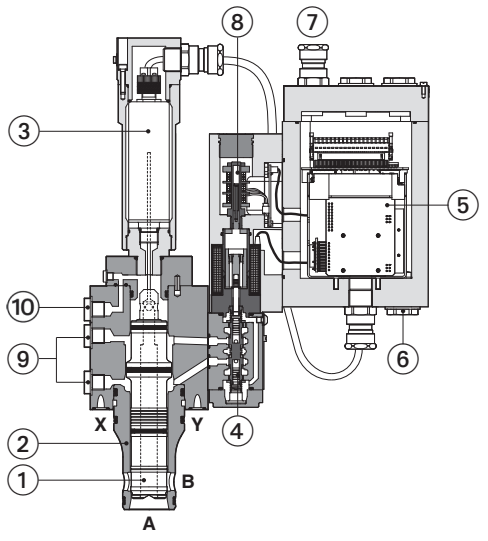


16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional 2-way cartridges high performance

piloted, with on-board driver and two LVDT transducers - **ATEX and IECEx**



① poppet
② sleeve
③ ex-proof LVDT position transducer (main stage)
④ proportional ex-proof pilot valve
⑤ ex-proof on-board digital driver
⑥ USB connector
⑦ ex-proof cable gland (to be ordered separately)
⑧ ex-proof solenoid with LVDT position transducer
⑨ air bleeding
⑩ air suction port

LIQZA-LES-SN-NP-322*

LIQZA-LES

Ex-proof digital proportional 2-way cartridges, high performance with two LVDT position transducers (pilot valve and main stage) for best accuracy in not compensated flow regulations.

They are equipped with ex-proof on-board digital driver,LVDT transducers and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducers, prevents the propagation of accidental internal sparks or fire to the external environment.
The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **25** ÷ **100** - ISO 7368

Max flow: **1200** ÷ **16000 l/min**

Max pressure: **420 bar**

1 MODEL CODE

LIQZA	-	LES	-	SN	-	NP	-	25	2	L4	/	M	/	*	*	/	*

LIQZA = Ex-proof proportional cartridge

LES = on-board driver and two LVDT transducers

Alternated P/Q controls:
SN = none

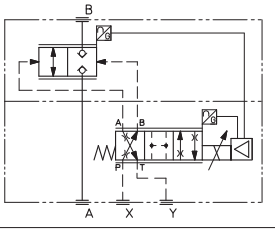
Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size and nominal flow (l/min) at Δp 5 bar:
25=500
32=800
40=1200
50=2000
63=3000
80=4500
100=7200

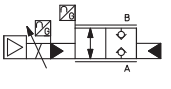
Spool type, regulating characteristics:
L4 = linear

Configuration: 2 = 2 way

functional symbol



simplified symbol



Cable entrance threaded connection:
M = M20X1,5

Electronic options:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)

Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

WARNING

The loss of the pilot pressure causes the undefined position of the main poppet.
The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet.
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

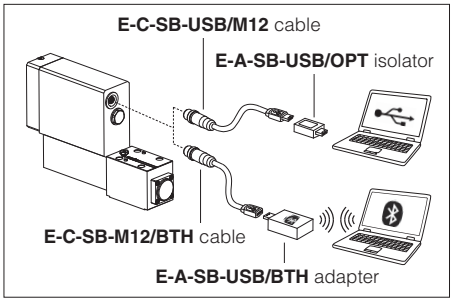
WARNING: the below operation must be performed in a safety area

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

USB or Bluetooth connection



WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: Bluetooth adapter is available only for European, USA and Canadian markets!
Bluetooth adapter is certified according RED (Europe), FCC (USA) and ISED (Canada) directives

4 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size			**25**	**32**	**40**	**50**	**63**	**80**	**100**
Max regulated flow		[l/min]							
Δp A-B	at Δp = 5 bar		500	800	1200	2000	3000	4500	7200
	at Δp = 10 bar		700	1100	1700	2800	4250	6350	10200
Max permissible flow			1200	1800	2500	4000	6000	10000	16000
Max pressure		[bar]	Ports A, B = **420** X = 350 Y ≤ 10						
Nominal flow of pilot valve at Δp = 70 bar		[l/min]	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar		[l/min]	0,2	0,3	0,7	0,7	1	1	1
Piloting pressure		[bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160						
Piloting volume		[cm³]	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow **(1)**		[l/min]	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal **(2)**		[ms]	≤ 30	≤ 32	≤ 35	≤ 35	≤ 40	≤ 45	≤ 55
Hysteresis		[% of the max regulation]	≤ 0,1						
Repeatability		[% of the max regulation]	± 0,1						
Thermal drift			zero point displacement < 1% at ΔT = 40°C						

(1) 0÷100% step signal
(2) With pilot pressure = 140 bar

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

9 CERTIFICATION DATA

Components type	Pilot valve solenoid and LVDT transducer			LVDT main stage transducer
Certifications	Multicertification **ATEX** **IECEx**			
Components Certified code	**OZA-LES**			**ETHA-15**
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X • IECEx: IECEx TPS 19.0004X			• ATEX: TUV IT 16 ATEX 053 X • IECEx: IECEx TPS 16.0003X
Method of protection	• ATEX Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db • IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db			• ATEX Ex II 2G Ex db IIC T6 Gb Ex II 2D Ex tb IIIC T85°C Db Ex I M2 Ex db IMb • IECEx Ex db IIC T6 Gb Ex tb IIIC T85°C Db Ex db IMb
Temperature class	**T6**	**T5**	**T4**	**T6**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C	≤ 85 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			factory wired

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver solenoid and LVDT transducers are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

11 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

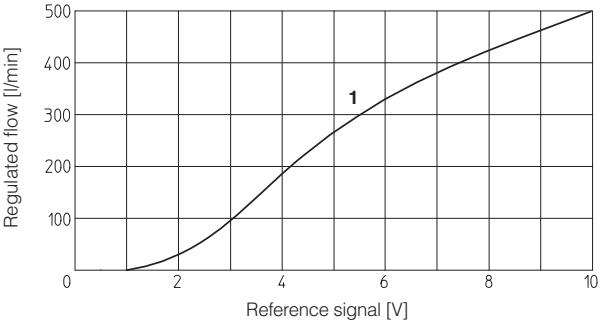
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 ELECTRONIC OPTIONS

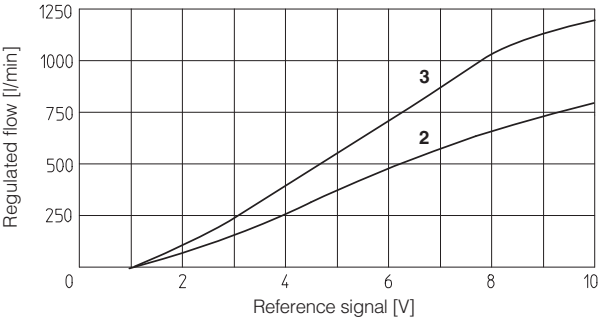
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

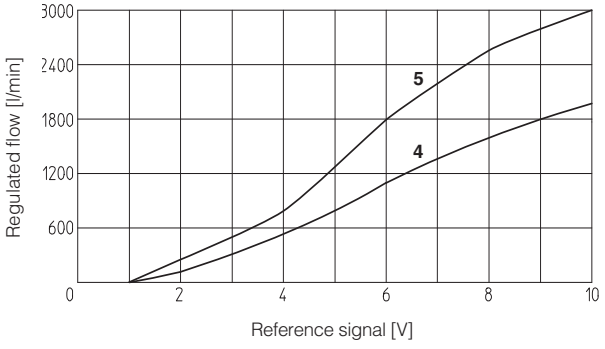
13.1 Regulation diagrams (values measured at Δp 5 bar)



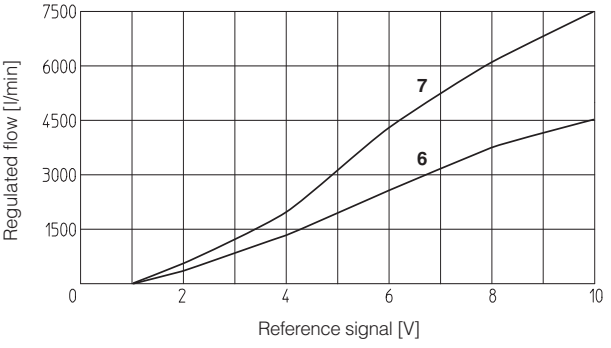
1 = LIQZA-LES-25*



2 = LIQZA-LES-32* **3** = LIQZA-LES-40*



4 = LIQZA-LES-50* **5** = LIQZA-LES-63*



6 = LIQZA-LES-80* **7** = LIQZA-LES-100*

14 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

14.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

14.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

14.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

14.4 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

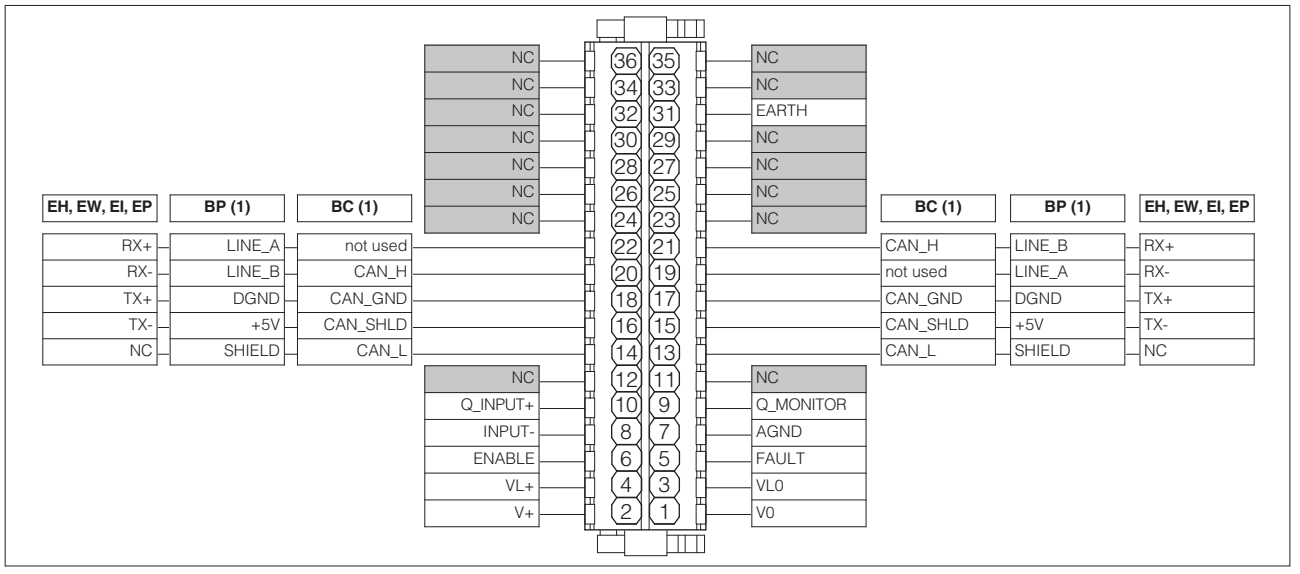
14.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

14.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

15 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

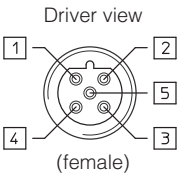
16 ELECTRONIC CONNECTIONS

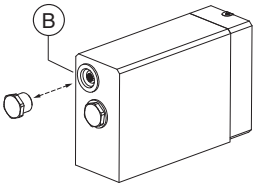
16.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: 0 ÷ 10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: 0 ÷ 10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

16.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





16.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

16.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

16.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

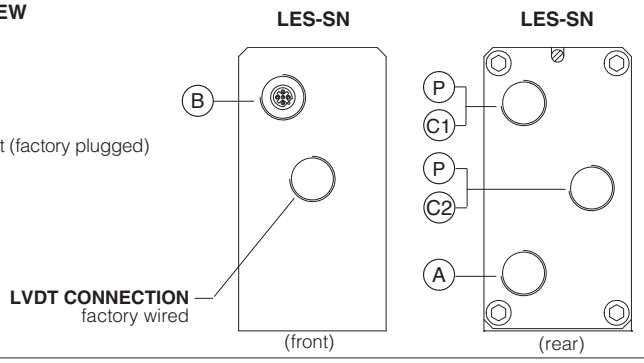
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

CABLE ENTRANCE OVERVIEW

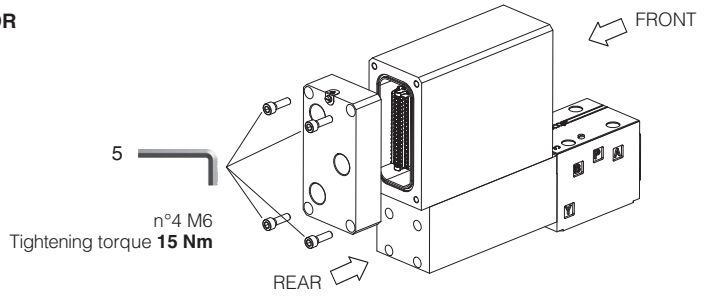
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (P) threaded plug



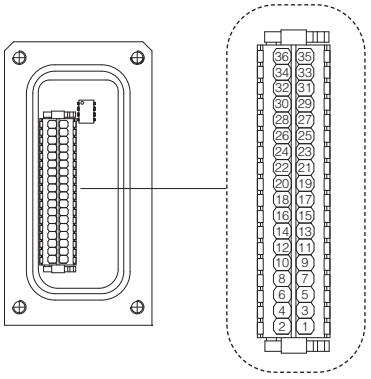
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

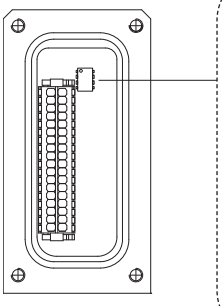


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 15

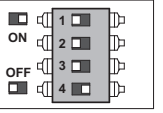


Fieldbus terminator only for BC and BP executions **(1)**



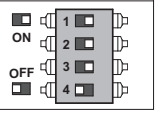
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

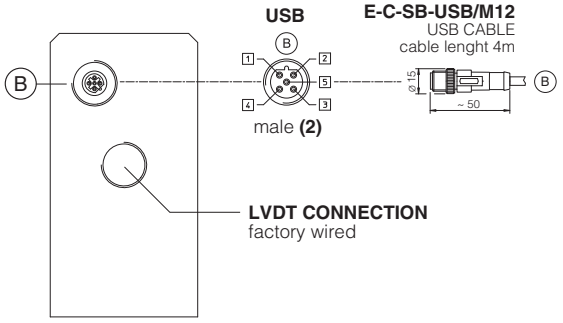


BP - PROFIBUS DP setting:

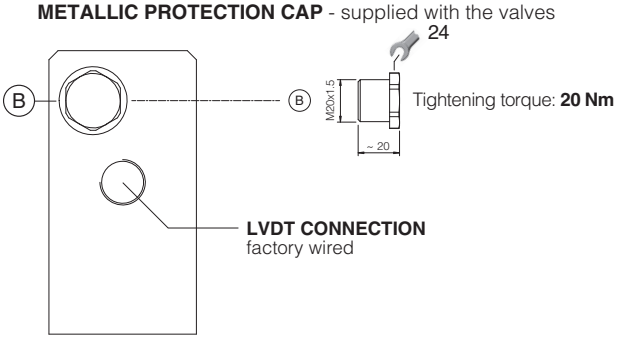
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR



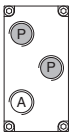
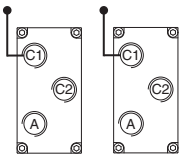
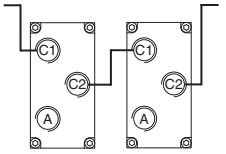
METALLIC PROTECTION CAP - supplied with the valves



(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF

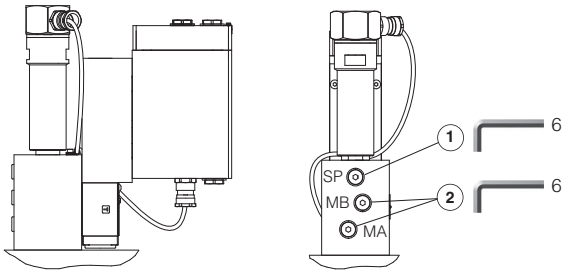
(2) Pin layout always referred to driver's view

17.1 Cable glands and threaded plug - see tech table **KX800**

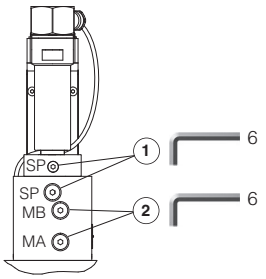
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

18 AIR BLEEDING

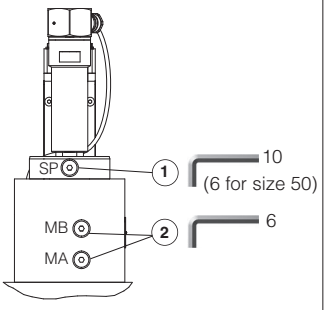
Size 25



Sizes 32, 40



Sizes 50 to 100



(1) Air suction port (SP):

N° 1 plug G1/4" for sizes 25 to 50
N° 1 plug G1/2" for sizes 63 to 100

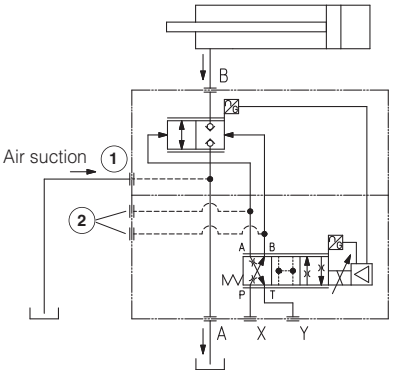
To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

(2) Air bleeding (MA, MB):

N° 2 plugs G1/4"

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.

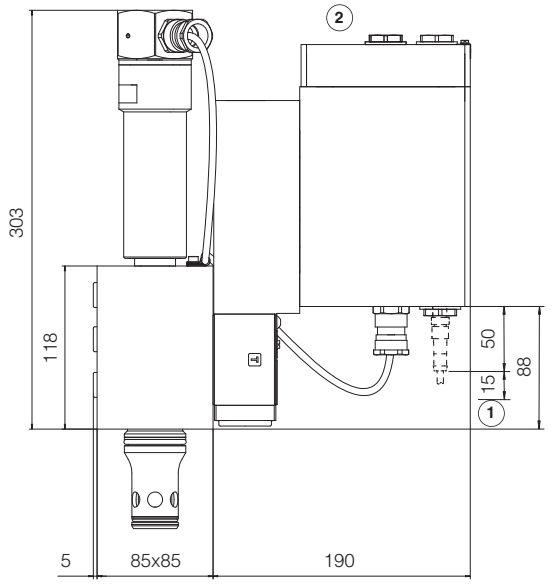


19 FASTENING BOLTS AND VALVE MASS

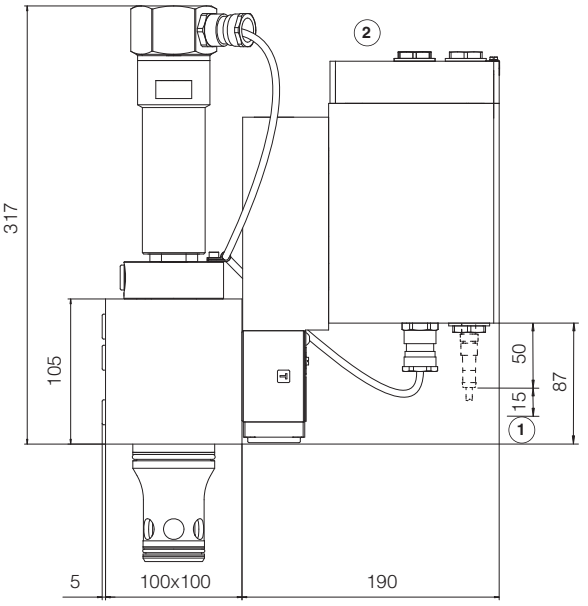
Type	Size	**Fastening bolts** (supplied with the valve)	Mass [kg]
LIQZA	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	15,2
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	18
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	23,7
	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	31
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	51
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	78,6
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	130

20 INSTALLATION DIMENSIONS [mm]

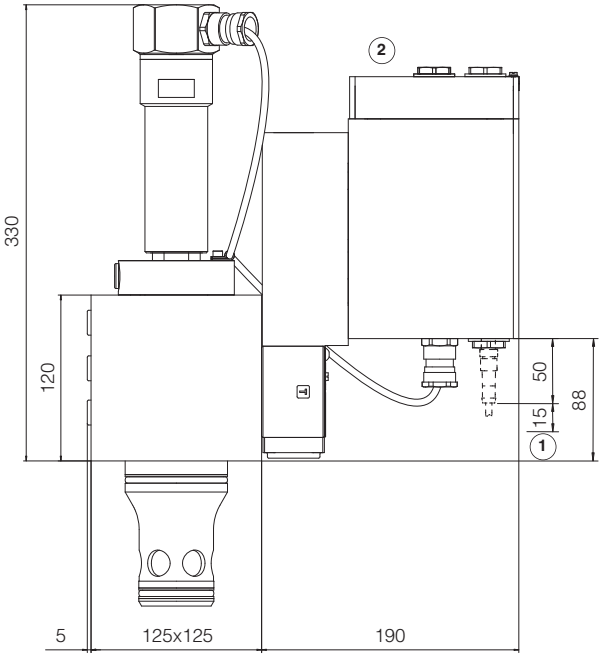
LIQZA-LES-252



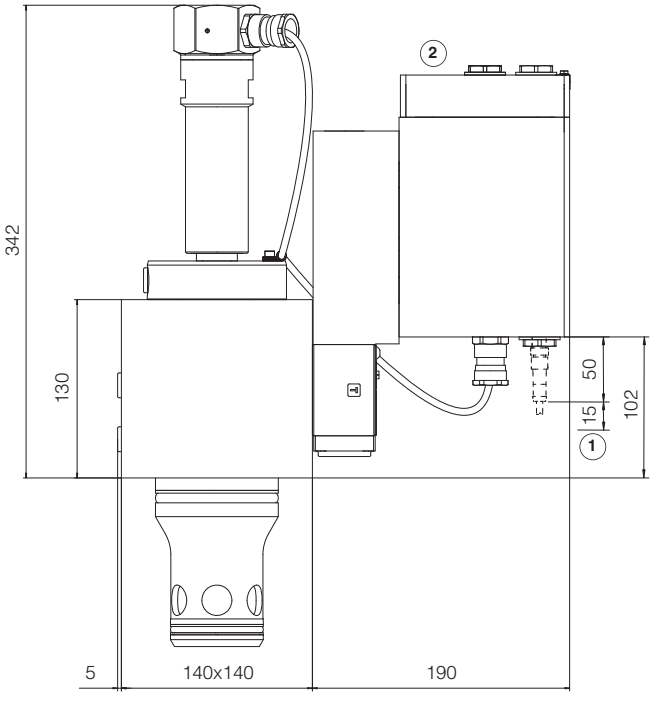
LIQZA-LES-322



LIQZA-LES-402



LIQZA-LES-502

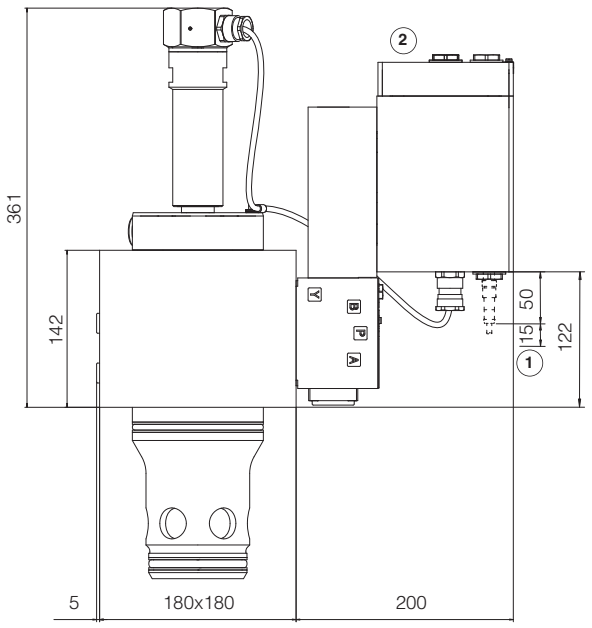


(1) = Space to remove the USB connector

(2) = The dimensions of all cable glands must be considered (see tech. table KX800)

Note: for mounting surface and cavity dimensions, see table P006

LIQZA-LES-632



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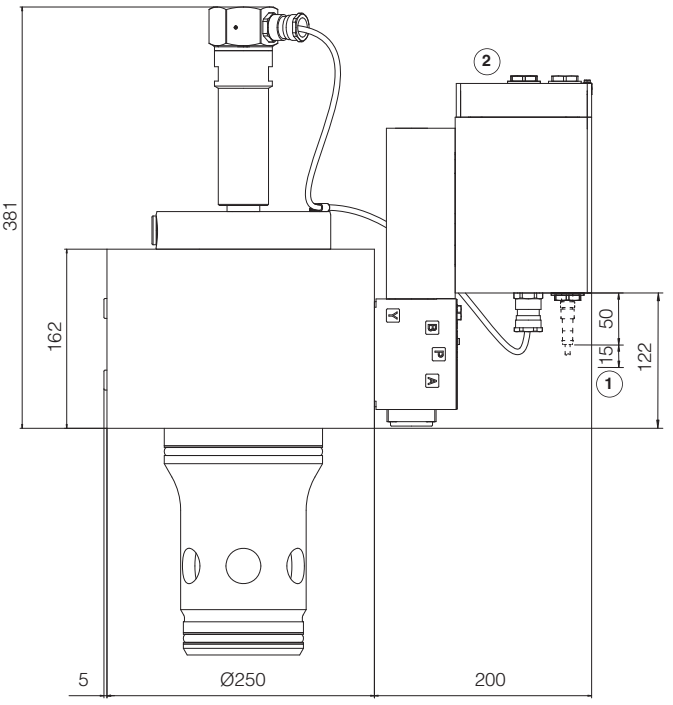
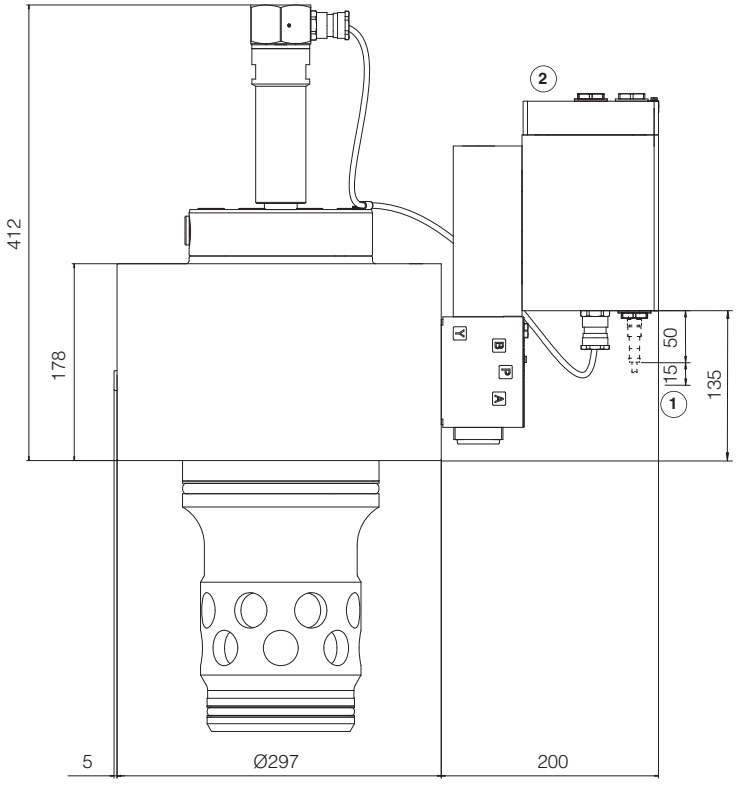


LIQZA-LES-1002



(1) = Space to remove the USB connector

(2) = The dimensions of all cable glands must be considered (see tech. table KX800)

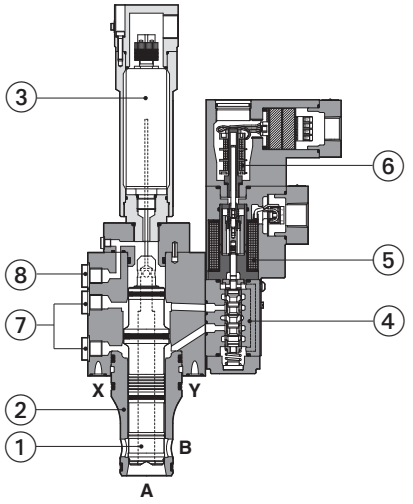
Note: for mounting surface and cavity dimensions, see table P006

21 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P006**	Mounting surfaces and cavities for cartridge valves
GS500	Programming tools		

Ex-proof proportional 2-way cartridges high performance

piloted, with two LVDT transducers - **ATEX and IECEx**



① poppet
② sleeve
③ ex-proof LVDT position transducer (main stage)
④ proportional ex-proof pilot valve
⑤ ex-proof solenoid
⑥ ex-proof LVDT position transducer (pilot valve)
⑦ air bleeding
⑧ air suction port

LIQZA-L-322*

LIQZA-L

Ex-proof digital proportional 2-way cartridges, high performance with two LVDT position transducers (pilot valve and main stage) for best accuracy in not compensated flow regulations.

They are equipped with ex-proof proportional solenoid and LVDT transducers certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)

The flameproof enclosure of solenoid and transducers prevent the propagation of accidental internal sparks or fire to the external environment.
They are designed to limit the surface temperature within the classified limits.

Size: **25** ÷ **100** - ISO 7368
Max flow: **1200** ÷ **16000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZA	/	*	-	L	-	25	2	L4	/	M	/	*	/	*

LIQZA: Ex-proof proportional cartridge

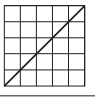
***** — **Certification**:
Multicertification ATEX, IECEx:
- = omit for Group II 2G
M = Group I (mining)

L = with two LVDT transducers

25 — **Valve size** and nominal flow (l/min) at Δp 5 bar:
25 = 500
32 = 800
40 = 1200
50 = 2000
63 = 3000
80 = 4500
100 = 7200

2 — **Configuration:** **2** = 2 way

L4 — **Poppet type,** regulating characteristics:
L4 = linear

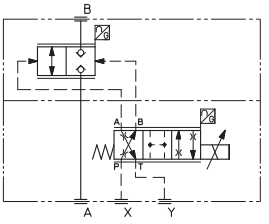


M — **Solenoid and transducers** (main stage and pilot valve) **threaded connection** for cable gland fitting:
GK = GK-1/2" **(1)**
M = M20x1,5
NPT = 1/2" NPT

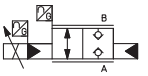
***** — Series number

***** — **Seals material**, see section 8 :
- = NBR
PE = FKM
BT = HNBR

functional symbol



simplified symbol



(1) Approved only for the italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-LEB-* /A	E-BM-LES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	GS230	GS240

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size		**25**	**32**	**40**	**50**	**63**	**80**	**100**
Max regulated flow	[l/min]							
Δp A-B at Δp = 5 bar		500	800	1200	2000	3000	4500	7200
at Δp = 10 bar		700	1100	1700	2800	4250	6350	10200
Max permissible flow		1200	1800	2500	4000	6000	10000	16000
Max pressure	[bar]	Ports A, B = **420** X = 350 Y ≤ 10						
Nominal flow of pilot valve at Δp = 70 bar	[l/min]	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar	[l/min]	0,2	0,3	0,7	0,7	1	1	1
Piloting pressure	[bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160						
Piloting volume	[cm³]	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow **(1)**	[l/min]	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal **(2)**	[ms]	≤ 30	≤ 32	≤ 35	≤ 35	≤ 40	≤ 45	≤ 55
Hysteresis	[% of the max regulation]	≤ 0,1						
Repeatability	[% of the max regulation]	± 0,1						
Thermal drift		zero point displacement < 1% at ΔT = 40°C						

(1) 0÷100% step signal
(2) With pilot pressure = 140 bar

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree with relevant cable gland	IP66/67 to DIN EN60529
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

⚠ **WARNING**
The loss of the pilot pressure causes the undefined position of the main poppet.
The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet.
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

7 CERTIFICATION DATA

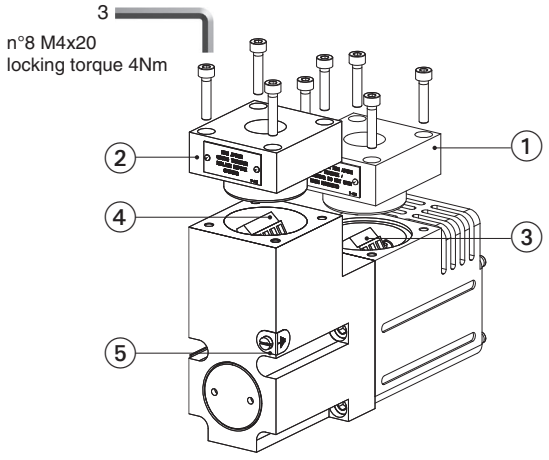
Valve type	LIQZA		LIQZA**/M**	LIQZA, LIQZA**/M**
Component type	Pilot solenoid and LVDT transducer			LVDT main stage transducer
Certifications	Multicertification Group II **ATEX IECEx**		Multicertification Group I **ATEX IECEx**	Multicertification Group I and II **ATEX IECEx**
Solenoid certified code	**OZA-T**		**OZAM-T**	**ETHA-15**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	ATEX: TUV IT 16 ATEX 053X ICEX: IECEX TPS 16.0003X
Method of protection	• ATEX Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T85°C/T200°C Db		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• ATEX Ex II 2G Ex db IIC T6 Gb Ex II 2D Ex tb IIIC T85°C Db Ex I M2 Ex db IMb • IECEx Ex db IIC T6 Gb Ex tb IIIC T85°C Db Ex db IMb
Temperature class	**T4**	**T3**	**-**	**T6**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 85 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +70 °C **(3)**
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code
(3) For Group I (mining) the temperaturerange is -20°C ÷ +70°C

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX PROOF SOLENOIDS AND LVDT TRANSDUCER WIRING

Pilot valve solenoid and LVDT transducer



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

Solenoid wiring

1 = Coil
2 = GND
3 = Coil

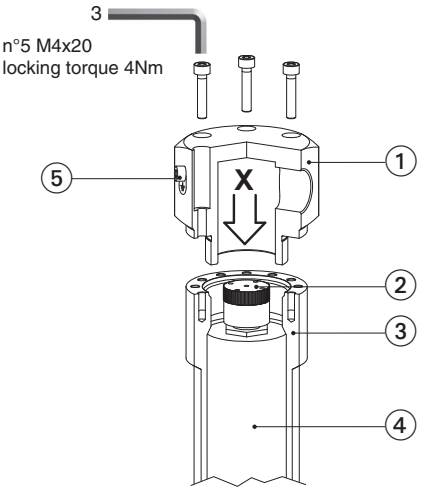
PCB 3 poles terminal board
suitable for wires cross sections
up to 2,5 mm² (max AWG14)

Position transdducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

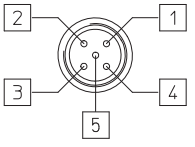
PCB 4 poles terminal board
suitable for wires cross sections
up to 2,5 mm² (max AWG14)

LVDT main stage transducer



① transducer cover with threaded connection for cable gland fitting
② transducer terminal board for cables wiring
③ ex-proof protection for LVDT transducer
④ LVDT transducer
⑤ screw terminal for additional equipotential grounding

Transducer wiring - view from **X**



1 = Do not connect
2 = Supply +15 V
3 = GND
4 = Output signal
5 = Supply -15 V

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²
Main LVDT transducer: section of cable connection wires = 1 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]		
[°C]	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II	LVDT main stage
40 °C	-	T4	150 °C	135 °C	-	90 °C	-
60 °C	-	-	150 °C	-	110 °C	-	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C	90°C

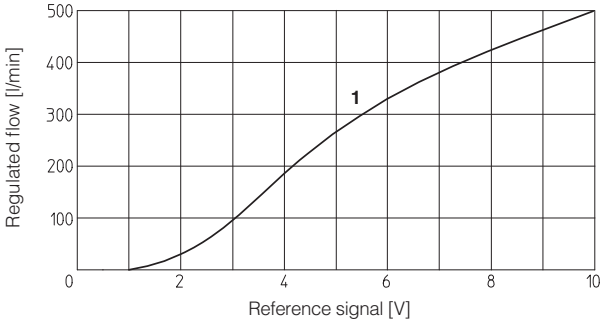
10 CABLE GLANDS

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

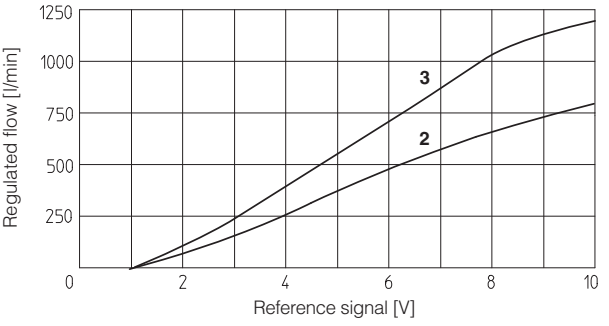
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

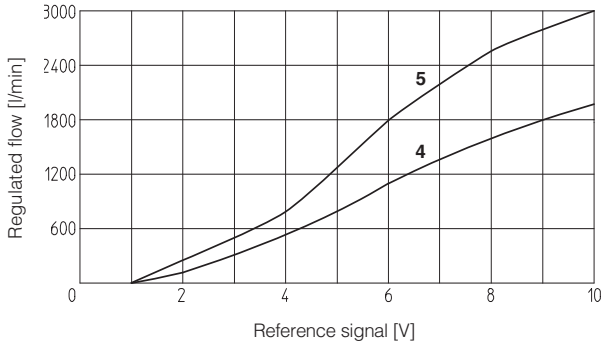
11.1 Regulation diagrams (values measured at Δp 5 bar)



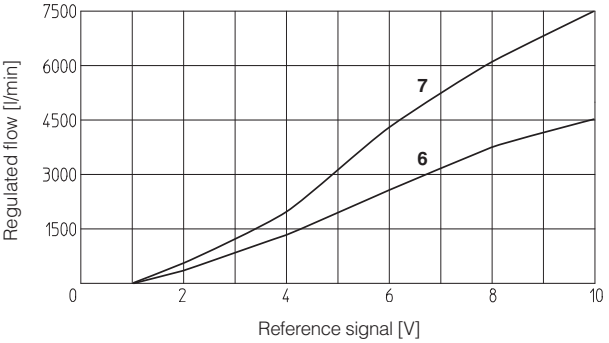
1 = LIQZA-L-25*



2 = LIQZA-L-32* **3** = LIQZA-L-40*



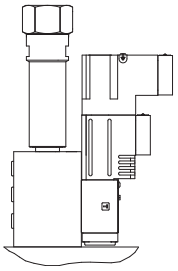
4 = LIQZA-L-50* **5** = LIQZA-L-63*

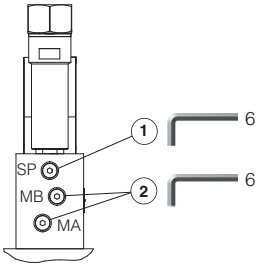


6 = LIQZA-L-80* **7** = LIQZA-L-100*

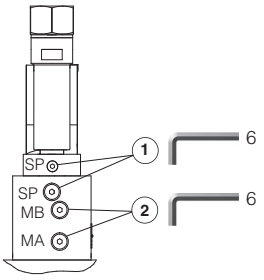
12 AIR BLEEDING

Size 25

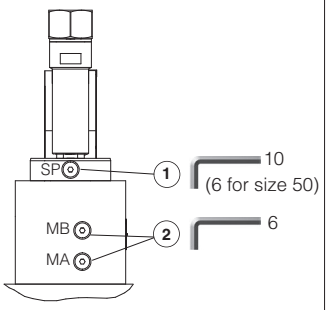




Sizes 32, 40



Sizes 50 to 100



(1) Air suction port (SP):

N° 1 plug G1/4" for sizes 25 to 50
N° 1 plug G1/2" for sizes 63 and 100

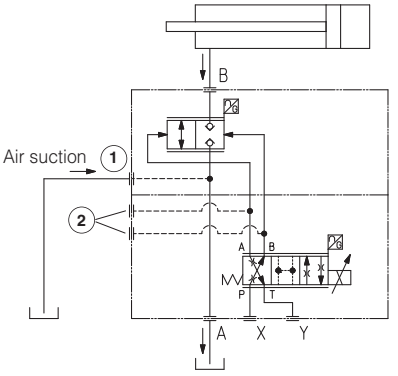
To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

(2) Air bleeding (MA, MB):

N° 2 plugs G1/4"

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.

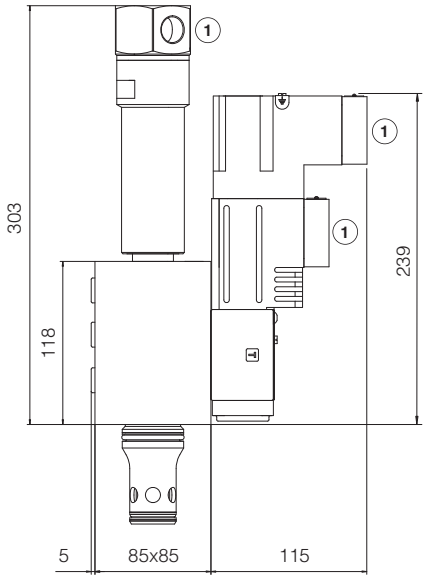


13 FASTENING BOLTS AND VALVE MASS

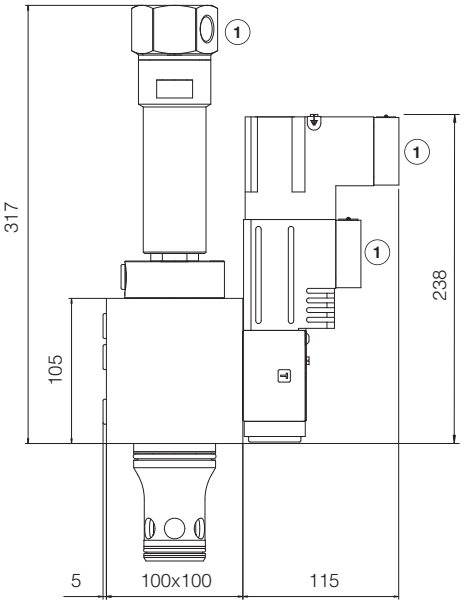
Type	Size	**Fastening bolts** (supplied with the valve)	Mass [kg]
LIQZA	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	12
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	14,8
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	20,5
	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	22,8
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	48,1
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	75,7
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	127,1

14 INSTALLATION DIMENSIONS [mm]

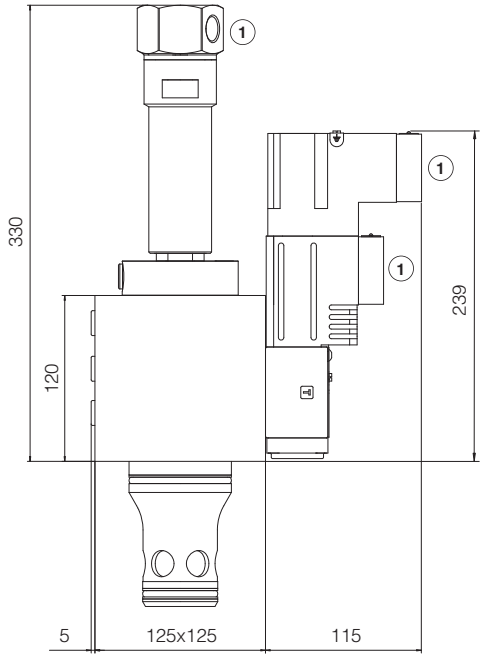
LIQZA-L-252



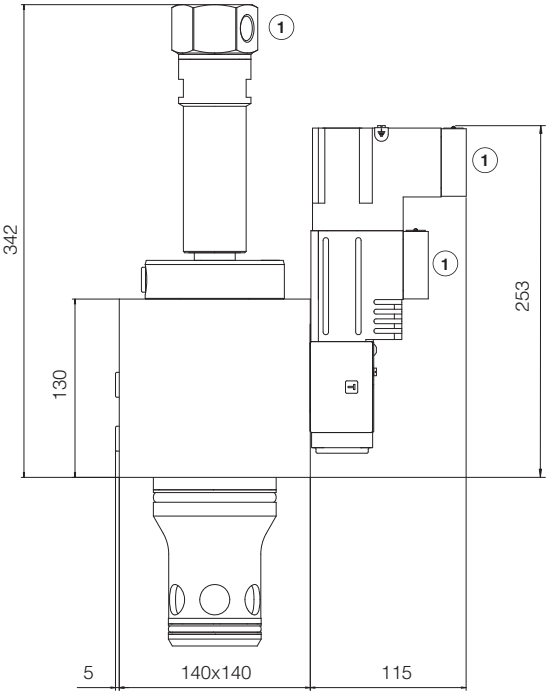
LIQZA-L-322



LIQZA-L-402



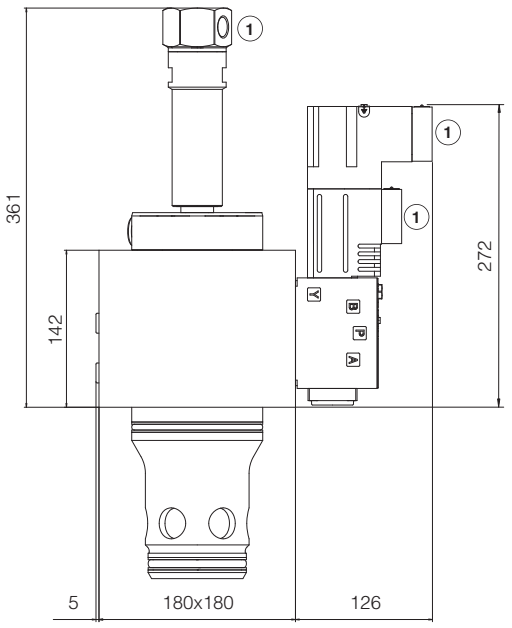
LIQZA-L-502



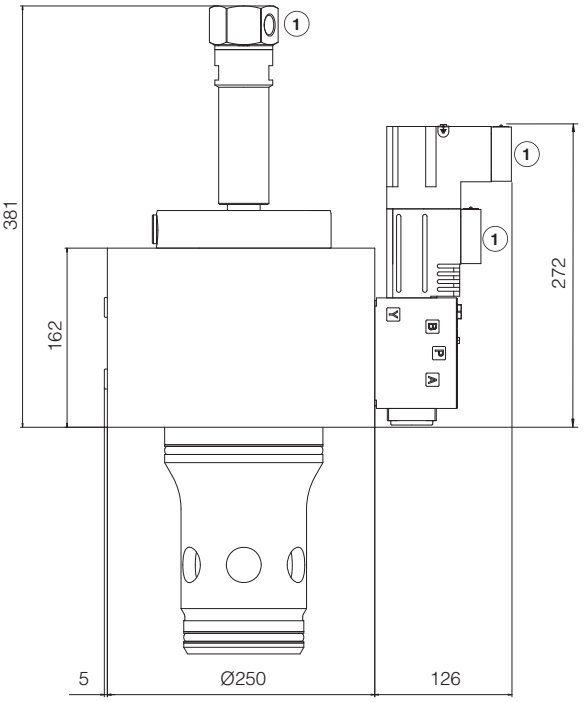
(1) = The dimensions of all cable glands must be considered (see tech. table **KX800**)

Note: for mounting surface and cavity dimensions, see table P006

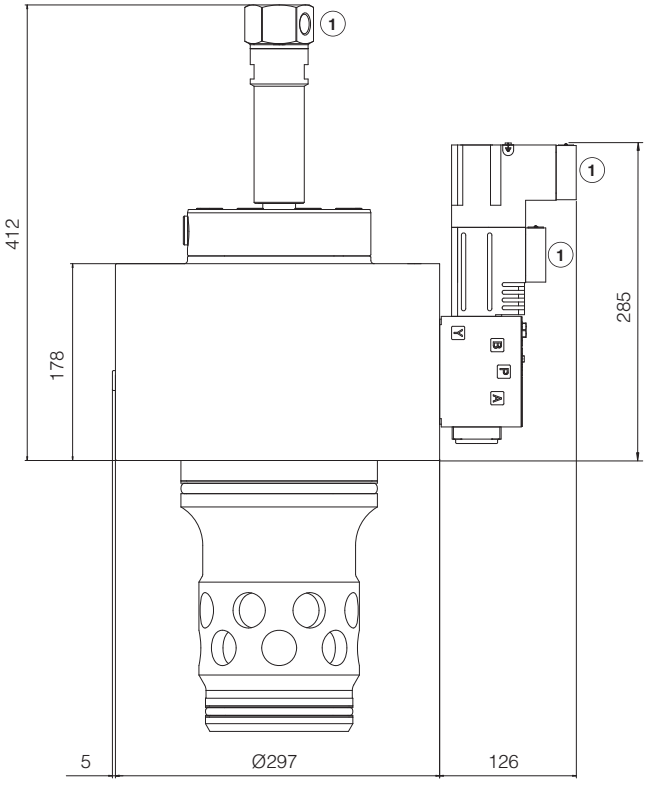
LIQZA-L-632



LIQZA-L-802



LIQZA-L-1002



(1) = The dimensions of all cable glands must be considered (see tech. table **KX800**)

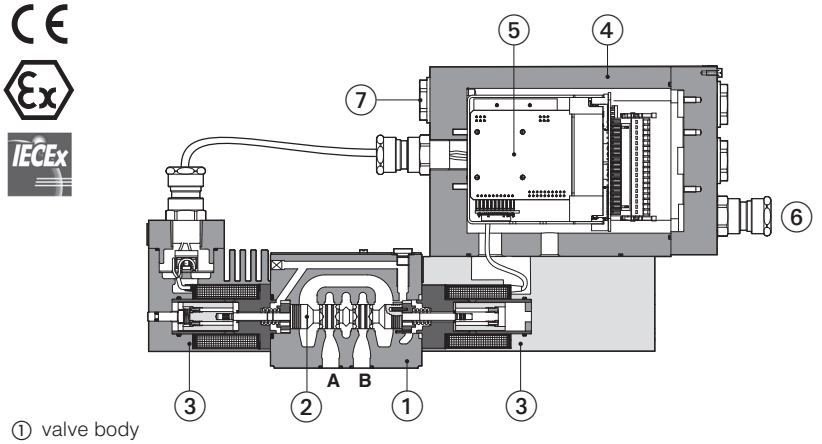
Note: for mounting surface and cavity dimensions, see table P006

15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**KX800**	Cable glands for ex-proof valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**P006**	Mounting surfaces and cavities for cartridge valves
FX900	Operating and manintenance information for ex-proof proportional valves		

Ex-proof digital proportional directional valves

direct, with on-board driver, without transducer and with positive spool overlap **ATEX and IECEx**



① valve body
② spool
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof cable glands (to be ordered separately)
⑦ USB port always present (factory plugged)

DKZA-AES-NP-17*

DHZA-AES, DKZA-AES

Ex-proof digital proportional valves direct, without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

They are equipped with ex-proof on-board digital driver and proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

DHZA:
Size: **06** -ISO 4401
Max flow: **60 l/min**
Max pressure: **350 bar**

DKZA:
Size: **10** -ISO 4401
Max flow: **120 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DHZA	-	AES	-	NP	-	0	71	-	L	5	/	M	/	*	*	/	*

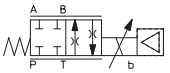
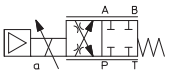
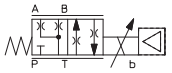
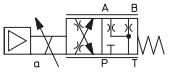
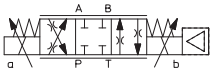
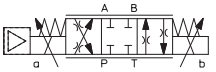
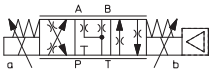
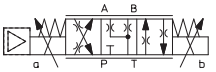
DHZA = Ex-proof proportional directional valves, direct
DHZA = size 06
DKZA = size 10

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 4401:
0 = 06 **1** = 10

Configuration:

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

Seals material, see section [8]:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid with integral digital electronics at side of port A **(2)**
Y = external drain

Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **W** (omit for std voltage 0 ÷ 10 VDC)
I = current reference input 4 ÷ 20 mA (omit for std voltage ±10 VDC)
W = power limitation function

Cable entrance threaded connection:
M = M20x1,5

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZA =	1	4,5	8	18	28
DKZA =	-	-	-	45	60

Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics:


L = linear


S = progressive


D = differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) For possible combined options, see section [14]
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

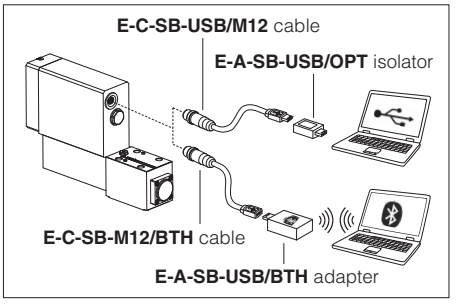
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

5 GENERAL CHARACTERISTICS

Assembly position	Horizontal position only
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years; 150 years only for RZMA-010, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DHZA**						**DKZA**		
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y); **Y** = 10						ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y); **Y** = 10		
Configuration		**51, 53, 71, 73**					**70**	**51, 53, 71, 73**		**70**
Spool type		**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**	**L5**	**L3,S3,D3**	**L5,S5,D5**	**L3,L5,D5**
Nominal flow [l/min]										
Δp P-T	Δp= 10 bar	1	4,5	8	18	28		45	60	
	Δp= 30 bar	1,7	8	14	30	50		80	100	
Max permissible flow		2,6	12	21	40	60		90	120	
Δp max P-T [bar]		70	70	70	50	50		40	40	
Response time [ms] **(1)**		≤ 35						≤ 45		
Leakage [cm³/min]		<30 (at P = 100 bar); <135 (at P = 350 bar)						<80 (at P = 100 bar); <600 (at P = 315 bar)		
Hysteresis		≤ 5 [% of max regulation]								
Repeatability		± 1 [% of max regulation]								

(1) 0 ÷ 100% step signal

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: maximum range ± 5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply (only /W option)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

9 CERTIFICATION DATA

Valve type		DHZA, DKZA				
Certifications		Multicertification Group II **ATEX IECEx**				
Solenoid certified code		**OZA-AES**				
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X		
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db		
Temperature class	Single solenoid valve	**T6**	**-**	**T5**	**T4**	**-**
	Double solenoid valve	**-**	**T4**	**-**	**-**	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards		EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31	
Cable entrance: threaded connection		**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

11 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 15.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

13 ELECTRONIC OPTIONS

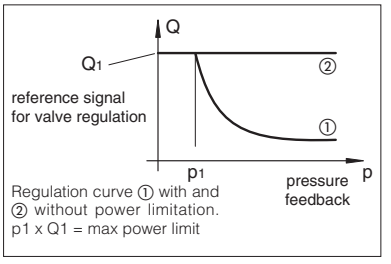
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only in combination with option **/W**
It is available to connect pressure transducer with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10VDC .Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator type HC-011 or KC-011 (see tech table D150).
It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}}\ ;\ \text{Flow Reference [INPUT+]}\right)$$

Hydraulic Power Limitation - option /W



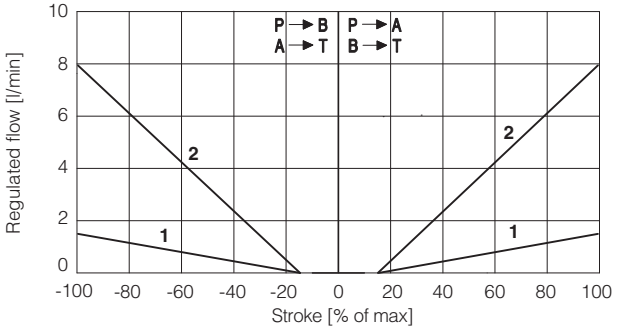
Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

14 POSSIBLE COMBINED OPTIONS

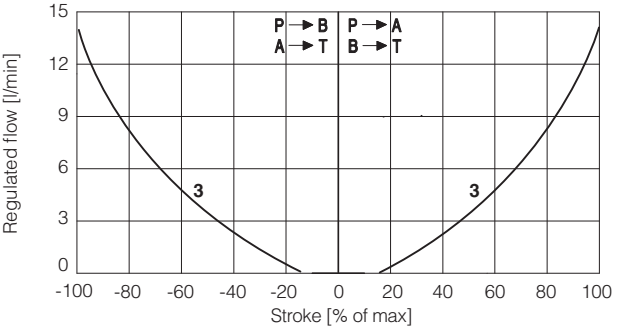
/BI, /BW, /BY, /IW, /IY, /WY, /BIW, /BIY, /BWY, /IWY, /CWB, /CWY, /BIWY, /CWBY

15 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

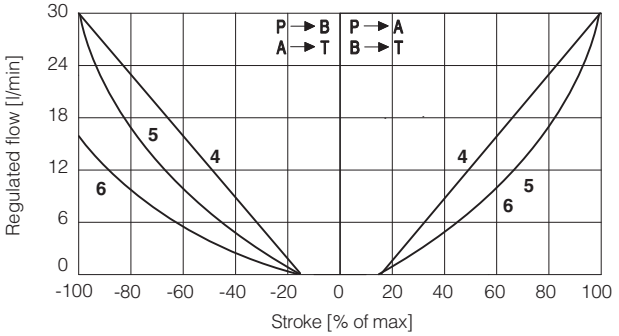
15.1 Regulation diagrams - values measure at Δp 30 bar P-T



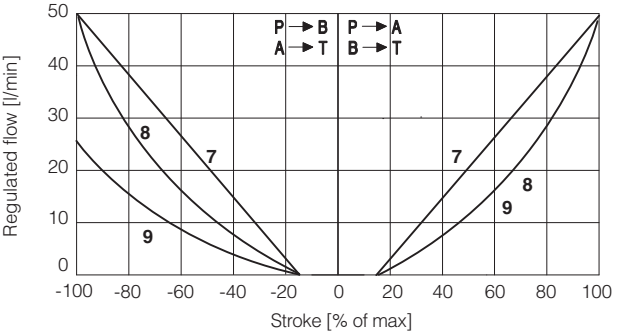
DHZA **1** = L14 **2** = L1



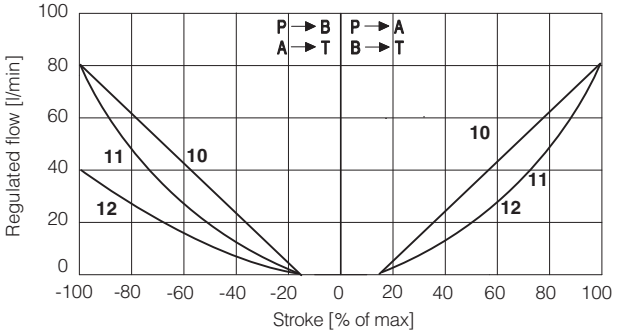
DHZA **3** = S2



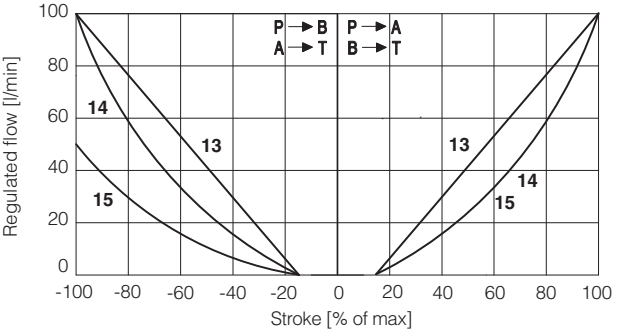
DHZA **4** = L3 **5** = S3 **6** = D3



DHZA **7** = L5 **8** = S5 **9** = D5



DKZA **10** = L3 **11** = S3 **12** = D3



DKZA **13** = L5 **14** = S5 **15** = D5

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC

16.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

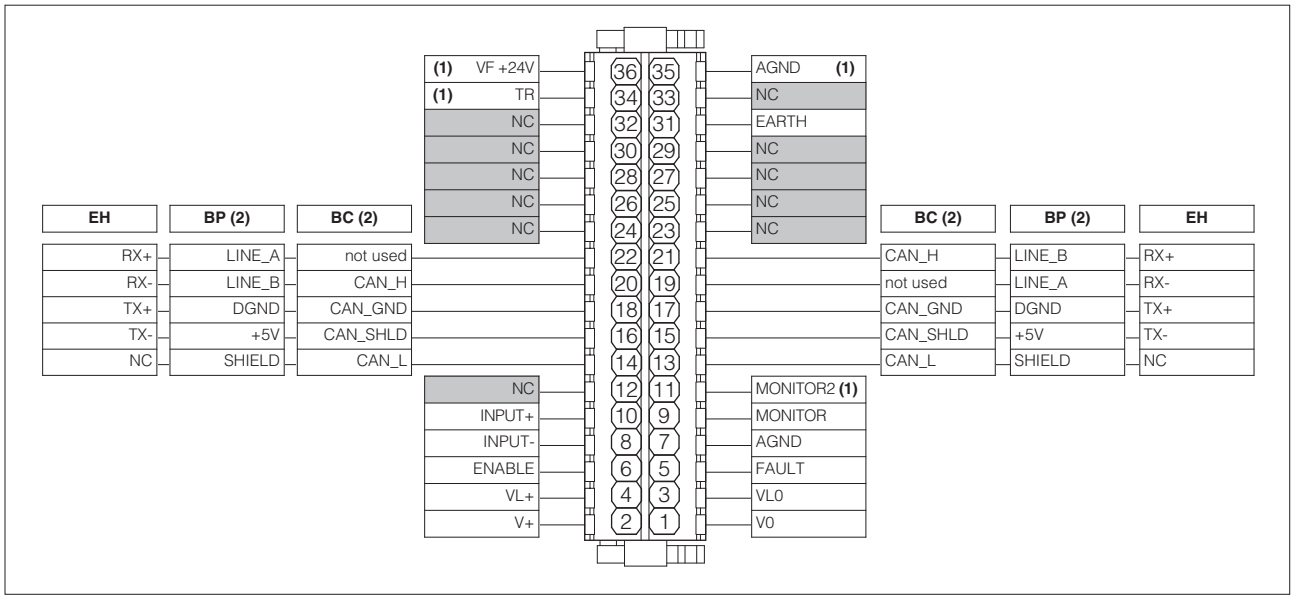
16.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16.7 Remote Pressure Transducer Input signal (TR) - only for **/W** option

Analog pressure transducers can be directly connected to the driver.
Analog input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

17 TERMINAL BOARD OVERVIEW



(1) Connections available only for /W option
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

18 ELECTRONIC CONNECTIONS

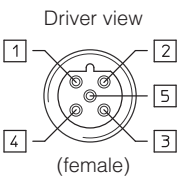
18.1 Main connections signals

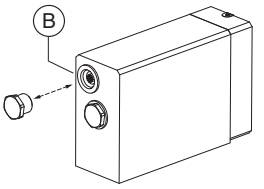
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to AGND Default is: ±5 VDC	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**MONITOR2**	2nd monitor output signal: ±5 VDC maximum range, referred to AGND **(1)** Default is: 0 ÷ 5 VDC	Output - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) 2nd monitor output signal is available only for /W option

18.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





18.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

18.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

18.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

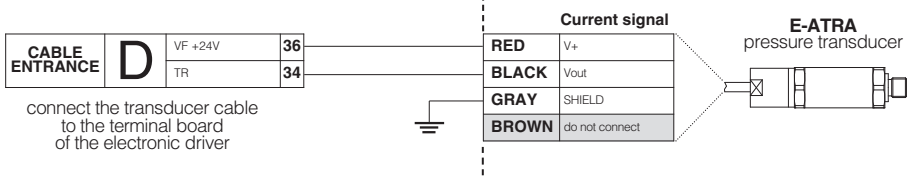
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

18.6 Remote pressure transducer connector - only for /W option

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	Voltage	Current
D	34	**TR**	Signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

for **/W** option



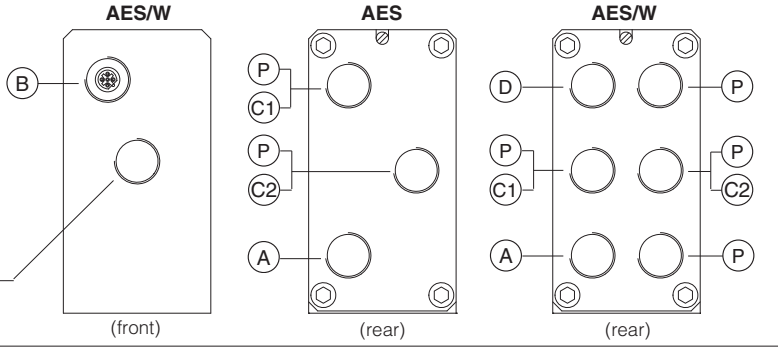
19 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

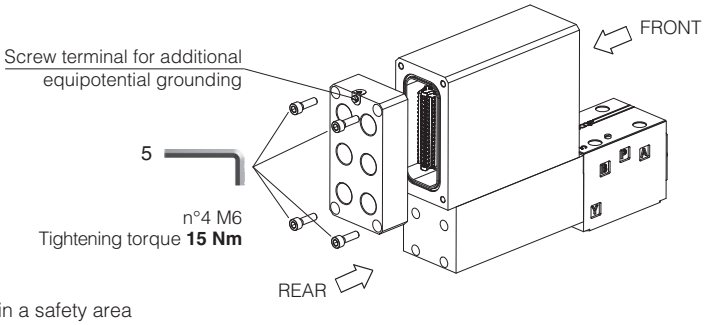
- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (D) pressure transducer (only /W option)
- (P) Threaded plug

COIL CONNECTION
only for double solenoid version - factory wired
(for single solenoid version - factory plugged)



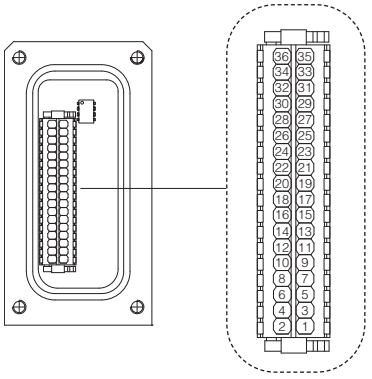
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

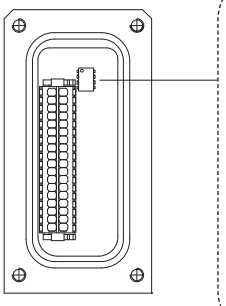


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 17

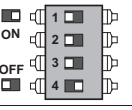


Fieldbus terminator only for BC and BP executions **(1)**



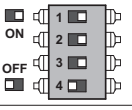
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

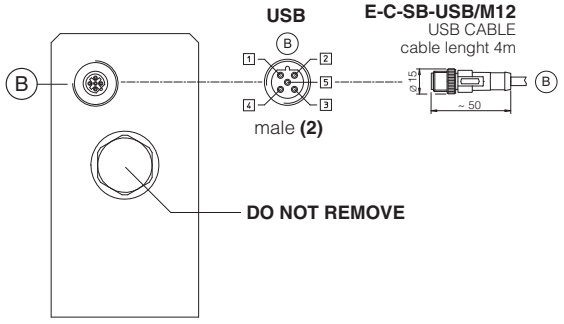


BP - PROFIBUS DP setting:

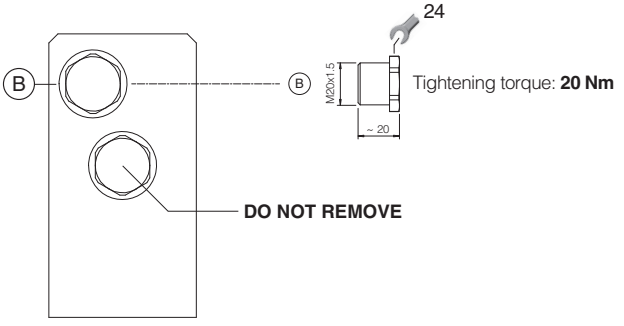
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

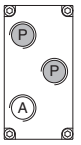
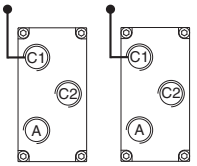
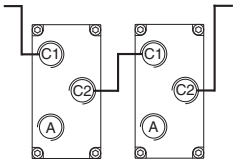


METALLIC PROTECTION CAP - supplied with the valves

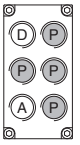
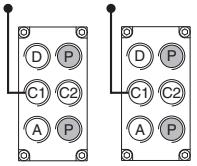
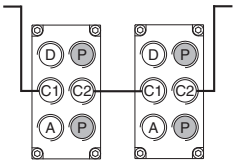


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

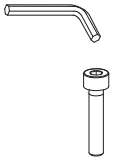
19.1 Cable glands and threaded plug for AES - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

19.2 Cable glands and threaded plug for AES with /W option - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D A	none	none		Cable entrance P are factory plugged Cable entrance A, D are open for costumers
BC, BP, EH "via stub" connection	3	D C1 A	1	C2		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers
BC, BP, EH "daisy chain" connection	4	D C1 - C2 A	none	none		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers

20 FASTENING BOLTS AND SEALS

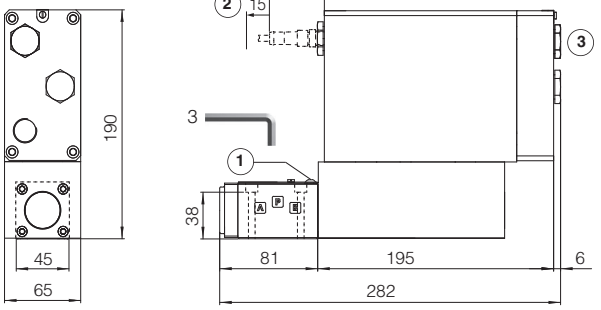
	DHZA	DKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

21 INSTALLATION DIMENSIONS FOR DHZA [mm]

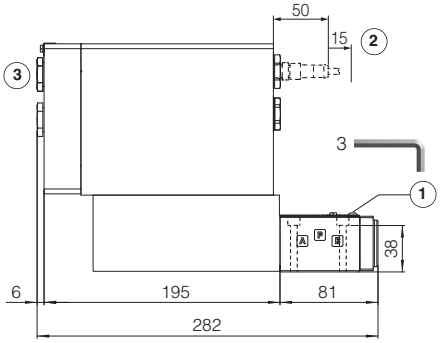
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface: 4401-03-03-0-05 without port X)

Mass [kg]	
DHZA-AES-05	8,2
DHZA-AES-07	9,9

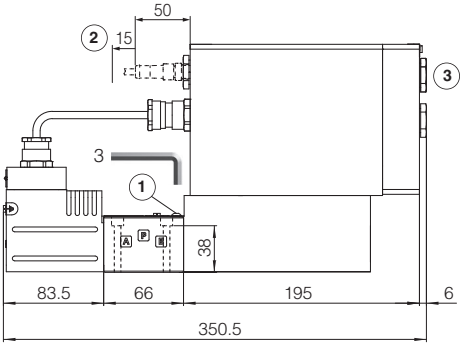
DHZA-AES-05*



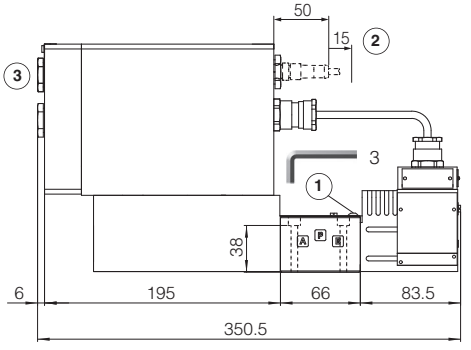
DHZA-AES-05*/B



DHZA-AES-07*



DHZA-AES-07*/B



(1) = Air bleed off

(2) = Space to remove the USB connector

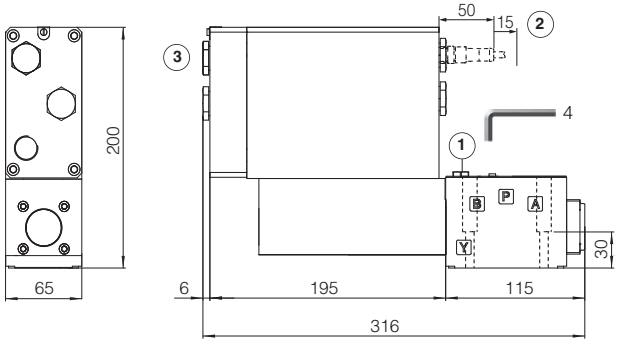
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

22 INSTALLATION DIMENSIONS FOR DKZA [mm]

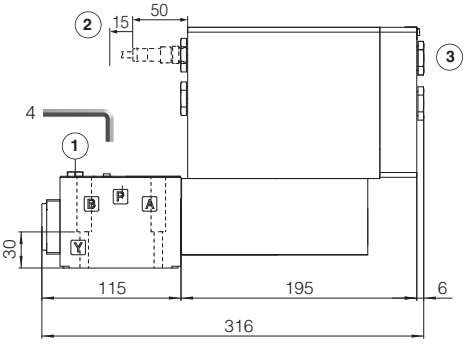
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface: 4401-05-05-0-05 without port X)

Mass [kg]	
DKZA-AES-15	10
DKZA-AES-17	11,7

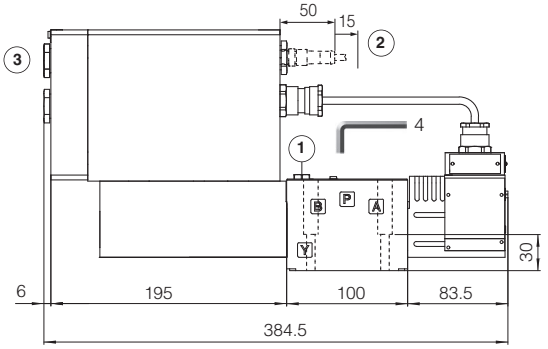
DKZA-AES-15*



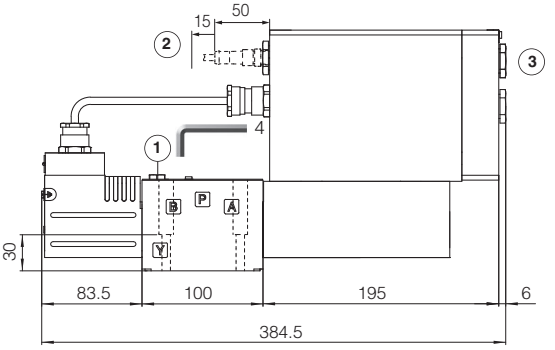
DKZA-AES-15*/B



DKZA-AES-17*



DKZA-AES-17*/B



(1) = Air bleed off

(2) = Space to remove the USB connector

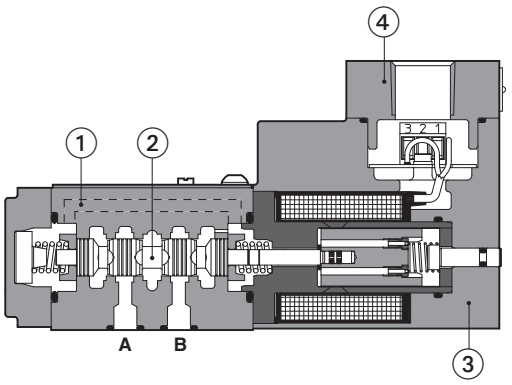
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

23 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GX800**	Ex-proof pressure transducer type E-ATRA-7
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		
GS510	Fieldbus		

Ex-proof proportional directional valves

direct, without transducer and with positive spool overlap - **ATEX, IECEx, EAC, PESO** or **cULus**



DHZA-A-05*

① valve body
② spool
③ ex-proof solenoid
④ threaded connections for cable clamp or conduit pipe

DHZA-A, DKZA-A

Ex-proof proportional valves direct, without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.
They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

DHZA:	**DKZA**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **60 l/min**	Max flow: **120 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZA	/	*	-	A	-	0	51	-	L	5	-	M	/	*	/	*	*	/	*

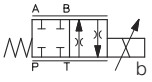
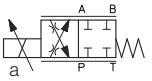
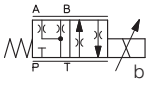
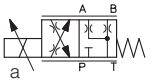
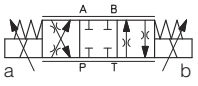
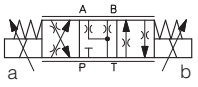
DHZA
Ex-proof proportional directional valves, direct
DHZA = size 06
DKZA = size 10

Certification type:
Multicertification ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

Valve size ISO 4401:
0 = 06 **1** = 10

Configuration:

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

Spool size:

	14 (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZA =	1	4,5	8	18	28
DKZA =	-	-	-	45	60

Nominal flow (l/min) at Δp 10 bar P-T

Spool type - regulating characteristics:

L = linear 
S = progressive 
D = differential-progressive 
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (5)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
B = solenoid at side of port A
MV = vertical hand lever (only for DHZA) **(4)**
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap
Y = external drain

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: all combination are available, with exception of MV + WP
(4) MV option is available only for **DHZA** with spool type **S3, S5, D3, D5, L3, L5**, not available in combination with **WP** option
(5) Approved only for italian market

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHZA						DKZA		
Pressure limits [bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y); **Y** = 10						ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y); **Y** = 10		
Configuration	**51, 53, 71, 73**					**70**	**51, 53, 71, 73**		**70**
Spool type	**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**	**L5**	**L3,S3,D3**	**L5,S5,D5**	**L3,L5,D5**
Nominal flow [l/min]									
Δp P-T Δp= 10 bar	1	4,5	8	18	28		45	60	
Δp P-T Δp= 30 bar	1,7	8	14	30	50		80	100	
Max permissible flow	2,6	12	21	40	60		90	120	
Δp max P-T [bar]	70	70	70	50	50		40	40	
Response time **(1)** [ms]	≤ 35						≤ 45		
Leakage [cm³/min]	<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (at p = 315 bar)		
Hysteresis	≤ 5 [% of max regulation]								
Repeatability	± 1 [% of max regulation]								

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max. power	35W	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

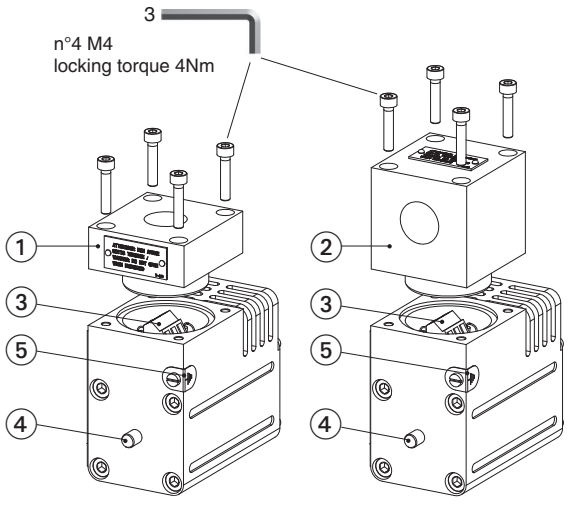
Valve type	DHZA, DKZA		DHZA**/M**, DKZA**/M**	DHZA**/UL**, DKZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX PROOF SOLENOIDS WIRING

Multicertification



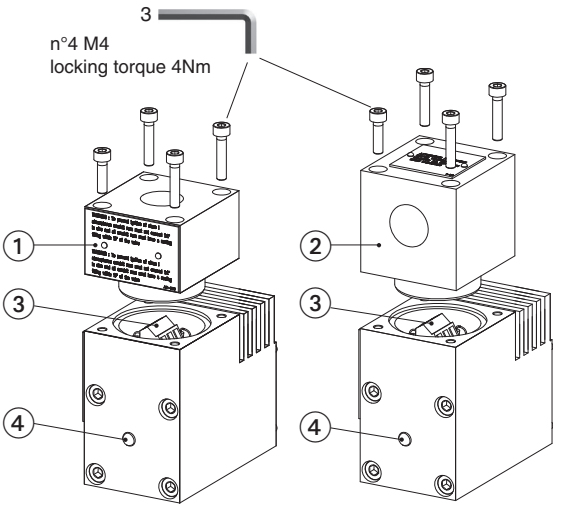
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

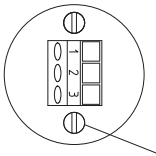
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section [9] note 1

alternative GND screw terminal connected to solenoid housing

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

10 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 OPTIONS

B = Solenoid at side of port A of the main stage

MV = Auxiliary vertical hand levers (only for DHZA)

This option allows to operate the valves in absence of electrical power supply, i.e. during commissioning, maintenance or in case of emergency.
When the valve is electrically operated the hand lever remains stopped in its rest position
The hand lever execution does not affect the performances of the original valves

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

O = Horizontal cable entrance, to be selected in case of limited vertical space

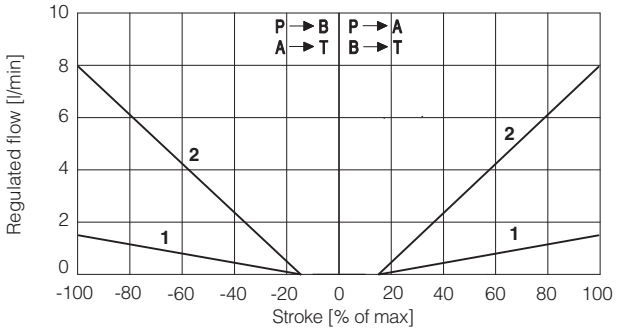
WP = Manual override protect by metallic cap.

Y = External drain, to be selected if the pressure at T port is higher than the max allowed limits

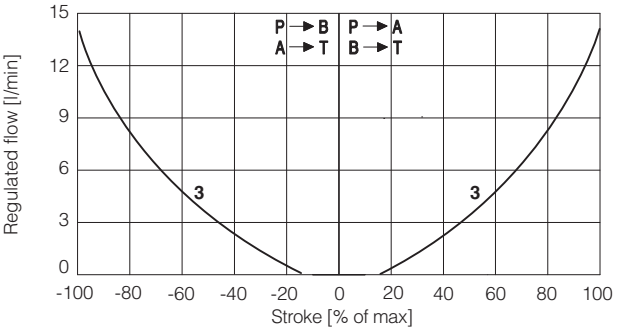
11.1 Possible combined options: all combination are available

12 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

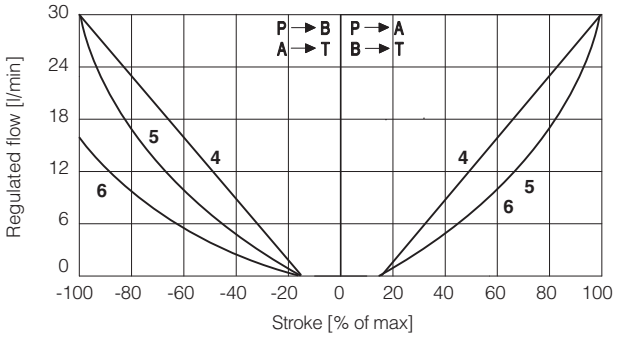
Regulation diagrams - values measure at Δp 30 bar P-T



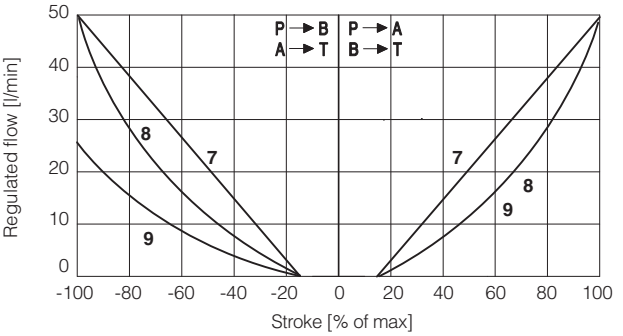
DHZA **1** = L14 **2** = L1



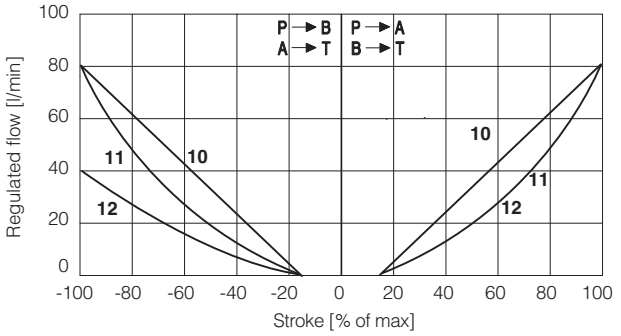
DHZA **3** = S2



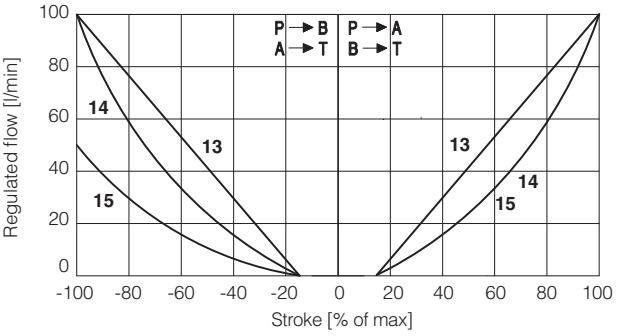
DHZA **4** = L3 **5** = S3 **6** = D3



DHZA **7** = L5 **8** = S5 **9** = D5

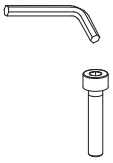


DKZA **10** = L3 **11** = S3 **12** = D3



DKZA **13** = L5 **14** = S5 **15** = D5

13 FASTENING BOLTS AND SEALS

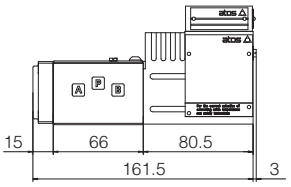
	DHZA	DKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports P, A, B, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports P, A, B, T: Ø 11,5 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

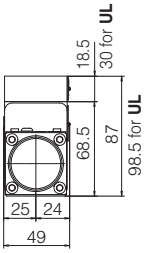
14 INSTALLATION DIMENSIONS FOR DHZA [mm]

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(for /Y surface: 4401-03-03-0-05 without port X)

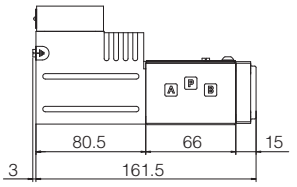
Mass [kg]	
DHZA-A-05	2,65
DHZA-A-07	4,3
Option /O	+0,35
Option /WP	+0,25

DHZA-A-05*

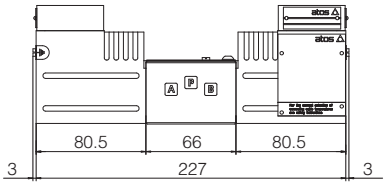




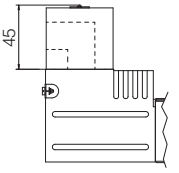
DHZA-A-05*/B



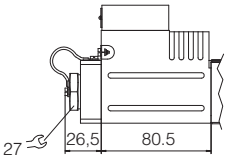
DHZA-A-07*



option /O



option /WP

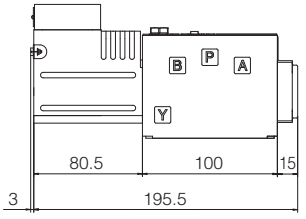


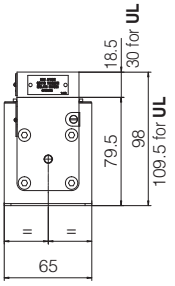
15 INSTALLATION DIMENSIONS FOR DKZA [mm]

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-05-04-0-05
(for /Y surface: 4401-05-05-0-05 without port X)

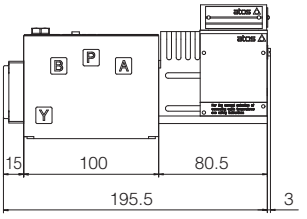
Mass [kg]	
DKZA-A-15	4,8
DKZA-A-17	6,5
Option /O	+0,35
Option /WP	+0,25

DKZA-A-15*

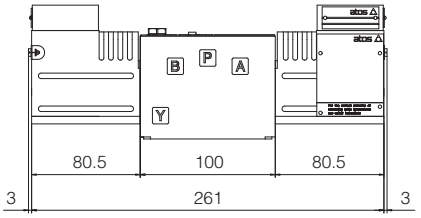




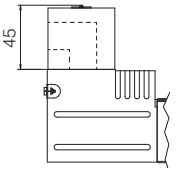
DKZA-A-15*/B



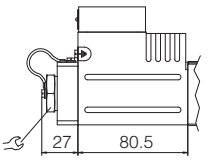
DKZA-A-17*



Option /O



Option /WP

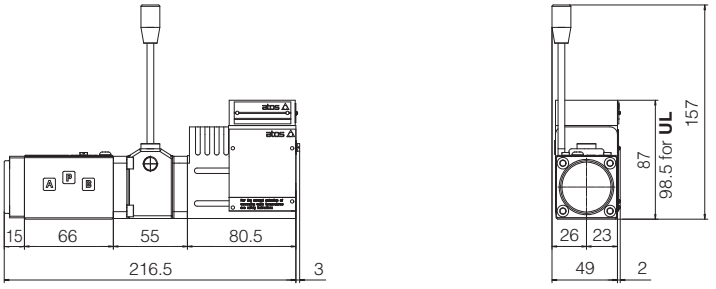


16 INSTALLATION DIMENSIONS FOR DHZA WITH OPTION /MV [mm]

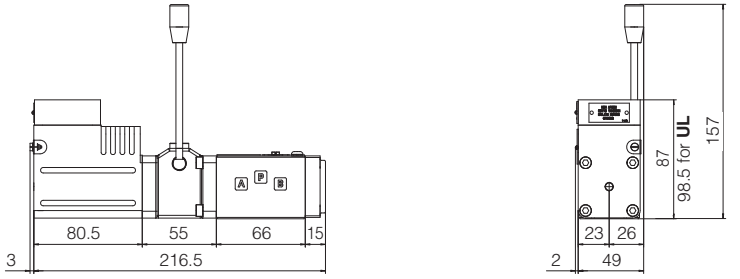
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(for /Y surface: 4401-03-03-0-05 without port X)

Mass [kg]	
DHZA-A-05	2,9
DHZA-A-07	4,6
Option /O	+0,35

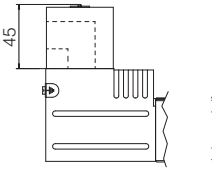
DHZA-A-05*/MV



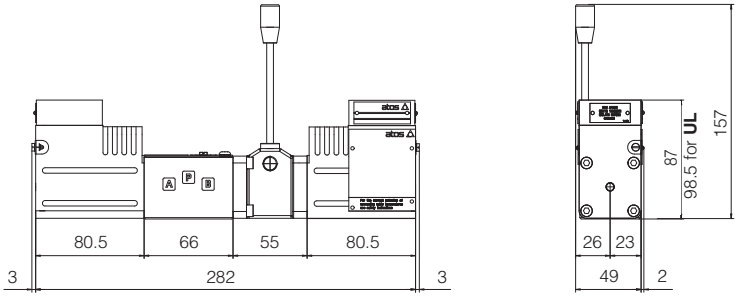
DHZA-A-05*/BMV



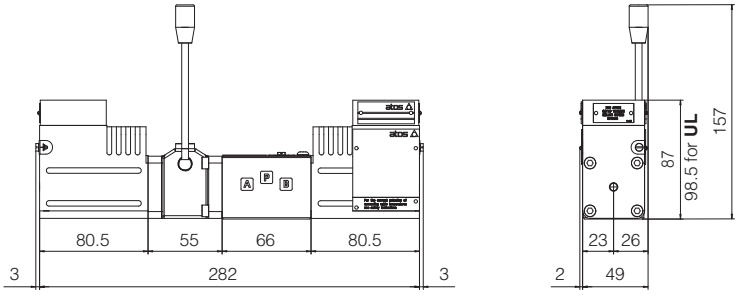
option /O



DHZA-A-07*/MV



DHZA-A-07*/BMV

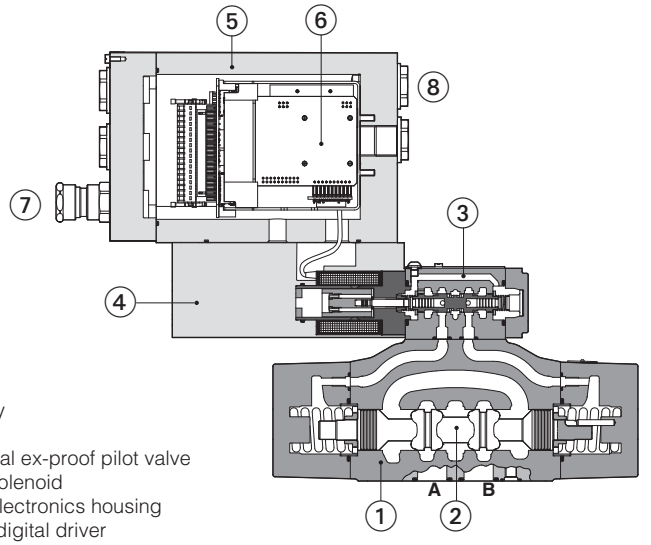


17 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional directional valves

Piloted, with on-board driver, without position transducer and with positive spool overlap **ATEX and IECEx**



① valve body
② spool
③ proportional ex-proof pilot valve
④ ex-proof solenoid
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

DPZA-AES-NP-25*

DPZA-AES

Ex-proof digital proportional valves, piloted, without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

They are equipped with ex-proof on-board digital driver and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **10** ÷ **32** -ISO 4401

Max flow: **180** ÷ **1500 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPZA	-	AES	-	NP	-	1	71	-	L	5	/	M	/	*	*	/	*

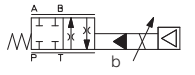
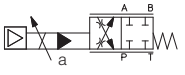
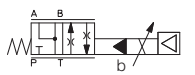
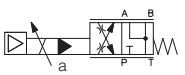
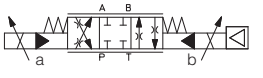
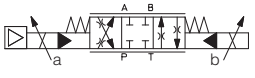
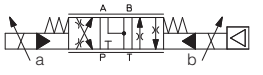
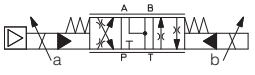
DPZA — Ex-proof proportional directional valve, piloted

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration (1):

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (1):
B = solenoid and integral electronics at side of port B of the main stage (side A of pilot valve) **(2)**
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **W** (omit for std voltage 0 ÷ 10 VDC)
I = current reference input 4 ÷ 20 mA (omit for std voltage ±10 VDC)
W = power limitation function

Cable entrance threaded connection:
M = M20x1,5

Spool size:	**3** (L,S,D)	**5** (L,S,D)
DPZA-1 =	-	100
DPZA-2 =	160	250
DPZA-4 =	-	480
DPZA-6 =	-	640

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:

L = linear 

S = progressive 

D = differential-progressive 

P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) For possible combined options, see section 14
(2) In standard configuration the solenoid (config. 51 and 53) and the on-board digital driver are at side A of the main stage (side B of pilot valve)

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

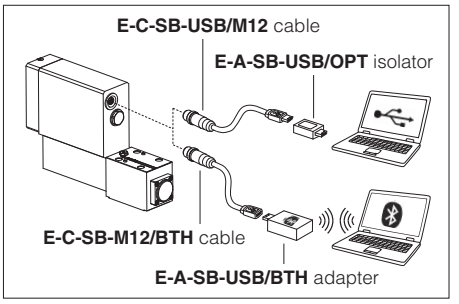
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model			**DPZA-*-1**	**DPZA-*-2**		**DPZA-*-4**	**DPZA-*-6**
Pressure limits		[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type			**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**		
Nominal flow	[l/min]						
Δp P-T		Δp = 10 bar	100	160	250	480	640
		Δp = 30 bar	160	270	430	830	1100
		max permissible flow	180	400	550	900	1500
Δp max P-T		[bar]	50	60	60	60	60
Piloting pressure		[bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)				
Piloting volume		[cm³]	1,4	3,7		9,0	21,6
Piloting flow **(1)**		[l/min]	1,7	3,7		6,8	14,4
Leakage **(2)**	Main stage	[l/min]	0,15/0,5	0,2/0,6		0,3/1,0	1,0/3,0
Response time **(1)**		[ms]	≤ 90	≤ 110		≤ 130	≤ 190
Hysteresis			≤ 5 [% of max regulation]				
Repeatability			± 1 [% of max regulation]				

(1) 0 ÷100 % step signal and pilot pressure 100 bar
(2) at p = 100/350 bar

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: maximum range ± 5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply (only /W option)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

9 CERTIFICATION DATA

Valve type		DPZA				
Certifications		Multicertification Group II **ATEX IECEx**				
Solenoid certified code		**OZA-AES**				
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X		
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db		
Temperature class	Single solenoid valve	**T6**	**-**	**T5**	**T4**	**-**
	Double solenoid valve	**-**	**T4**	**-**	**-**	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards		EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31	
Cable entrance: threaded connection		**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

11 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 HYDRAULIC OPTIONS

B = DPZA-*-*5 = solenoid and integral electronics at side of port B of the main stage.
DPZA-*-*7 = integral electronics at side of port B of the main stage.

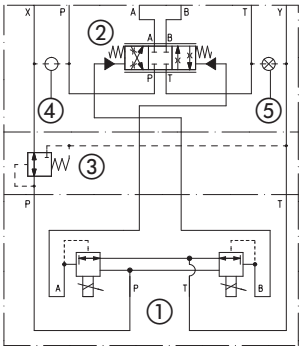
D and **E** = Pilot and drain configuration can be modified as shown in section 13 .
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:

Option /D Internal drain.

Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZA-1 and -2 = 28 bar
DPZA-4 and -6 = 40 bar
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

FUNCTIONAL SCHEME
example of configuration 7*
3 positions, spring centered



① Pilot valve ② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

13 ELECTRONIC OPTIONS

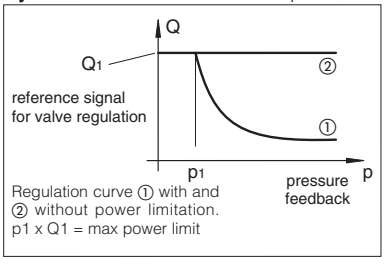
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only in combination with option **/W**
It is available to connect pressure transducer with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator type HC-011 or KC-011 (see tech table D150).
It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} ; \text{Flow Reference [INPUT+]} \right)$$

Hydraulic Power Limitation - option /W



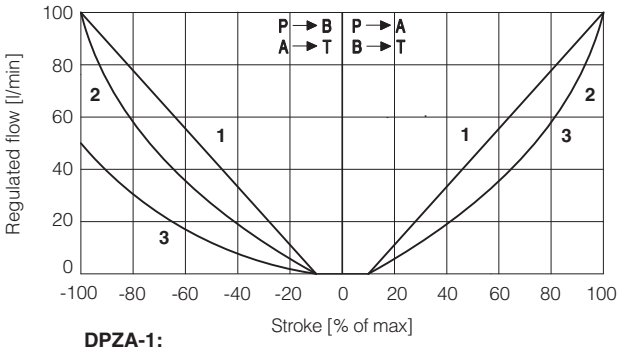
Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

14 POSSIBLE COMBINED OPTIONS

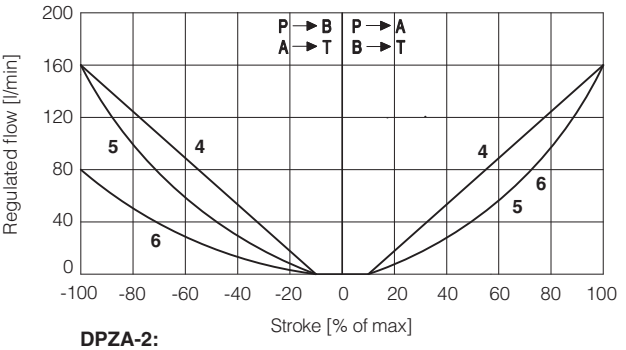
Hydraulic options: all combination possible
Electronics options: /IW, /CW, /CWI

15 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

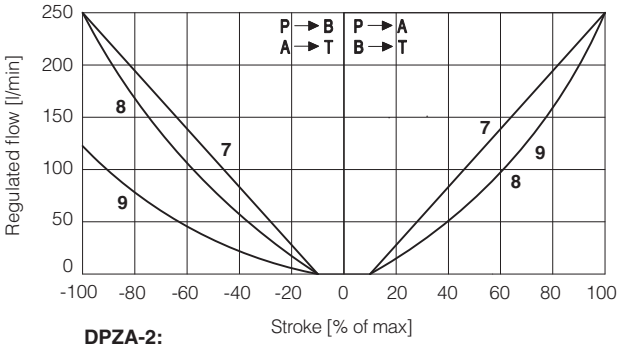
15.1 Regulation diagrams (values measure at Δp 10 bar P-T)



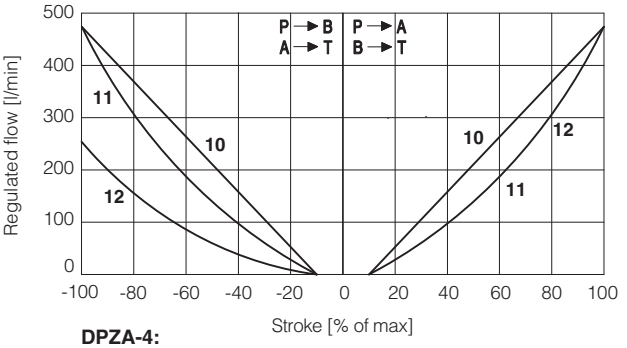
DPZA-1:
1 = L5 **2** = S5 **3** = D5



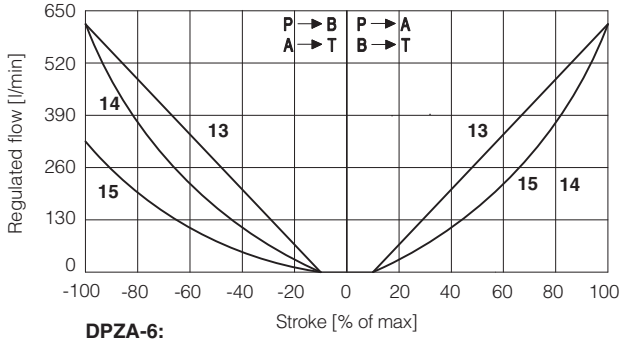
DPZA-2:
4 = L3 **5** = S3 **6** = D3



DPZA-2:
7 = L5 **8** = S5 **9** = D5



DPZA-4:
10 = L5 **11** = S5 **12** = D5



DPZA-6:
13 = L5 **14** = S5 **15** = D5

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\begin{matrix} 0 \div +10\ V \\ 12 \div 20\ mA \end{matrix}$ } P → A / B → T

Reference signal $\begin{matrix} 0 \div -10\ V \\ 12 \div 4\ mA \end{matrix}$ } P → B / A → T

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC

16.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

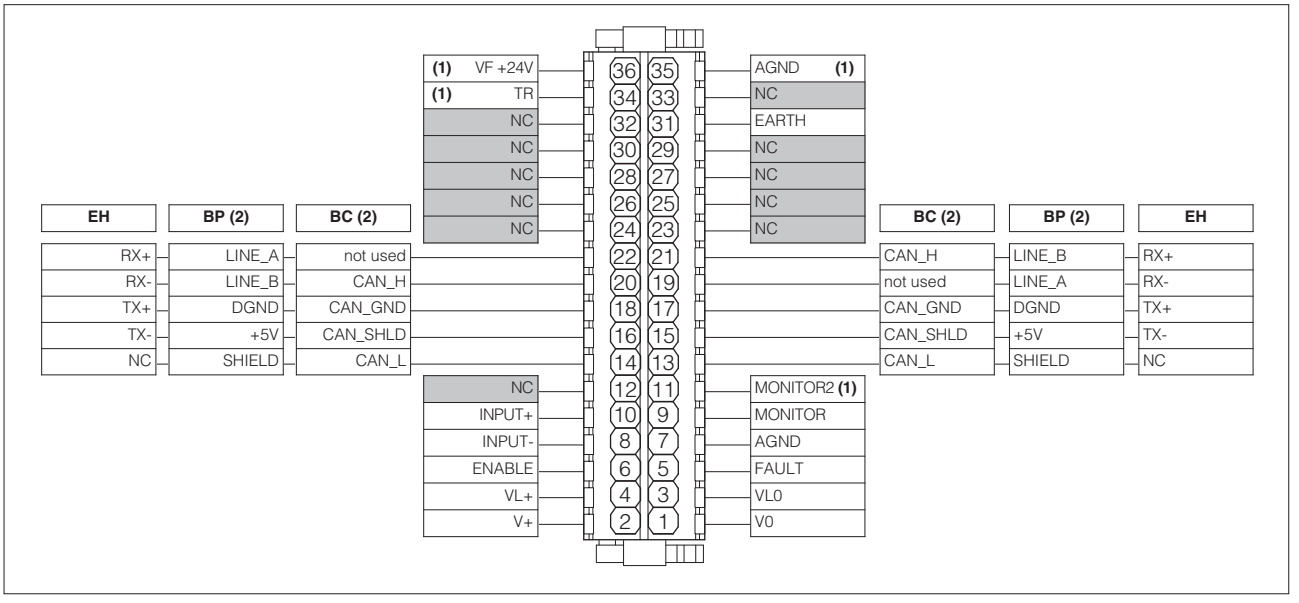
16.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16.7 Remote Pressure Transducer Input signal (TR) - only for **/W** option

Analog pressure transducers can be directly connected to the driver.
Analog input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

17 TERMINAL BOARD OVERVIEW



(1) Connections available only for /W option
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

18 ELECTRONIC CONNECTIONS

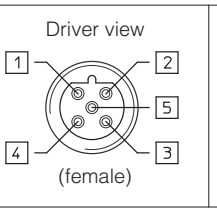
18.1 Main connections signals

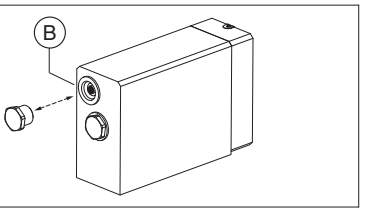
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to AGND Default is: ±5 VDC	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**MONITOR2**	2nd monitor output signal: ±5 VDC maximum range, referred to AGND **(1)** Default is: 0 ÷ 5 VDC	Output - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) 2nd monitor output signal is available only for /W option

18.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





18.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

18.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

18.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

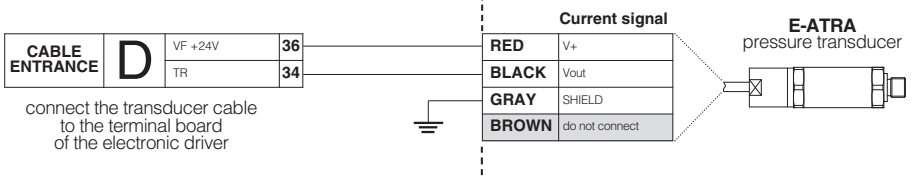
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

17.6 Remote pressure transducer connector - only for /W option

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	Voltage	Current
D	34	**TR**	Signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

for **/W** option



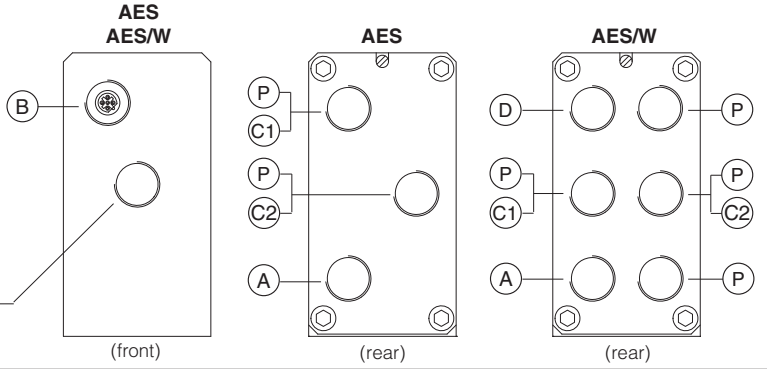
19 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

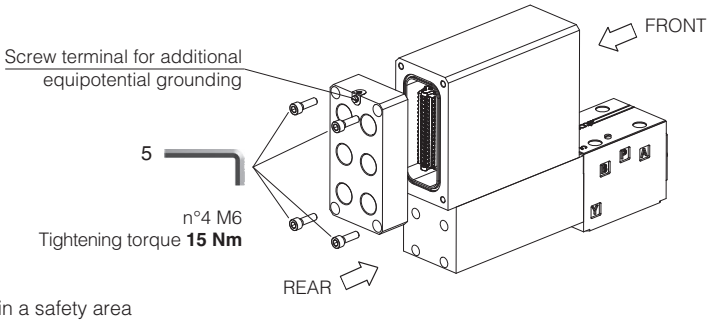
- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (D) pressure transducer (only /W option)
- (P) Threaded plug

COIL CONNECTION
only for double solenoid version - factory wired
(for single solenoid version - factory plugged)



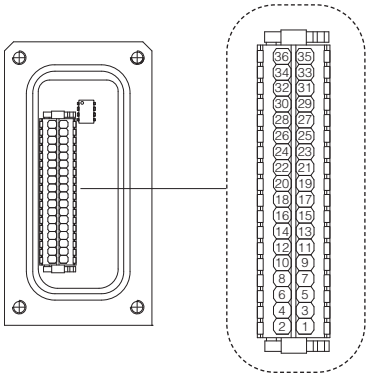
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

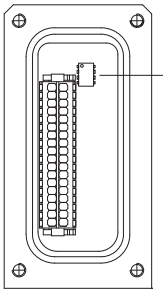


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 17

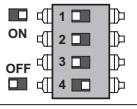


Fieldbus terminator only for BC and BP executions **(1)**



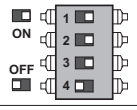
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

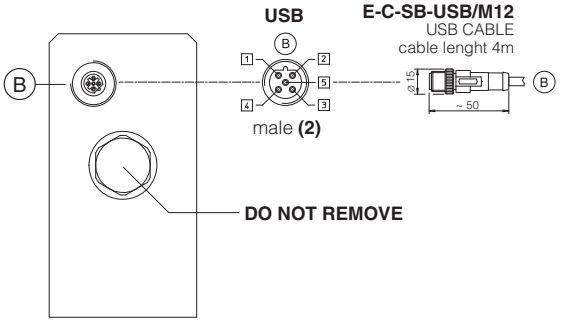


BP - PROFIBUS DP setting:

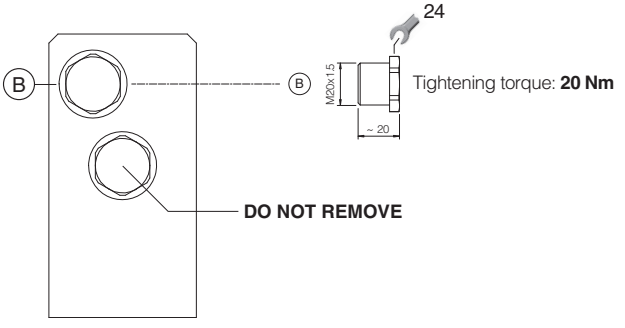
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

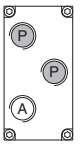
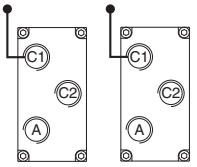
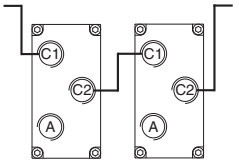


METALLIC PROTECTION CAP - supplied with the valves

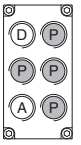
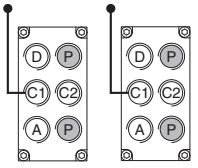
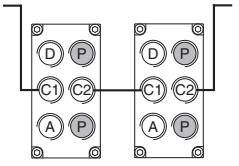


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

19.1 Cable glands and threaded plug for AES - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

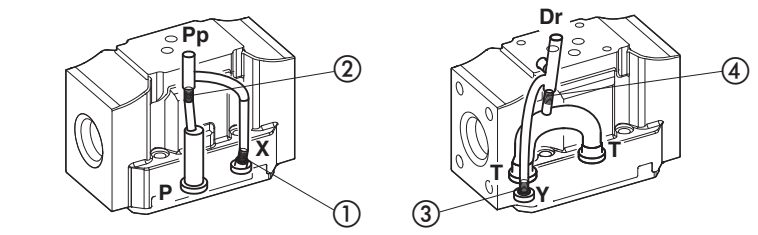
19.2 Cable glands and threaded plug for AES with /W option - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D A	none	none		Cable entrance P are factory plugged Cable entrance A, D are open for costumers
BC, BP, EH “via stub” connection	3	D C1 A	1	C2		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers
BC, BP, EH “daisy chain” connection	4	D C1 - C2 A	none	none		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers

20 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

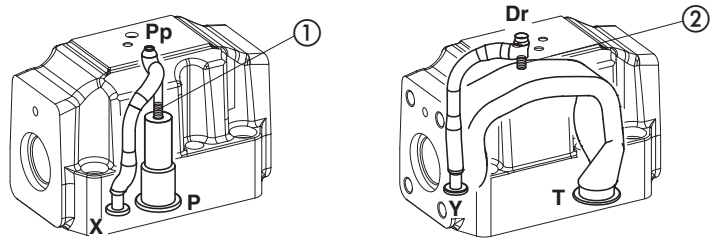
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZA-1 Pilot channels Drain channels



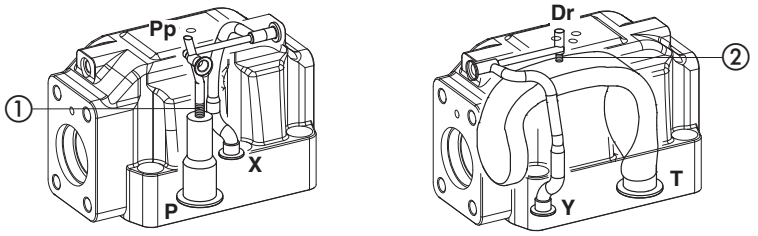
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 Pilot channels Drain channels



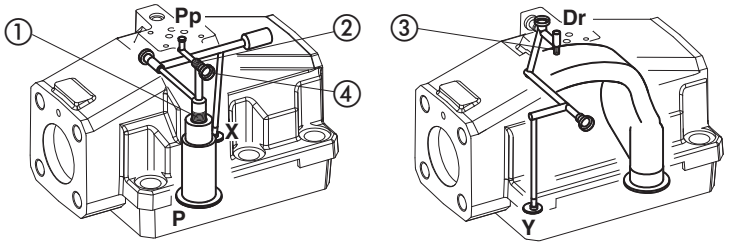
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4 Pilot channels Drain channels



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels Drain channels



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Add plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orefice ② remove plug ④ = G1/8"

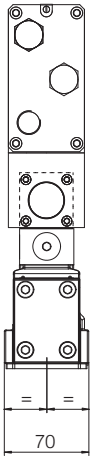
21 FASTENING BOLTS AND SEALS

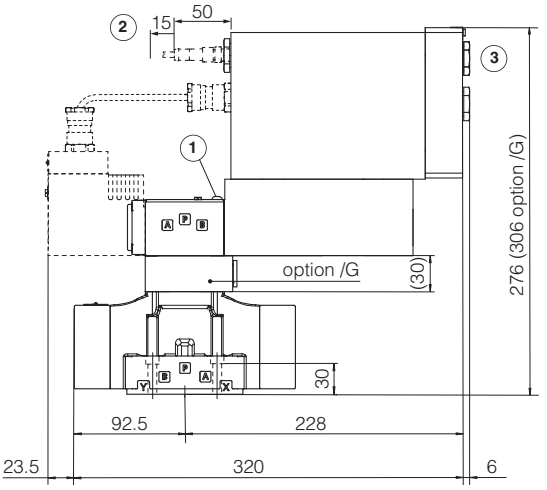
Type	Size	Fastening bolts	Seals
DPZA	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

DPZA-AES-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZA-*-15*	14,7
DPZA-*-17*	16,4
Option /G	+0,9



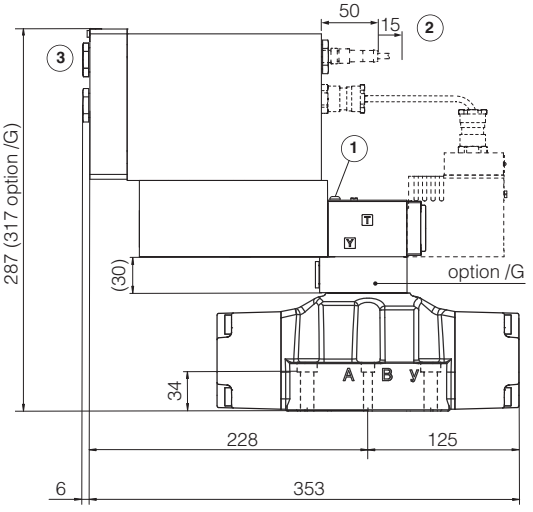


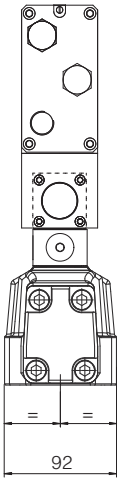
Dotted line = double solenoid version

DPZA-AES-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZA-*-25*	18,9
DPZA-*-27*	20,6
Option /G	+0,9





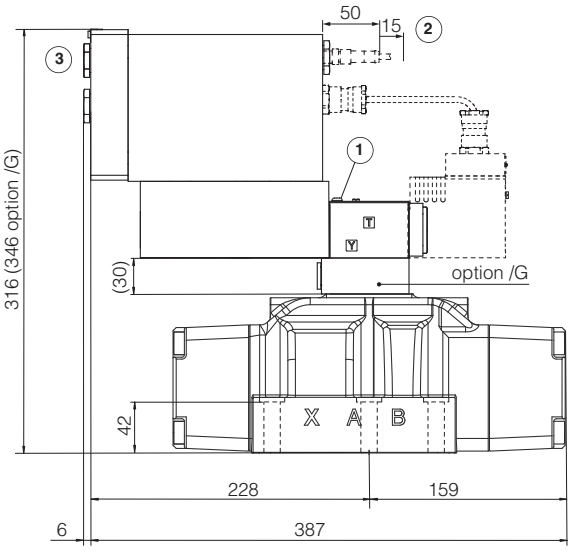
Dotted line = double solenoid version

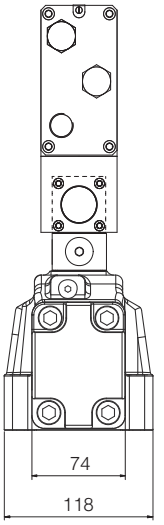
(1) = Air bleed off
(2) = Space to remove the USB connector
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

DPZA-AES-*-4

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)

Mass [kg]	
DPZA-*-45*	24,1
DPZA-*-47*	25,8
Option /G	+0,9



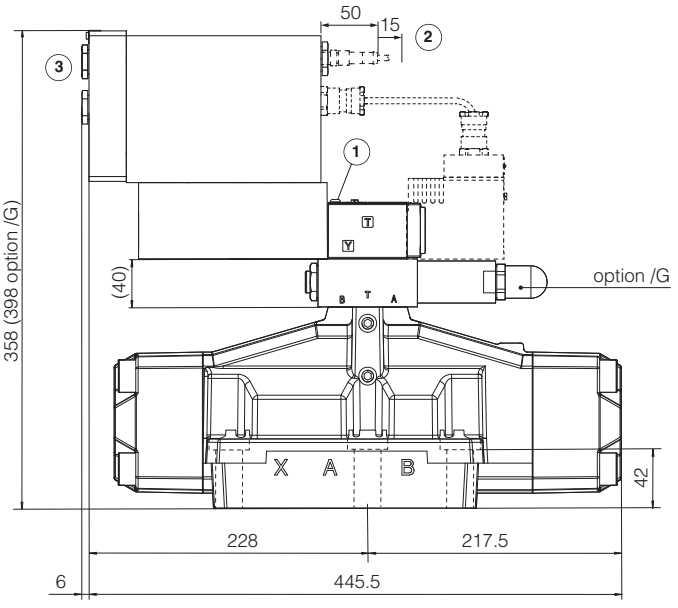


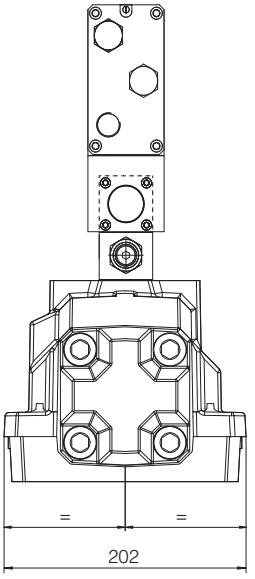
Dotted line = double solenoid version

DPZA-AES-*-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

Mass [kg]	
DPZA-*-65*	49,2
DPZA-*-67*	50,9
Option /G	+0,9





Dotted line = double solenoid version

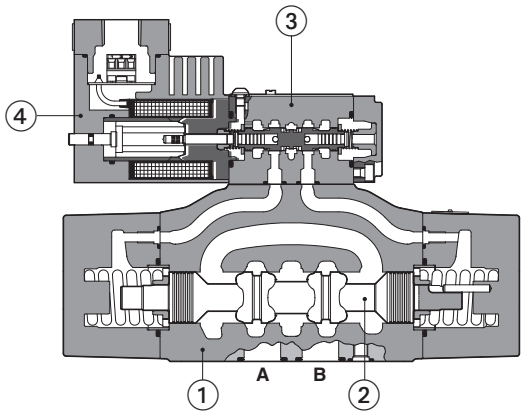
(1) = Air bleed off
(2) = Space to remove the USB connector
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

23 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GX800**	Ex-proof pressure transducer type E-ATRA-7
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		
GS510	Fieldbus		

Ex-proof proportional directional valves

piloted, without transducer and with positive spool overlap - **ATEX, IECEx, EAC, PESO** or **cULus**



① main stage valve body
② main stage pool
③ pilot valve
④ ex-proof solenoid

DPZA-A-25*

DPZA-A

Ex-proof proportional valves, piloted, without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.
They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx** and **EAC** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **10** ÷ **32** - ISO 4401

Max flow: **180** ÷ **1500 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPZA	/	*	-	A	-	2	71	-	L	5	-	GK	/	*	/	*	*	/	*

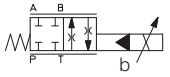
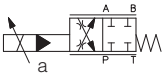
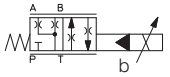
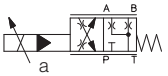
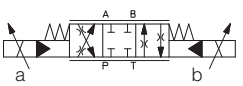
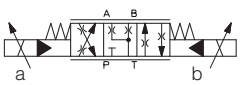
DPZA: Ex-proof proportional directional valve, piloted

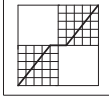
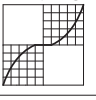
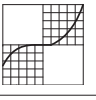
***** **Certification type**:
Multicertification ATEX, IECEx, EAC:
- = omit for Group II 2G / 2D **(1)**
M = Group IM2 (mining)
North American Certification:
UL = cULus

A = without transducer

2 **Valve size** ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

71 **Configuration**:

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

L **Spool type,** regulating characteristics:
L = linear 
S = progressive 
D = differential-progressive 
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

5 **Spool size**:

		3 (L,S,D)	**5** (L,S,D)
DPZA-1	=	-	100
DPZA-2	=	160	250
DPZA-4	=	-	480
DPZA-6	=	-	640

Nominal flow (l/min) at Δp 10bar P-T

GK **Solenoid threaded connection** for cable gland fitting:
GK = GK-1/2" - not for **cULus**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

***** **Options (3)**:
B = solenoid at side of port A
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap

***** **Voltage code**:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

***** Series number

***** **Seals material,** see section 6 :
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com

(2) Not for multicertification **M** group I (mining) **(3)** For possible combined options, see 11.1

⚠ For valve with internal drain (option /D) the pressure at T port makes difficult the manual override operation that can be possible only if the pressure at T port is lower than 50 bar.

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZA-*-1	DPZA-*-2		DPZA-*-4	DPZA-*-6
Pressure limits [bar]		ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type		**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**		
Nominal flow [l/min]						
Δp P-T	Δp = 10 bar	100	160	250	480	640
	Δp = 30 bar	160	270	430	830	1100
	Max permissible flow	180	400	550	900	1500
Δp max P-T [bar]						
Piloting pressure [bar]		min. = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)				
Piloting volume [cm³]		1,4	3,7		9,0	21,6
Piloting flow **(1)** [l/min]		1,7	3,7		6,8	14,4
Leakage **(2)** Main stage [l/min]		0,15/0,5	0,2/0,6		0,3/1,0	1,0/3,0
Response time **(1)** [ms]		≤ 90	≤ 110		≤ 130	≤ 190
Hysteresis		≤ 5 [% of max regulation]				
Repeatability		± 1 [% of max regulation]				

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2
(1) 0-100% step signal and pilot pressure 100 bar **(2)** at p = 100/350 bar

5 ELECTRICAL CHARACTERISTICS

Max. power	35W	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 300 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

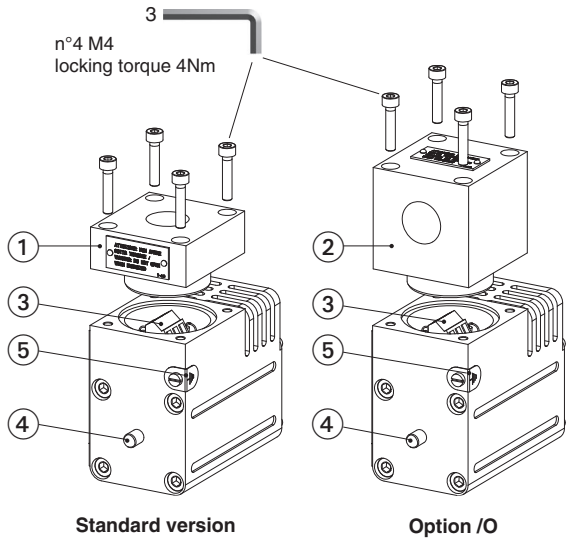
Valve type	DPZA		DPZA/**M**	DPZA/**UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX , EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX PROOF SOLENOIDS WIRING

Multicertification



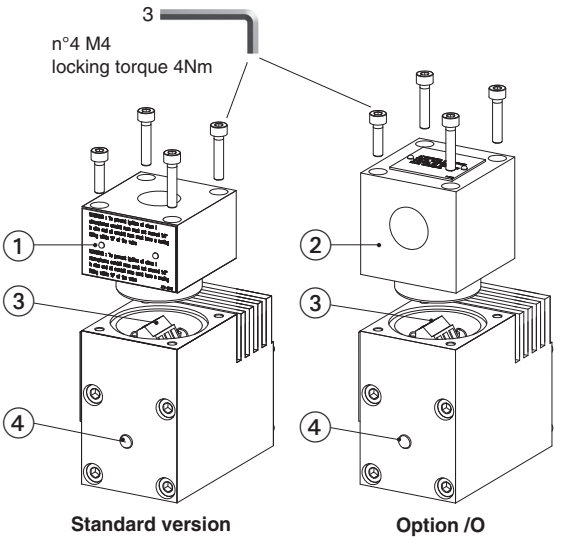
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

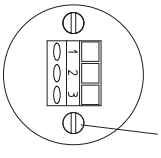
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override



⚠ **Pay attention to respect the polarity**

1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1

alternative GND screw terminal connected to solenoid housing

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	-	90 °C	-
45 °C	-	T4	150 °C	135 °C	-	90 °C
55 °C	-	T3	150 °C	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

10 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 OPTIONS

B = DPZA-*-*5 = solenoid and integral electronics at side of port B of the main stage.
DPZA-*-*7 = integral electronics at side of port B of the main stage.

D and **E** = Pilot and drain configuration can be modified as shown in section 13 .
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:
Option /D Internal drain.
Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZA-1 and -2 = 28 bar
DPZA-4 and -6 = 40 bar
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

O = Horizontal cable entrance , to be selected in case of limited verical space.

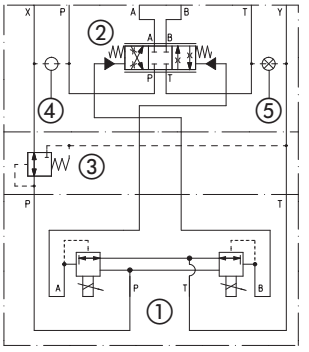
WP = Manual override protected by metallic cap.

11.1 Possible combined options

/BD, /BE, /BG, /BO, /BWP
/BDE, /BDG, /BDO, /BDWP,
/BDEG, /BDEO, /BDEWP, /BDEGO, /BDEGWP, BDEGOWP
/BEG, /BEO, /BEWP, /BEGO, /BEGWP, /BEGOWP
/BGO, /BGWP, BGOWP
/DE, /DG, /DO, /DWP, /DEG, /DEO, /DEWP, /DEGO, /DEGWP, /DEGOWP
/EG, /EO, /EWP, /EGO, /EGWP, /EGOWP
/GO, /GWP, /GOWP
/OWP

FUNCTIONAL SCHEME

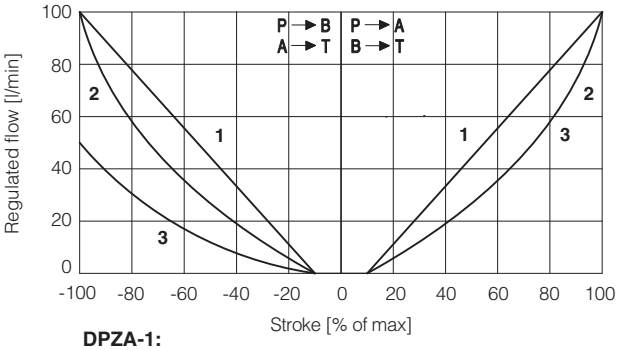
example of configuration 7*
3 positions, spring centered



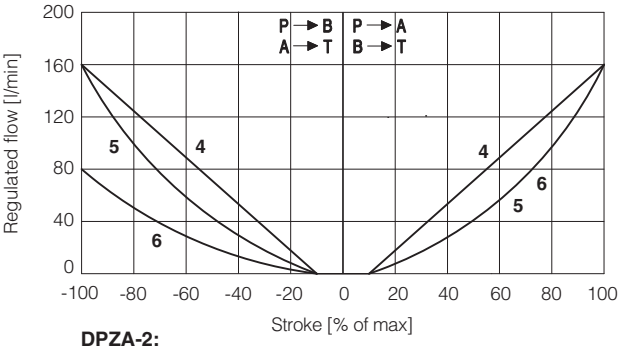
① Pilot valve ② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

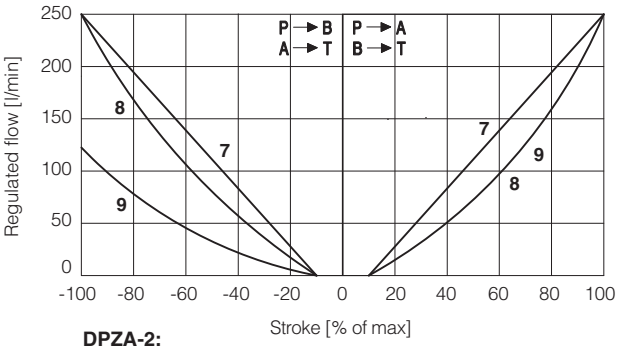
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



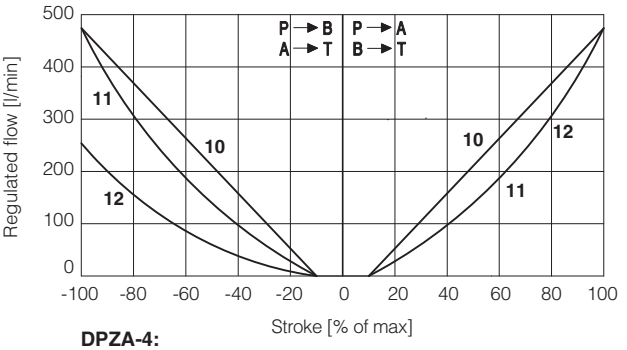
DPZA-1:
1 = L5 **2** = S5 **3** = D5



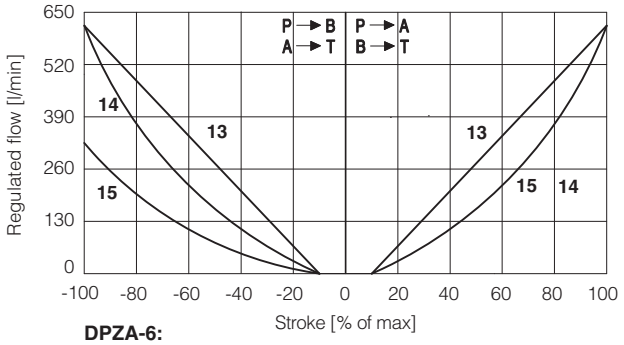
DPZA-2:
4 = L3 **5** = S3 **6** = D3



DPZA-2:
7 = L5 **8** = S5 **9** = D5



DPZA-4:
10 = L5 **11** = S5 **12** = D5



DPZA-6:
13 = L5 **14** = S5 **15** = D5

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

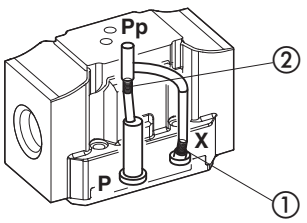
Reference signal $\begin{matrix}0 \div +10\ V\\12 \div 20\ mA\end{matrix}\}$ P → A / B → T

Reference signal $\begin{matrix}0 \div -10\ V\\12 \div 4\ mA\end{matrix}\}$ P → B / A → T

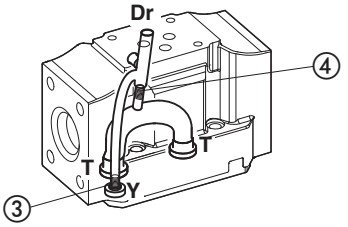
13 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZA-1 Pilot channels

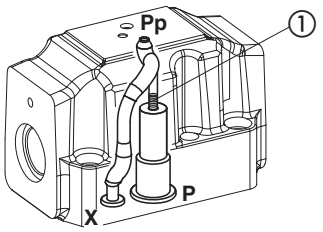


Drain channels

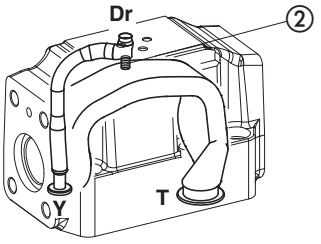


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 Pilot channels

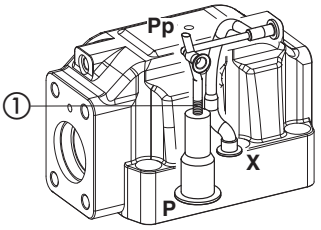


Drain channels

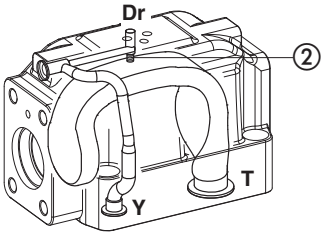


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4 Pilot channels

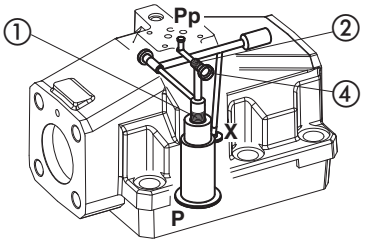


Drain channels

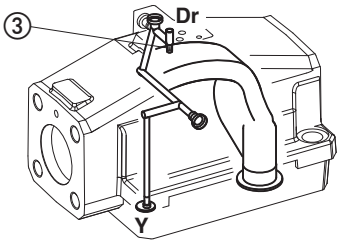


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels



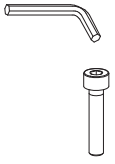
Drain channels



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Add plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orefice ② remove plug ④ = G1/8”

14 FASTENING BOLTS AND SEALS

	DPZA-1	DPZA-2	DPZA-4	DPZA-6
	**Fastening bolts:** 4 socket head screws M6x60 class 12.9 Tightening torque = 15 Nm	**Fastening bolts:** 4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	**Fastening bolts:** 6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm
	**Seals:** 5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø 5 mm (max)	**Seals:** 4 OR 130 Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø 7 mm (max)	**Seals:** 4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)	**Seals:** 4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)

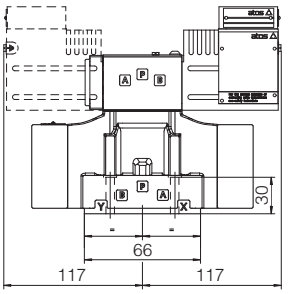
15 INSTALLATION DIMENSIONS FOR DPZA [mm]

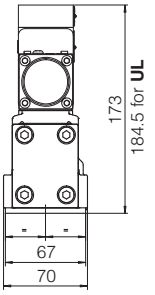
DPZA-1

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-05-05-0-05

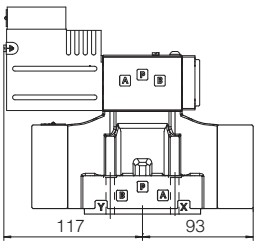
Mass [kg]	
DPZA-*-15*	8,5
DPZA-*-17*	10,2
Option /G	+0,9
Option /O	+0,35
Option /WP	+0,25

DPZA-A-15*
DPZA-A-17* (dotted line)

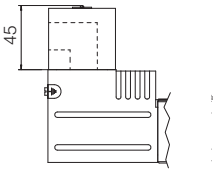




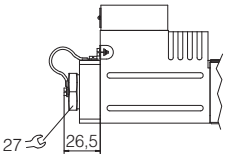
DPZA-A-15* /B



option /O



option /WP



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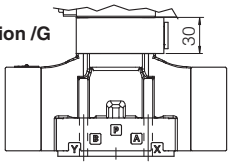
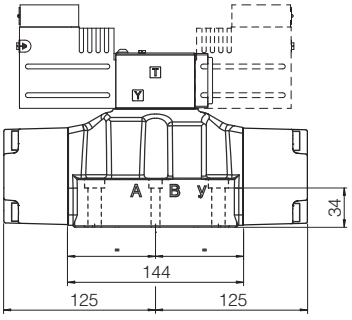


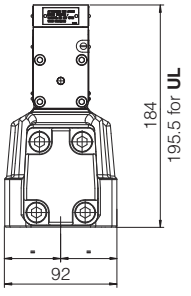
DPZA-2

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-07-07-0-05

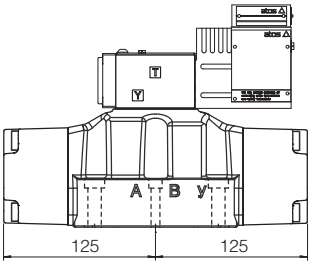
Mass [kg]	
DPZA-*-25*	12,7
DPZA-*-27*	14,4
Option /G	+0,9
Option /O	+0,35
Option /WP	+0,25

DPZA-A-25*
DPZA-A-27* (dotted line)

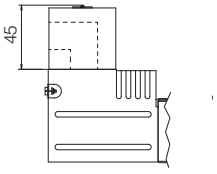




DPZA-A-25* /B



option /O



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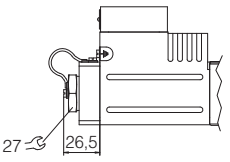
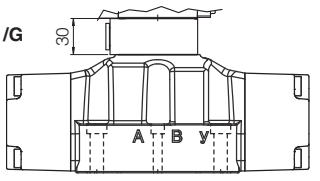


option /G

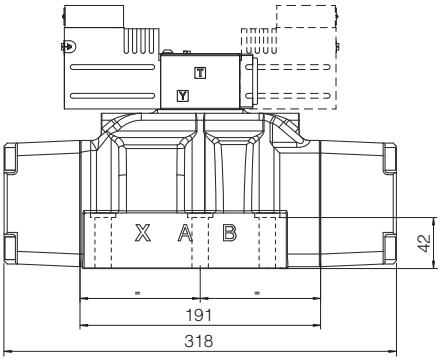


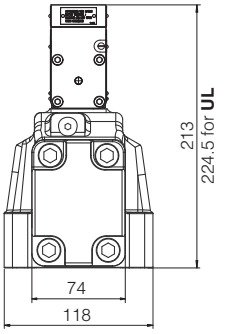
DPZA-4

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-08-08-0-05

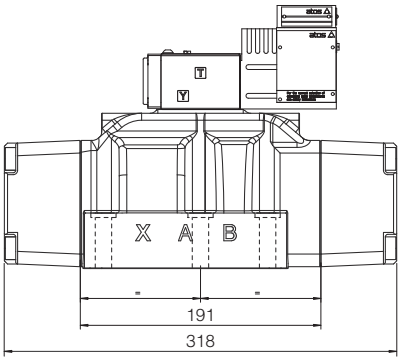
Mass [kg]	
DPZA-*-45*	17,9
DPZA-*-47*	19,6
Option /G	+0,9
Option /O	+0,35
Option /WP	+0,25

DPZA-A-45*
DPZA-A-47* (dotted line)

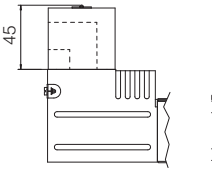




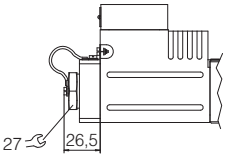
DPZA-A-45* /B



option /O



option /WP



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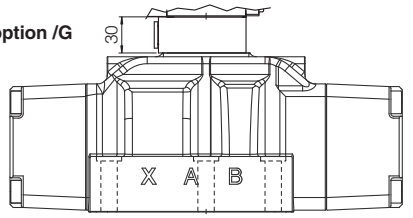
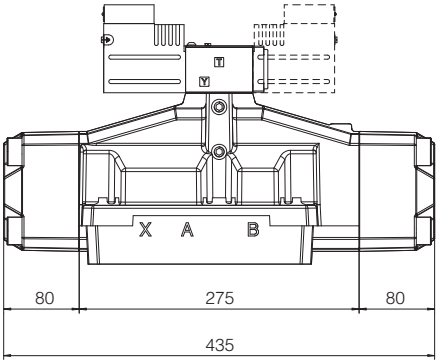


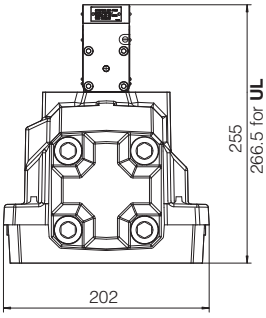
DPZA-6

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-10-09-0-05

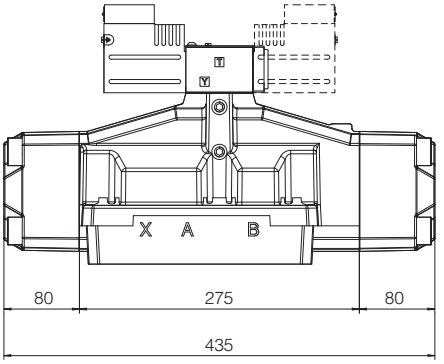
Mass [kg]	
DPZA-*-45*	43,0
DPZA-*-47*	44,7
Option /G	+0,9
Option /O	+0,35
Option /WP	+0,25

DPZA-A-65*
DPZA-A-67* (dotted line)

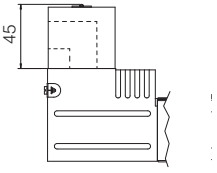




DPZA-A-65* /B



option /O



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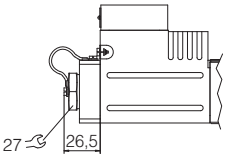
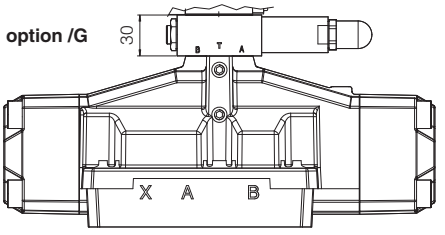


option /G

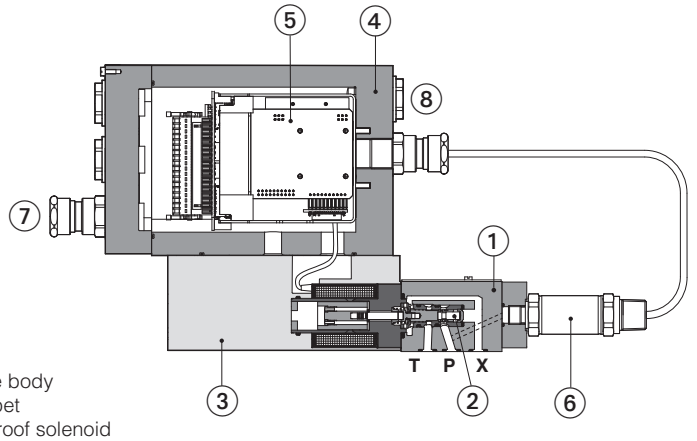


16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional relief valves high performance

direct or piloted, with on board driver and pressure transducer - **ATEX and IECEx**



① valve body
② poppet
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof pressure transducer
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

RZMA-RES-P-BC-10-*

RZMA-RES, AGMZA-RES

Ex-proof high performance digital proportional relief valves direct or piloted with pressure transducer for pressure closed loop controls.

They are equipped with ex-proof on-board digital driver, pressure transducer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

RZMA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **4** and **40 l/min**

AGMZA, piloted:
Size: **10**, **20** and **32** - ISO 6264
Max flow: **200**, **400** and **600 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZMA	-	RES	-	P	-	NP	-	010	/	315	/	M	/	*	*	*	/	*

RZMA
Ex-proof proportional pressure relief valves
RZMA = subplate size 06
AGMZA = subplate size 10, 20, 32

RES = on-board driver

P = on-board ex-proof pressure transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size and configuration:
RZMA: direct **010** = Qmax 4 l/min
RZMA: piloted **030** = Qmax 40 l/min
AGMZA: piloted **10, 20, 32** = Qmax 200, 400, 600 l/min

Max regulated pressure:
80 = 80 bar **180** = 180 bar **250** = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Electronic options (1):
I = current reference input and monitor 4÷20mA (omit for std voltage 0÷10VDC)

Hydraulic options - only AGMZA **(1)**:
E = external pilot
Y = external drain

Dynamic response preset, see section 18:
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

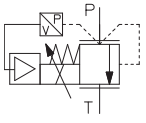
Series number

Seals material, see section 9:
- = NBR
PE = FKM
BT = HNBR

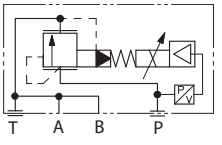
(1) Possible combined options: /EY, /EI, /YI

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

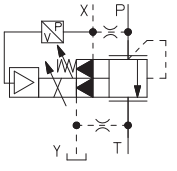
RZMA-RES-*-010



RZMA-RES-*-030



AGMZA-RES-*



3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: The below operation must be performed in a safety area

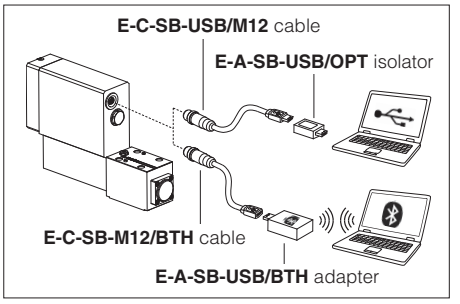
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	RZMA-010 150 years, RZMA-030 and AGZMA 75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZMA		AGMZA		
Size code		**010**	**030**	**10**	**20**	**32**
Valve size		06		10	20	32
Max regulated pressure	[bar]	**80**	**180** **250**			
Min regulated pressure	[bar]	see min. pressure / flow diagrams at sections 20 21 22				
Max pressure at port P, A, B, X	[bar]	315				
Max pressure at port T, Y	[bar]	210				
Max flow	[l/min]	4	40	200	400	600
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 60		≤ 90	≤ 110	≤ 125
Hysteresis[% of the max pressure]		≤ 0,3				
Linearity[% of the max pressure]		≤ 1,0				
Repeatability[% of the max pressure]		≤ 0,2				

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: range 0 ÷ 10 VDC @ max 5 mA Current: range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	RZMA, AGMZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-RES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-31 EN 60079-1	IEC 60079-0 IEC 60079-31 IEC 60079-1	
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
in case the complete valve must wisthstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

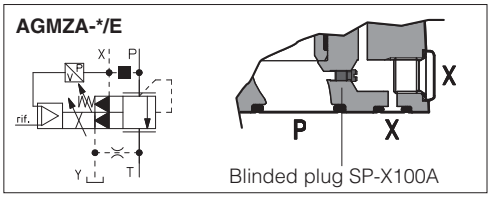
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS - only for AGMZA

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").

Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.

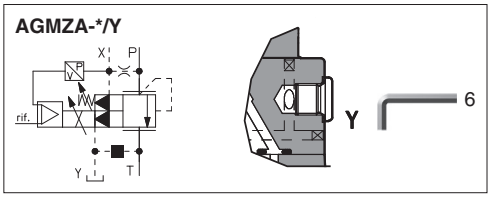
AGMZA-*/E



14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

AGMZA-*/Y



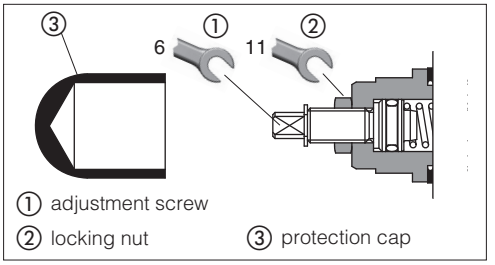
15 POSSIBLE COMBINED OPTIONS

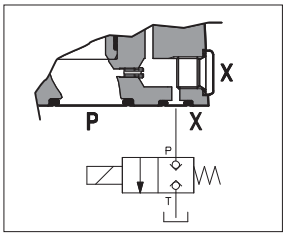
EY, /EI, /YI

16 MECHANICAL PRESSURE LIMITER - only for AGMZA

The AGMZA are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.





17 REMOTE PRESSURE UNLOADING - only for AGMZA

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).
This function can be used in emergency to unload the system pressure by-passing the proportional control.

18 DYNAMIC RESPONSE - 4 pressure PIDs

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port.
Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

(1) interchangeable with previous TERS version

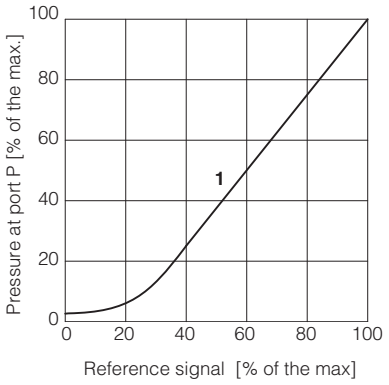
PID	Dynamic response
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop

19 PRESSURE TRANSDUCER FAILURE

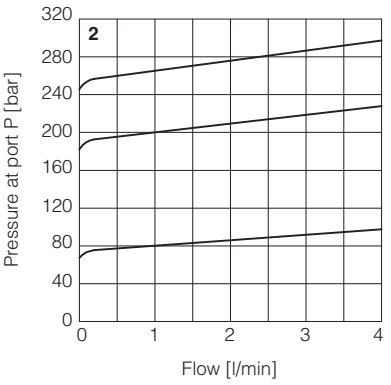
In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

20 DIAGRAMS RZMA-010 (based on mineral oil ISO VG 46 at 50 °C)

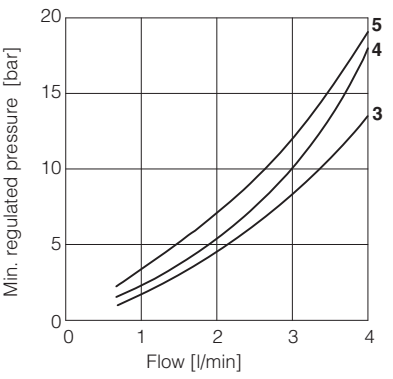
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-5 Min. pressure/flow diagrams
with zero reference signal

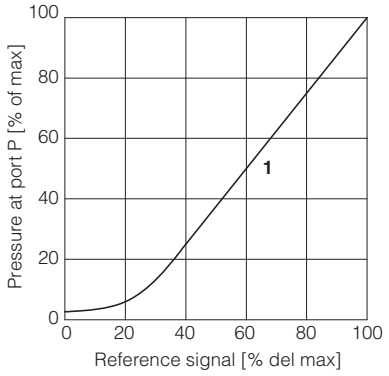


3 = RZMA/80
4 = RZMA/180
5 = RZMA/250

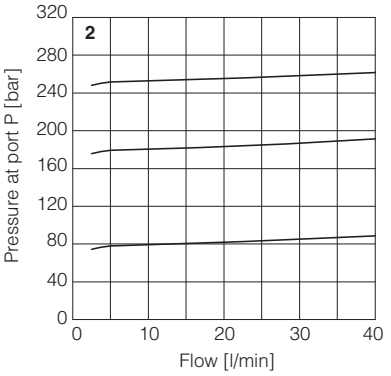
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

21 DIAGRAMS RZMA-030 (based on mineral oil ISO VG 46 at 50 °C)

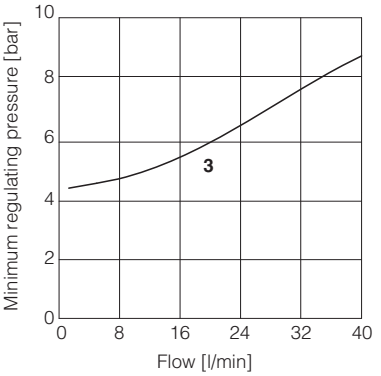
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



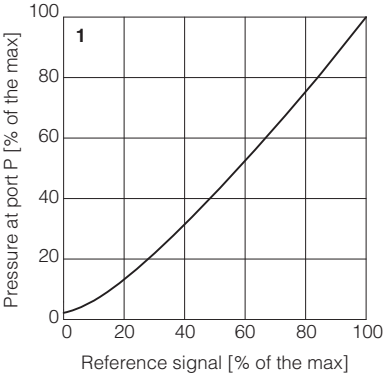
3 Min. pressure/flow diagrams
with zero reference signal



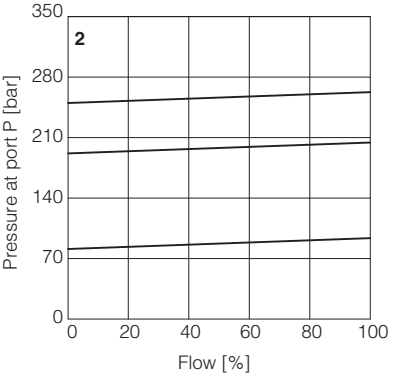
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

22 DIAGRAMS AGMZA (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

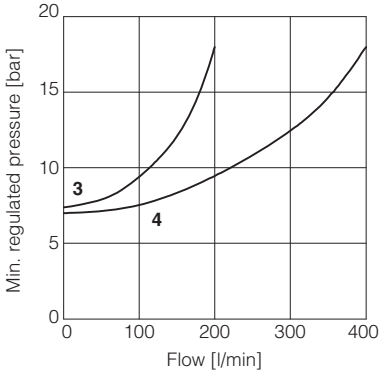


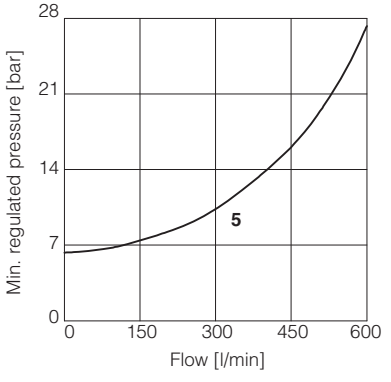
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



3-5 = Min. pressure/flow diagrams
with zero reference signal

3 = AGMZA-*-10
4 = AGMZA-*-20
5 = AGMZA-*-32





23 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

23.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

23.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

23.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

23.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

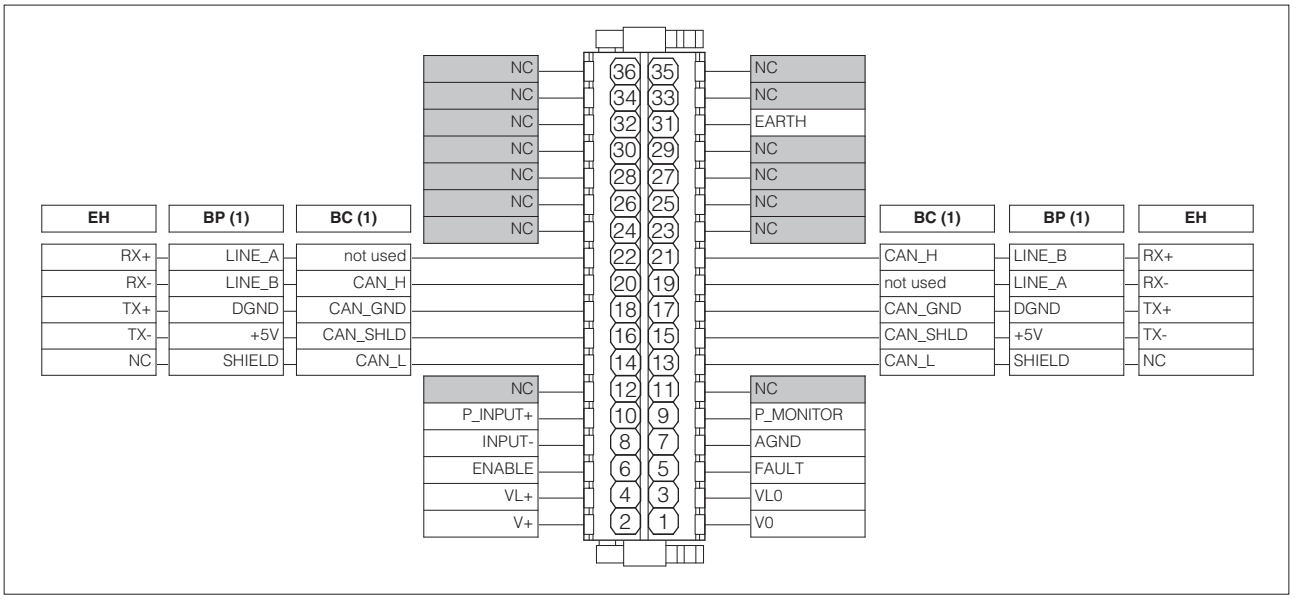
23.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

23.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

24 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

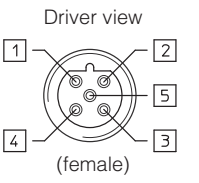
25 ELECTRONIC CONNECTIONS

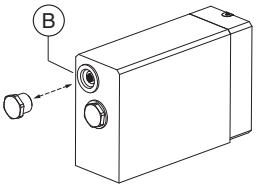
25.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative pressure reference input signal for INPUT+	Input - analog signal
	9	**P_MONITOR**	Pressure monitor output signal: 0 ÷10 VDC / 0 ÷ 20 mA maximum range, referred to AGND Default is: 0 ÷10 VDC or 4 ÷ 20 mA	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

25.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





25.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

25.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

25.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

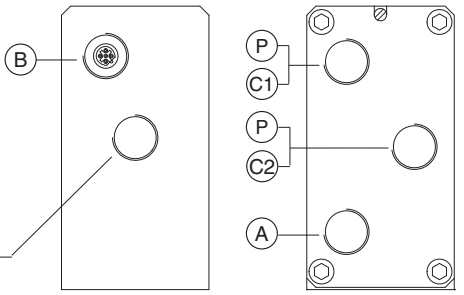
26 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

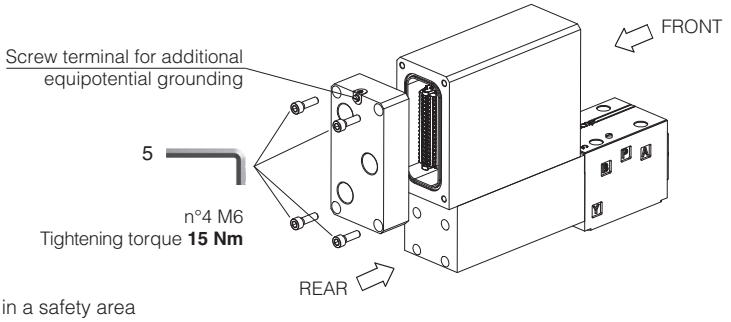
- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug

PRESSURE TRANSDUCER CONNECTION
factory wired



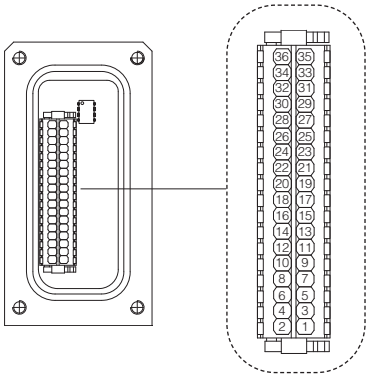
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

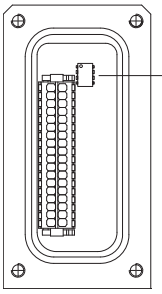


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 24

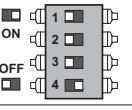


Fieldbus terminator only for BC and BP executions **(1)**



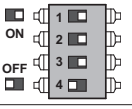
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

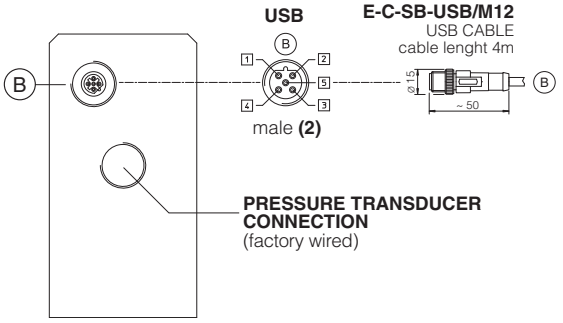


BP - PROFIBUS DP setting:

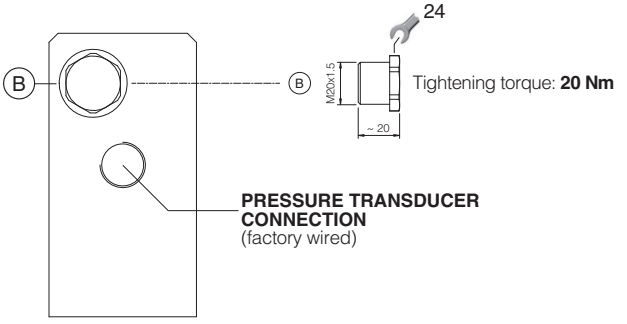
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

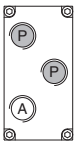
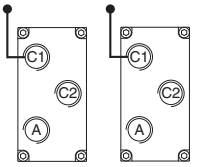
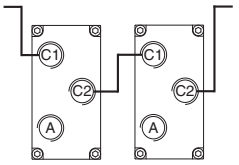


METALLIC PROTECTION CAP - supplied with the valves



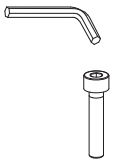
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

26.1 Cable glands and threaded plug - see tech table **KX800**

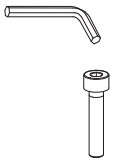
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

27 FASTENING BOLTS AND SEALS

27.1 RZMA valves

	RZMA-RES-*-010	RZMA-RES-*-030
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm

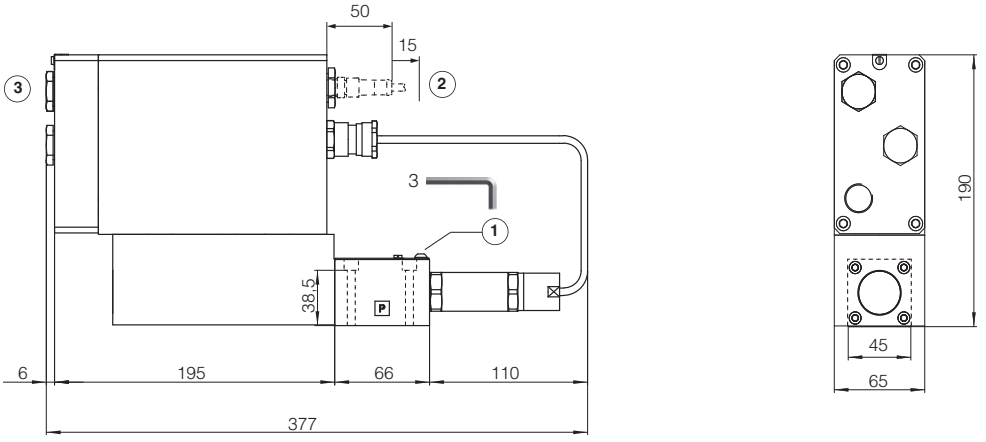
27.2 AGMZA valves

	AGMZA-RES-*-10	AGMZA-RES-*-20	AGMZA-RES-*-32
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**Seals:** 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

RZMA-RES-*-010

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

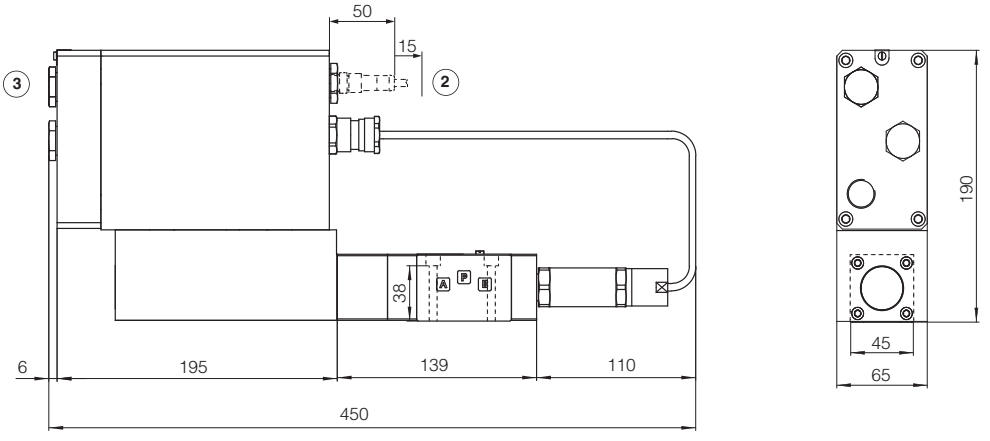
Mass [kg]	
RZMA-RES-*-010	8.5



RZMA-RES-*-030

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(ports A and B connected to port T)

Mass [kg]	
RZMA-RES-*-030	9,5



(1) = Air bleed off

(2) = Space to remove the USB connector

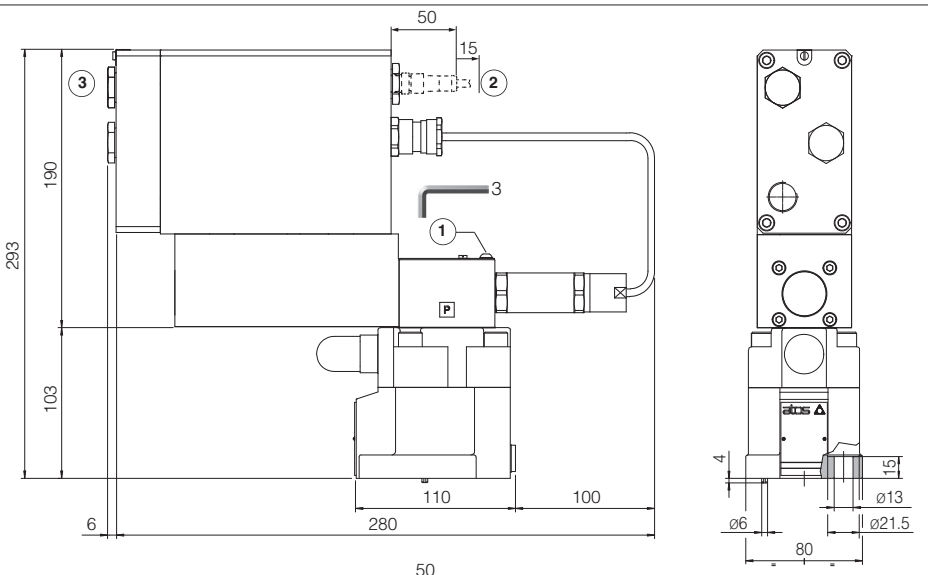
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

29 INSTALLATION DIMENSIONS FOR AGMZA [mm]

AGMZA-RES-*-10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

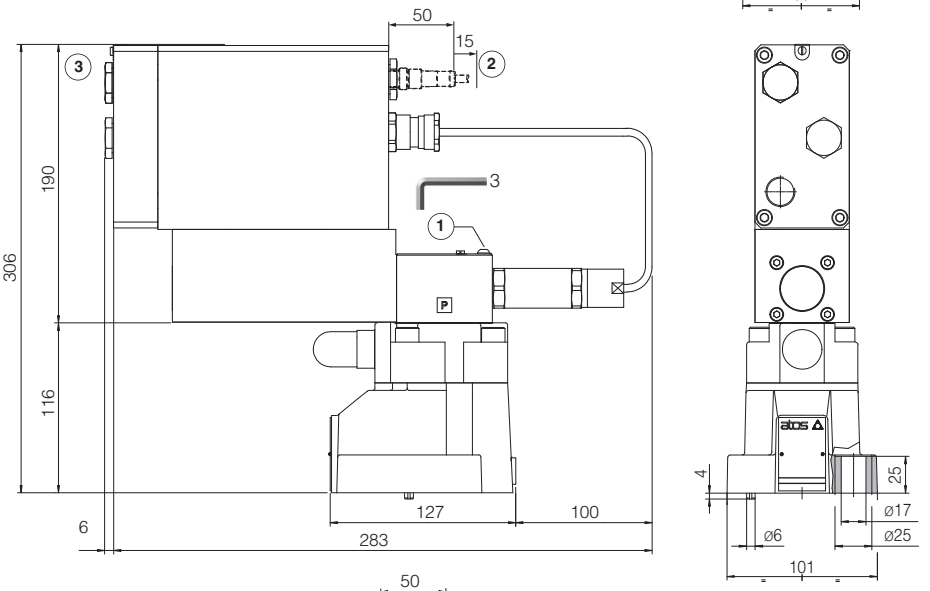
Mass [kg]	
AGMZA-RES-*-10	12,1



AGMZA-RES-*-20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

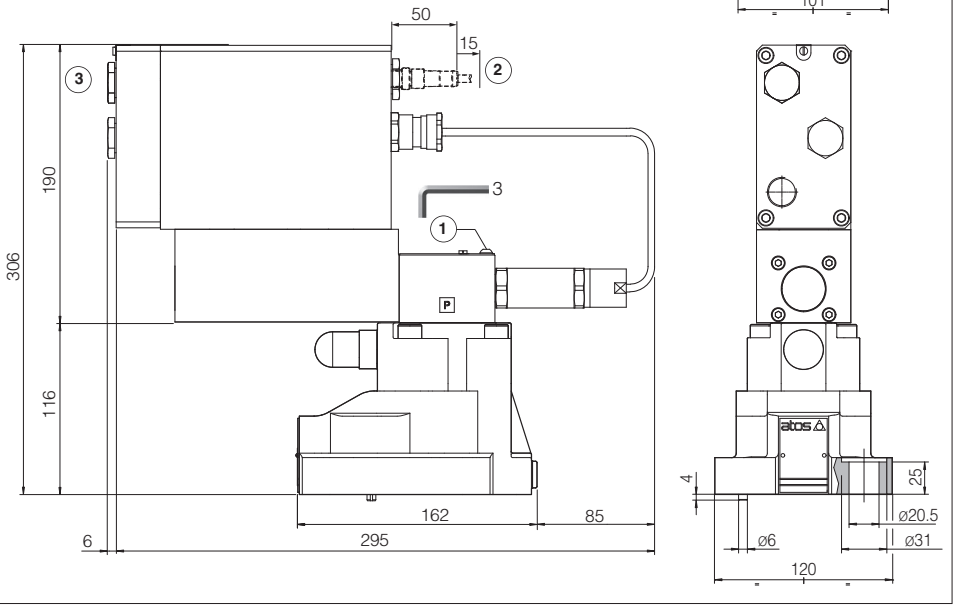
Mass [kg]	
AGMZA-RES-*-20	13,3



AGMZA-RES-*-32

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)
(with M20 fixing holes instead of standard M18)

Mass [kg]	
AGMZA-RES-*-32	15,3



(1) = Air bleed off

(2) = Space to remove the USB connector

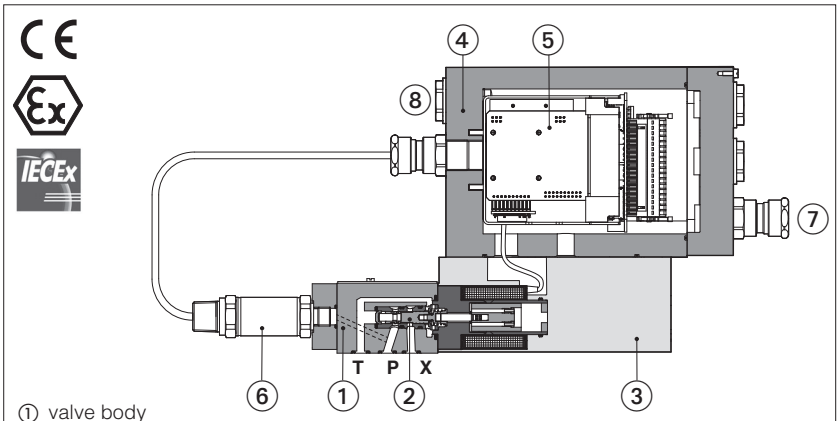
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

30 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GX800**	Ex-proof pressure transducer type E-ATRA-7
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		
GS510	Fieldbus		

Ex-proof digital proportional reducing valves high performance

direct or piloted, with on-board driver and pressure transducer - **ATEX and IECEx**



① valve body
② spool
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof pressure transducer
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

RZGA-RES-P-BC-10-*

RZGA-RES, AGRCZA-RES

Ex-proof digital, high performance proportional reducing valves, direct or piloted, with pressure transducer for pressure closed loop controls.

They are equipped with ex-proof on-board digital driver, pressure transducer and proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification ATEX and IECEx for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

RZGA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **12** and **40 l/min**

AGRCZA, piloted:
Size: **10** and **20** - ISO 5871
Max flow: **160** and **300 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZGA	- RES	- P	- NP	- 010	/ 210	/ M	/ *	*	*	/ *

RZGA Ex-proof proportional pressure reducing valves
RZGA = subplate size 06
AGRCZA = subplate size 10, 20

RES = on-board driver

P = on-board ex-proof pressure transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size and configuration:
RZGA: direct **010** = Qmax 12 l/min
RZGA: piloted **033** = Qmax 40 l/min
AGRCZA: piloted **10, 20** = Qmax 160, 300 l/min

Max regulated pressure:
only for RZGA-010
32 = 32 bar **100** = 100 bar **210** = 210 bar
only for RZGA-033 and AGRCZA
80 = 80 bar **180** = 180 bar **250** = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Electronic options (1):
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)

Hydraulic options - only AGRCZA **(1)**:
P = with integral mechanical pressure limiter
R = with integral check valve for free reverse flow

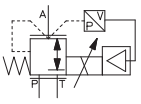
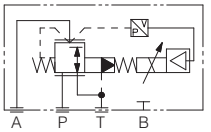
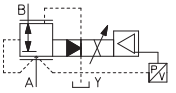
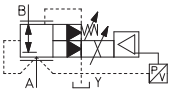
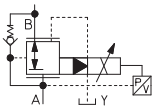
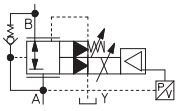
Dynamic response preset, see sect. 16:
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /IP, /IR, /PR

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

RZGA-RES-010	RZGA-RES-033	AGRCZA-RES	AGRCZA-RES-*/P	AGRCZA-RES-*/R	AGRCZA-RES-*/PR
					

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: The below operation must be performed in a safety area

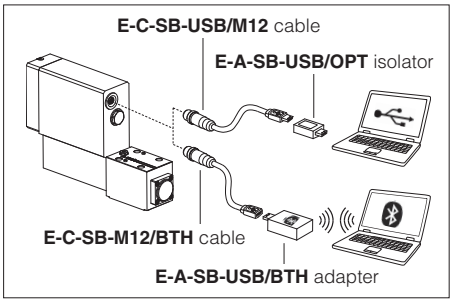
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	RZGA-010 150 years, RZGA-033 and AGRCZA 75 years see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZGA					AGRCZA	
Size code		010			033		10	20
Valve size		06			06		10	20
Max regulated pressure	[bar]	32	100	210	80		180	250
Max pressure at port P, A, B, X	[bar]	315						
Max pressure at port T, Y	[bar]	210						
Min regulated pressure	[bar]	0,8			2,5		1,0	
Max flow	[l/min]	12			40		160	300
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 50					≤ 60	
Hysteresis	[% of the max pressure]	≤ 0,3						
Linearity	[% of the max pressure]	≤ 1,0						
Repeatability	[% of the max pressure]	≤ 0,2						

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: range 0 ÷ 10 VDC @ max 5 mA Current: range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 610006-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 500 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	RZMA, AGMZA			
Certifications	Multicertification Group II **ATEX IECEx**			
Solenoid certified code	**OZA-RES**			
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**		**T4**
Surface temperature	≤ 85 °C	≤ 100 °C		≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C		-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

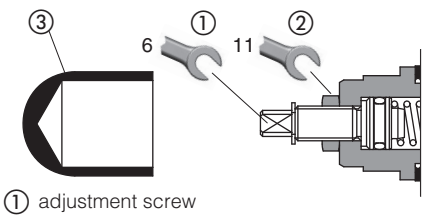
Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS - only for AGRCZA

P = The AGRCZA are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:
- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working

P option

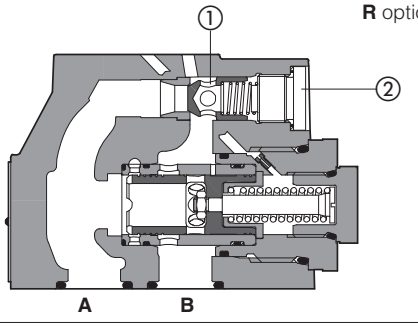


① adjustment screw
② locking nut
③ protection cap

R = The AGRCZA are provided with integral check valve for free reverse flow A→B

① Check valve - cracking pressure = 0,5 bar
② Plug

R option



14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

15 POSSIBLE COMBINED OPTIONS

/IP, /IR, /PR

16 DYNAMIC RESPONSE - 4 pressure PIDs

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port.
Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

(1) interchangeable with previous TERS version

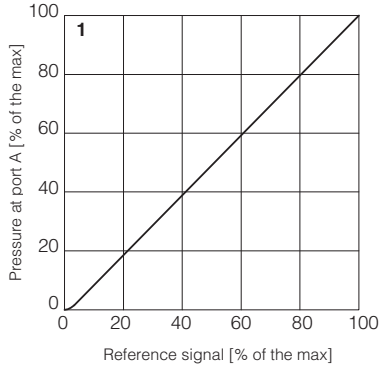
PID	Dynamic response
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop

17 PRESSURE TRANSDUCER FAILURE

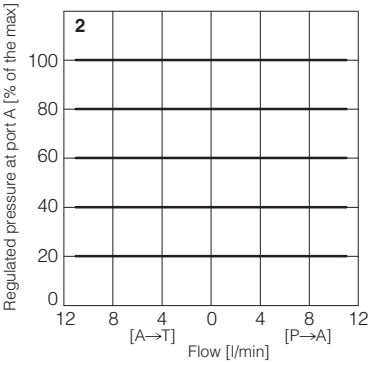
In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

18 DIAGRAMS RZGA-010 (based on mineral oil ISO VG 46 at 50 °C)

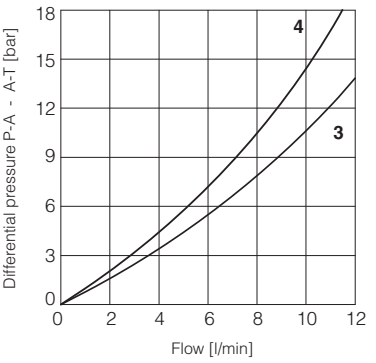
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



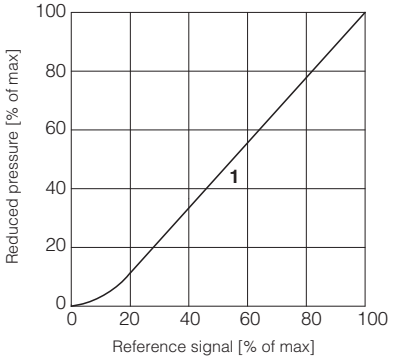
3-4 Min. pressure/flow diagrams
with zero reference signal



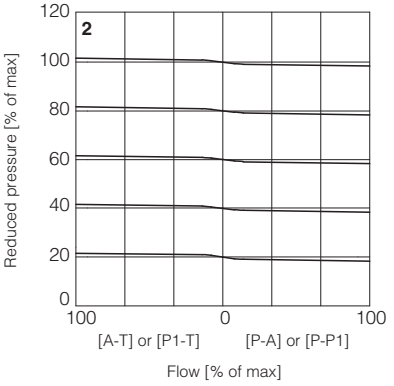
3 = Pressure drops vs. flow P→A
4 = Pressure drops vs. flow A→T

19 DIAGRAMS RZGA-033 (based on mineral oil ISO VG 46 at 50 °C)

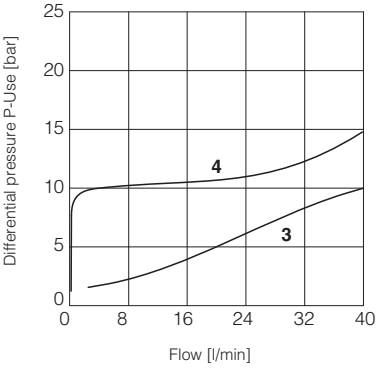
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min



3-4 Pressure drop/flow diagram

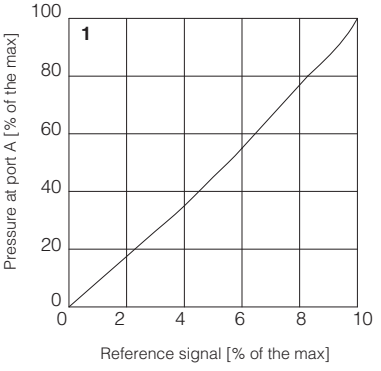


3 = A-T or P1-T (dotted line /350)
4 = P-P1 or P-A

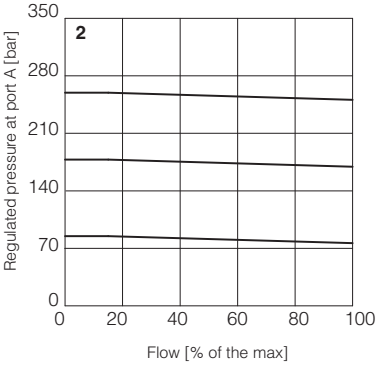
Note: the presence of counter pressure at port T can affect the effective pressure regulation

20 DIAGRAMS AGRCZA (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams
with flow rate Q = 10 l/min



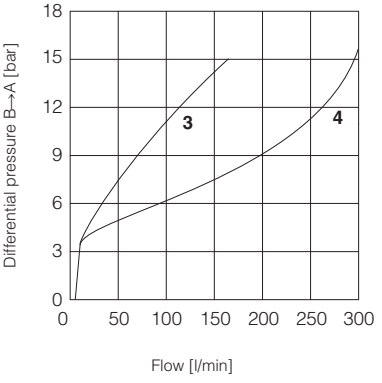
2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min

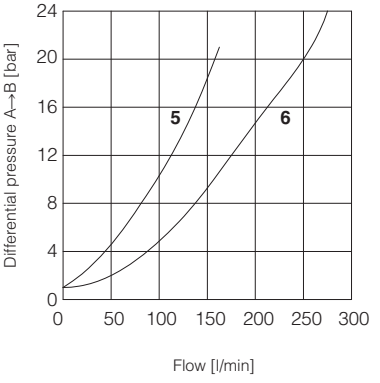


3-6 Pressure drop/flow diagrams
with zero reference signal

Differential pressure B→A
3 = AGRCZA-*-10
4 = AGRCZA-*-20

Differential pressure A→B
(through check valve)
5 = AGRCZA-*-10/*/R
6 = AGRCZA-*-20/*/R





21 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

21.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

21.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

21.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

21.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

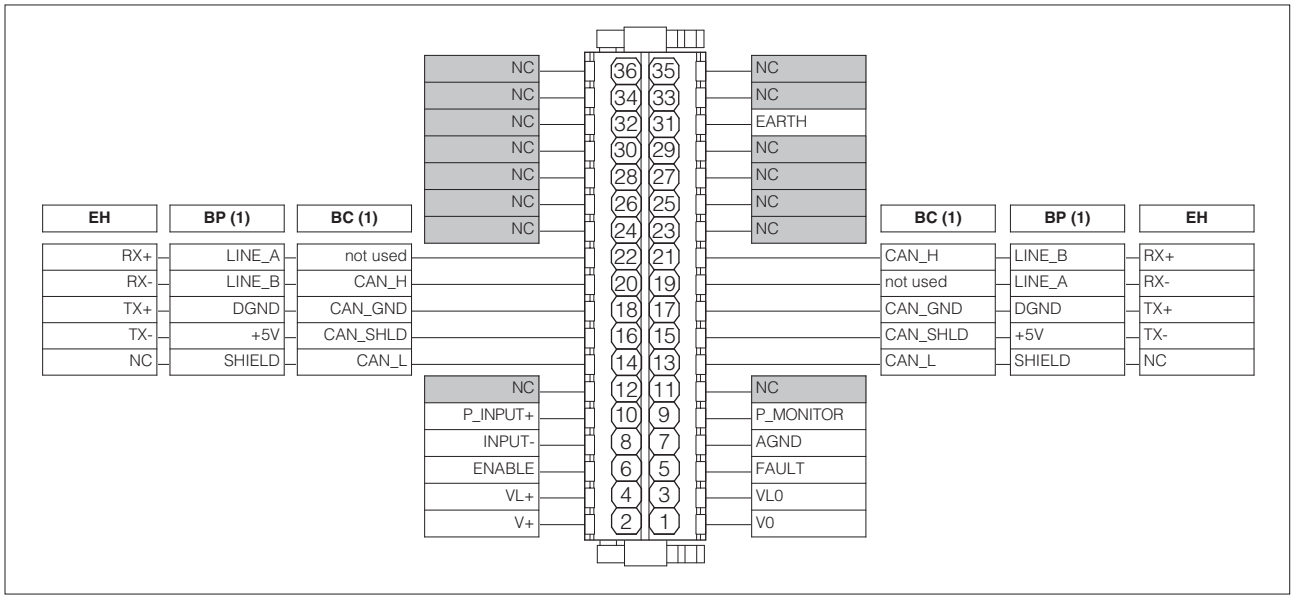
21.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

21.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

22 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

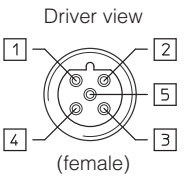
23 ELECTRONIC CONNECTIONS

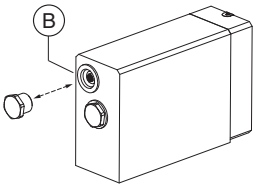
23.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative pressure reference input signal for INPUT+	Input - analog signal
	9	**P_MONITOR**	Pressure monitor output signal: 0 ÷10 VDC / 0 ÷ 20 mA maximum range, referred to AGND Default is: 0 ÷10 VDC or 4 ÷ 20 mA	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

23.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





23.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

23.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

23.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

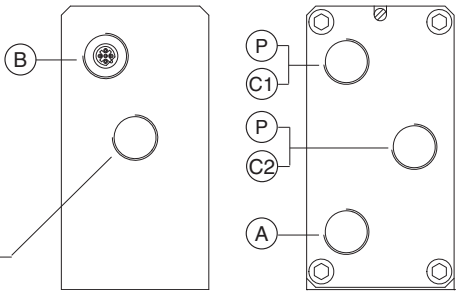
24 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

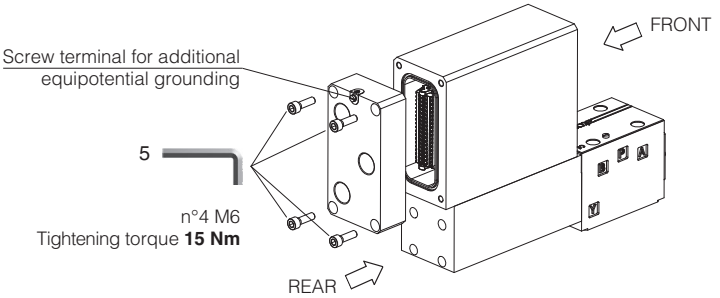
- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug

PRESSURE TRANSDUCER CONNECTION
factory wired



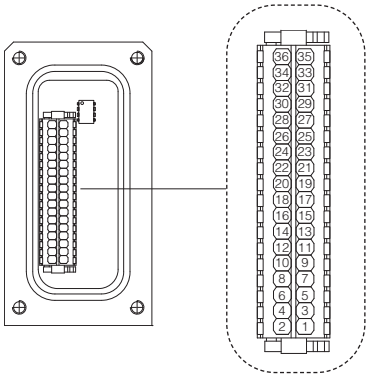
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

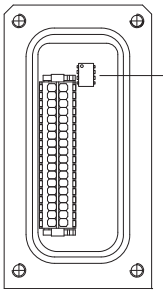


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 22

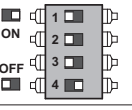


Fieldbus terminator only for BC and BP executions **(1)**



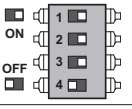
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

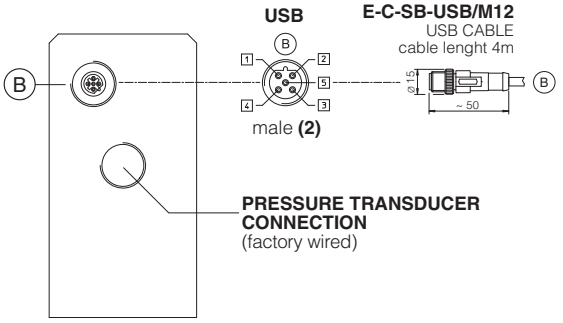


BP - PROFIBUS DP setting:

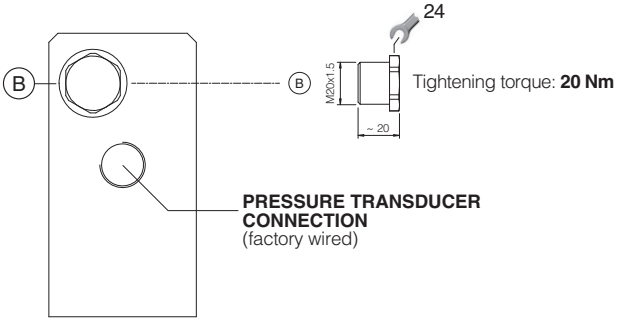
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

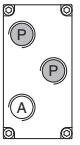
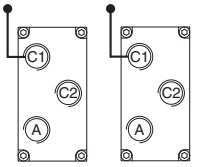
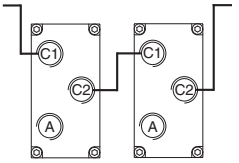


METALLIC PROTECTION CAP - supplied with the valves



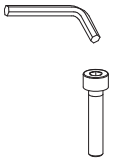
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

24.1 Cable glands and threaded plug - see tech table **KX800**

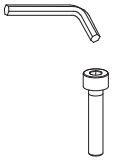
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

25 FASTENING BOLTS AND SEALS

25.1 RZGA valves

	RZGA-RES-*-010	RZGA-RES-*-033
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm

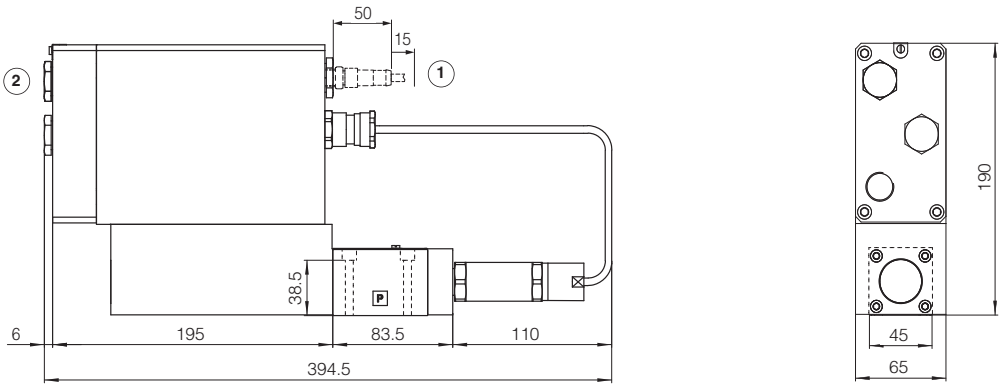
25.2 AGRCZA valves

	AGRCZA-RES-*-10	AGRCZA-RES-*-20
	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm
	**Seals:** 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm

RZGA-RES-*-010

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(port B not used)

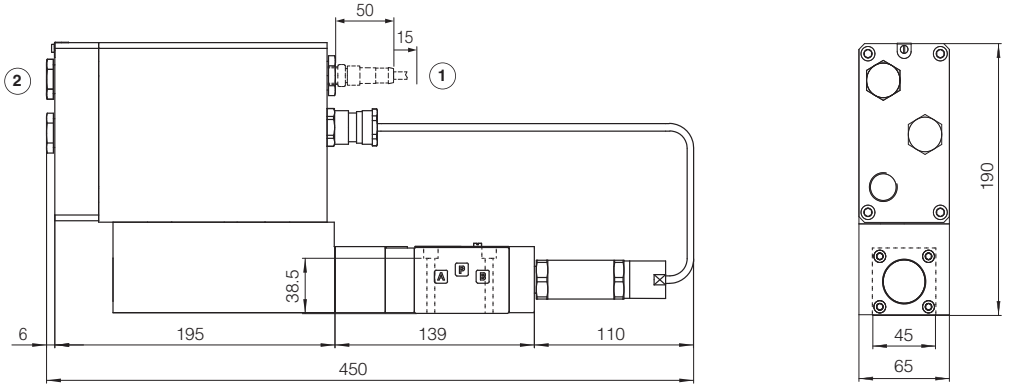
Mass [kg]	
RZGA-RES-*-010	8,5



RZGA-RES-*-033

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(ports A and B connected to port T)

Mass [kg]	
RZGA-RES-*-033	9,5



(1) = Space to remove the USB connector

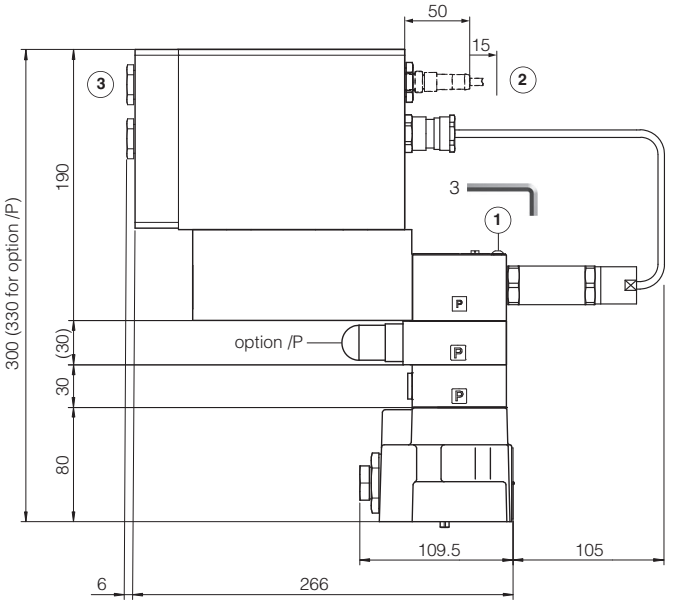
(2) = The dimensions of cable glands must be considered (see tech table **KX800**)

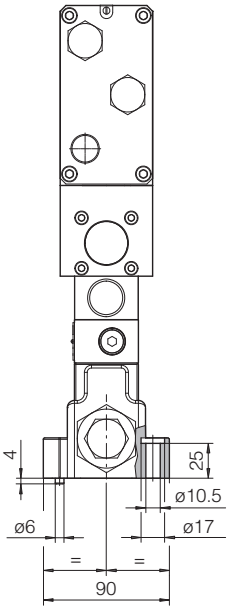
27 INSTALLATION DIMENSIONS FOR AGRCZA [mm]

AGRCZA-RES-*-10

ISO 5781: 2000
Mounting surface: 5781-06-07-0-00 (see table P005)

Mass [kg]	
AGRCZA-RES-*-10	12,1

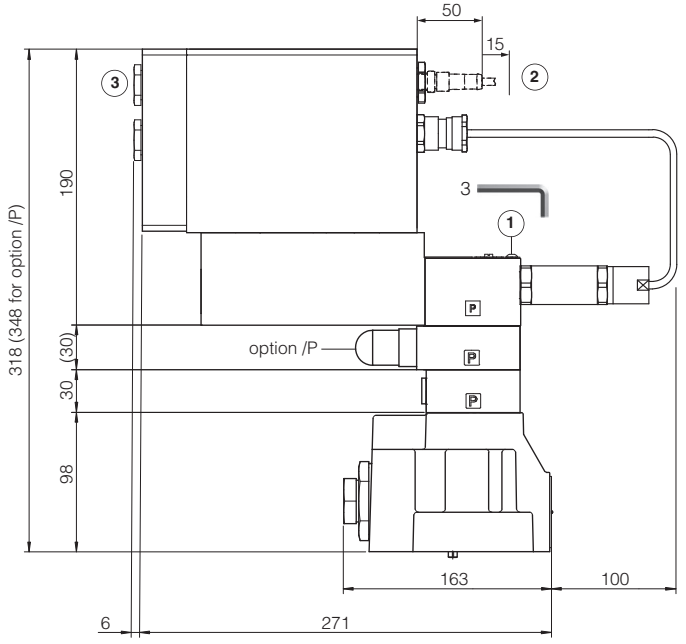


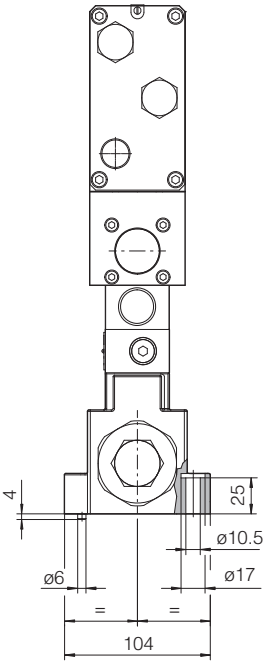


AGRCZA-RES-*-20

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00 (see table P005)

Mass [kg]	
AGRCZA-RES-*-20	13,3





(1) = Air bleed off

(2) = Space to remove the USB connector

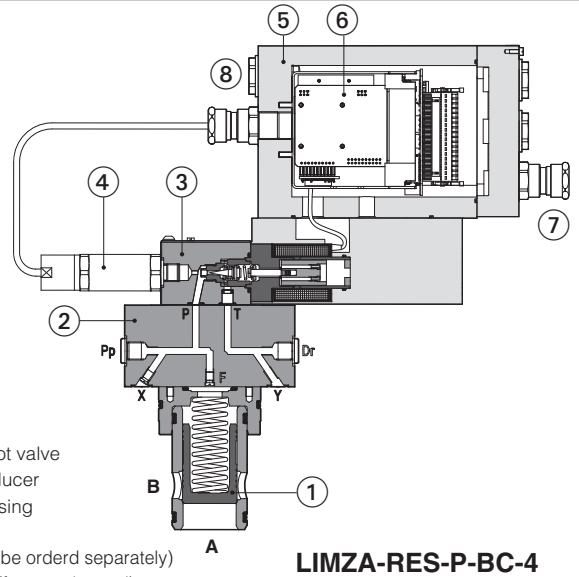
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

28 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GX800**	Ex-proof pressure transducer type E-ATRA-7
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		
GS510	Fieldbus		

Ex-proof digital proportional pressure cartridges high performance

with on-board driver and pressure transducer - **ATEX and IECEx**



① poppet
② functional cover
③ Proportional ex-proof pilot valve
④ ex-proof pressure transducer
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be orderd separately)
⑧ USB port always present (factory plugged)

LIMZA-RES-P-BC-4

LICZA-RES, LIMZA-RES, LIRZA-RES

2-way ex-proof digital proportional pressure cartridges, high performance with pressure transducer, respectively performing:
pressure compensator, relief or reducing functions.

They are equipped with ex-proof on-board digital driver, pressure transducer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **16** ÷ **80** -ISO7368

Max flow: up to **4500 l/min**

Max pressure: **250 bar**

1 **MODEL CODE FOR COVERS**

LIMZA	- RES	- P	- NP	- 3	/ 315	/ M	/ *	/ *	* /	*

LIMZA
Ex-proof proportional pressure cartridges
LICZA = pressure compensator
LIMZA = pressure relief
LIRZA = pressure reducing

RES = on-board driver

P = on-board ex-proof pressure transducer

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 7368:
1 = 16
2 = 25
3 = 32
4 = 40
5 = 50 (not for LIRZA)
6 = 63 (only for LIMZA)
8 = 80; (only for LIMZA)

Max regulated pressure:
80 = 80 bar
180 = 180 bar
250 = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (1):
P =with integral mechanical pressure limiter (standard for size 1, 2, 3)

Electronics options (1):
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)

Dynamic response preset, see section 18:
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

Series number

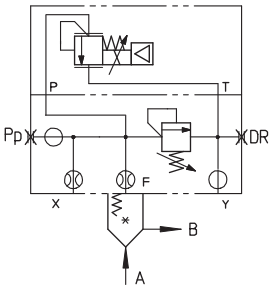
Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /IP

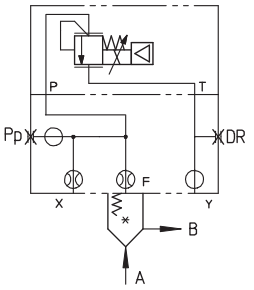
2 HYDRAULICS SYMBOLS

LICZA

LICZA-RES-1÷3
LICZA-RES-4÷5 /P

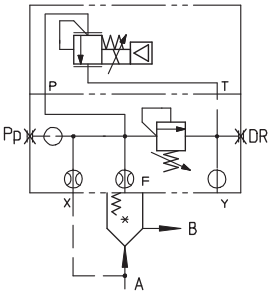


LICZA-RES-4÷5

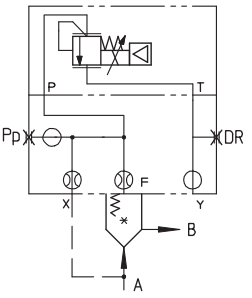


LIMZA

LIMZA-RES-1÷3
LIMZA-RES-4÷8 /P

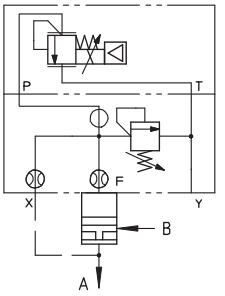


LIMZA-RES-4÷8

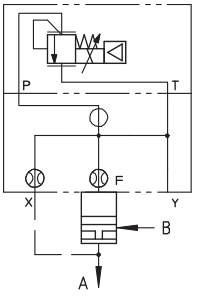


LIRZA

LIRZA-RES-1÷3
LIRZA-RES-4 /P



LIRZA-RES-4



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	**	/	*

Cartridge according to ISO 7368

Cartridges size ISO 7368:
16
25
32
40
50
63
80

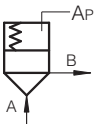
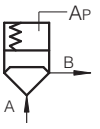
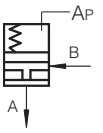
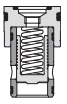
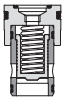
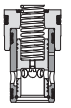
Type of poppet:
31 = for LIMZA and LICZA
36 = for LICZA
37 = for LIRZA

Spring cracking pressure:
2 = 1,5 bar for poppet 31
3 = 3 bar
4 = 4 bar
6 = 6 bar for poppet 31 and 36
7 = 7 bar for poppet 37

Series number

Seals material,
see section [11]:
- = NBR
PE = FKM
BT = HNBR

4 TYPE OF POPPET

Type of poppet	**31**	**36**	**37**
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	**1:1**	**1:1**	**1:1**

5 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

6 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

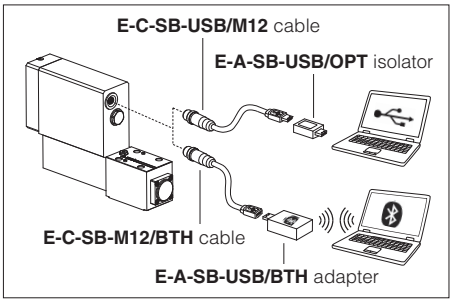
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET IRT)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

7 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 12 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**LICZA**					**LIMZA**							**LIRZA**			
Valve size	[l/min]	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**1**	**2**	**3**	**4**
Max flow	[bar]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pressure		see section 20															
Max regulated pres. at port A	[bar]	80; 180; 250					80; 180; 250							80; 180; 250			
Max pressure	[bar]	Ports: T, Y = 210															
		Ports: P, A, B, X = 350															
Response time 0-100% step signal **(1)** (depending on installation)	[ms]	≤ 100 ÷ 350					≤ 100 ÷ 350							≤ 100 ÷ 250			
Hysteresis	[% of regulated max pres.]	≤ 0,5															
Linearity	[% of regulated max pres.]	≤ 1,0															
Repeatibility	[% of regulated max pres.]	≤ 0,2															

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: range 0 ÷ 10 VDC @ max 5 mA Current: range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 500 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

12 CERTIFICATION DATA

Valve type	LICZA, LIMZA, LIRZA			
Certifications	Multicertification Group II **ATEX IECEx**			
Solenoid certified code	**OZA-RES**			
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**		**T4**
Surface temperature	≤ 85 °C	≤ 100 °C		≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C		-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

13 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

13.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

14 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

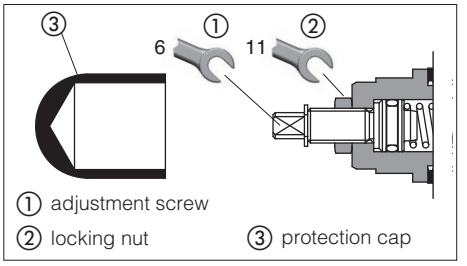
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

15 HYDRAULIC OPTIONS

P = Integral mechanical pressure limiter (standard for size 1, 2 and 3)

The LICZA, LIMZA and LIRZA standard size 1, 2, 3 and option /P are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



16 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

17 POSSIBLE COMBINED OPTIONS

/IP

18 DYNAMIC RESPONSE - 4 pressure PIDs

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port.
Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

(1) interchangeable with previous TERS version

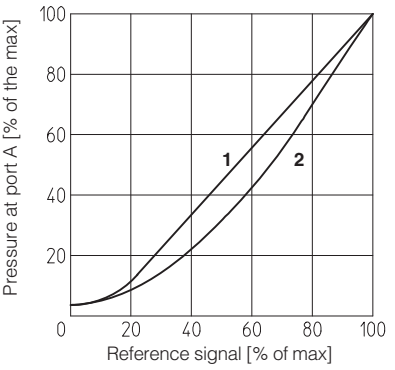
PID	Dynamic response
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop

19 PRESSURE TRANSDUCER FAILURE

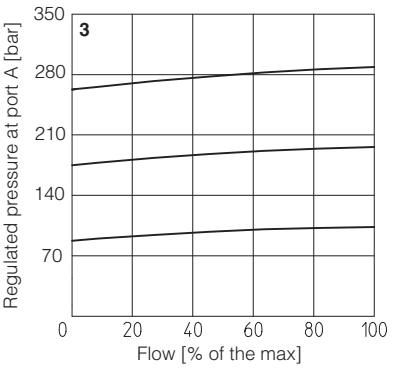
In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

20 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams LIMZA
2 Regulation diagrams LICZA



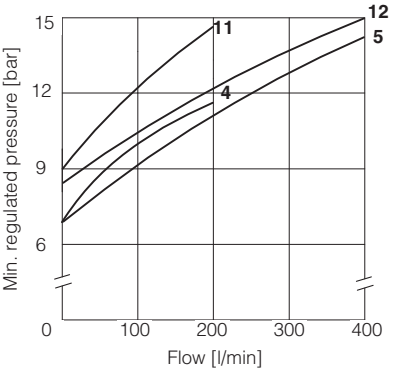
3 Pressure/flow diagrams LICZA, LIMZA

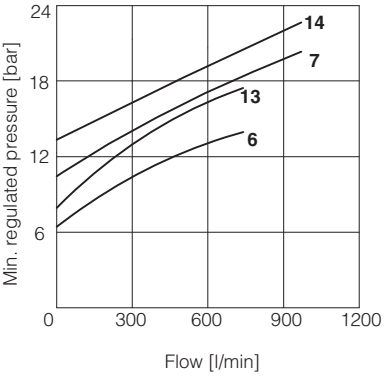


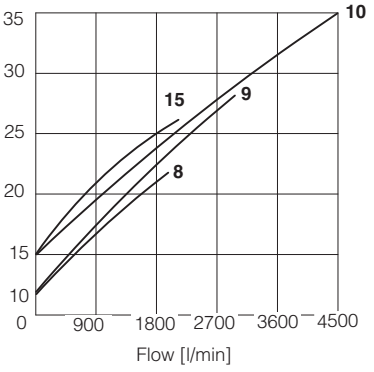
4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZA-*-1
5 = LIMZA-*-2
6 = LIMZA-*-3
7 = LIMZA-*-4
8 = LIMZA-*-5
9 = LIMZA-*-6
10 = LIMZA-*-8

11 = LICZA-*-1
12 = LICZA-*-2
13 = LICZA-*-3
14 = LICZA-*-4
15 = LICZA-*-5





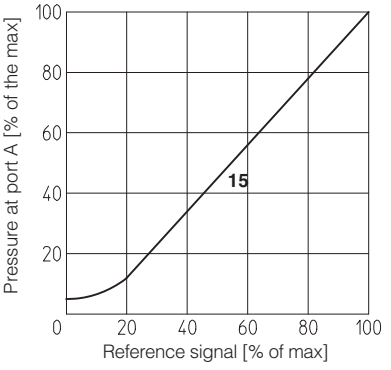


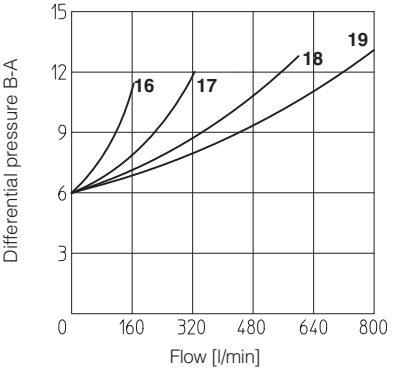
Regulation diagrams LIRZA

15 = LIRZA-A

16-19 Min. pressure/flow diagrams
with reference signal "null"

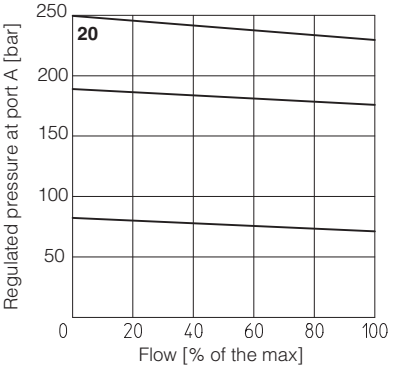
16 = LIRZA-*-1
17 = LIRZA-*-2
18 = LIRZA-*-3
19 = LIRZA-*-4





Pressure/flow diagrams

20 = LIRZA-A



21 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

21.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

21.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

21.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

21.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

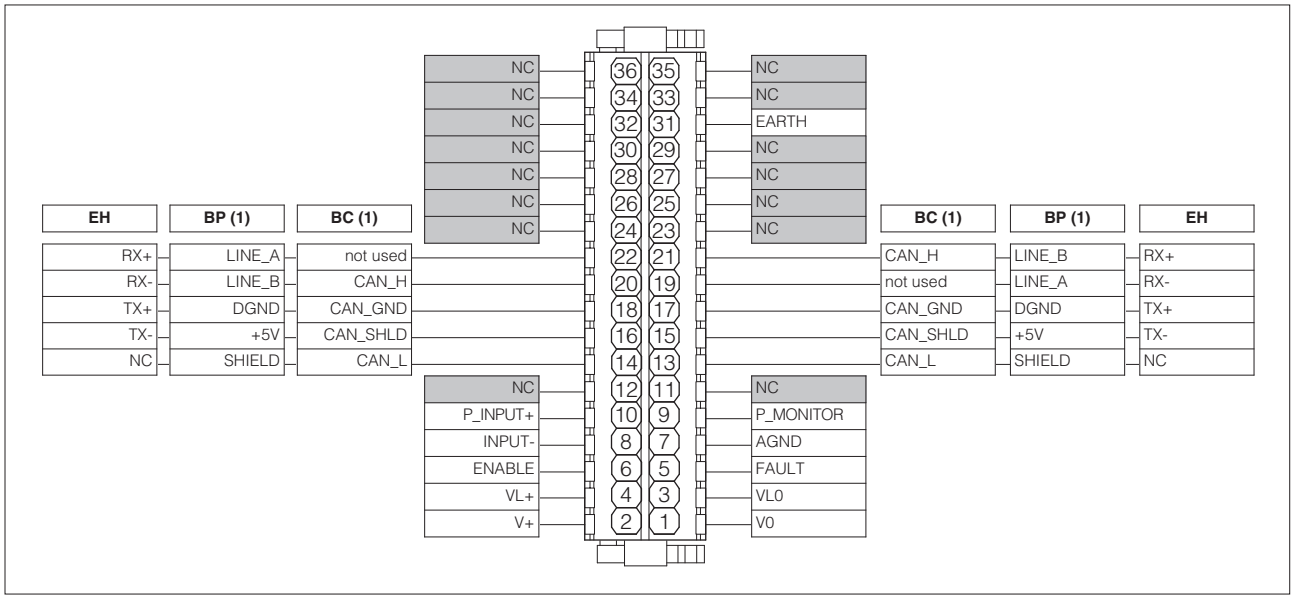
21.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

21.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

22 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

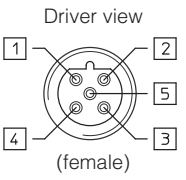
23 ELECTRONIC CONNECTIONS

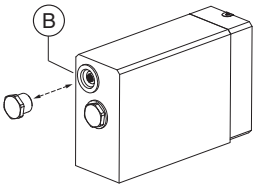
23.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative pressure reference input signal for INPUT+	Input - analog signal
	9	**P_MONITOR**	Pressure monitor output signal: 0 ÷10 VDC / 0 ÷ 20 mA maximum range, referred to AGND Default is: 0 ÷10 VDC or 4 ÷ 20 mA	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

23.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





23.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

23.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

23.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

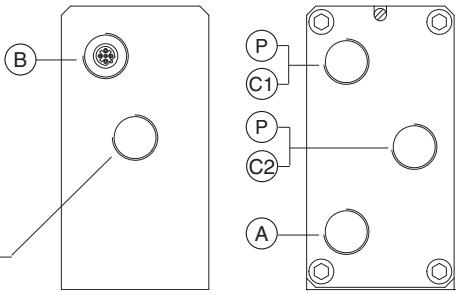
24 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

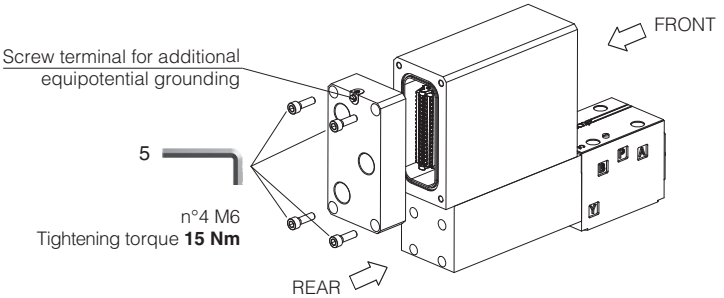
- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug

PRESSURE TRANSDUCER CONNECTION
factory wired



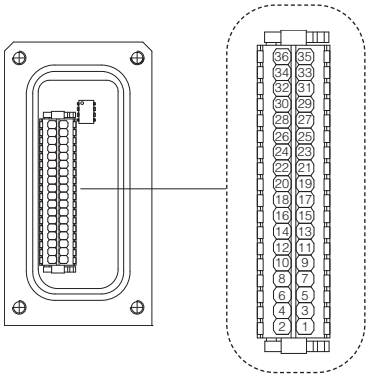
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

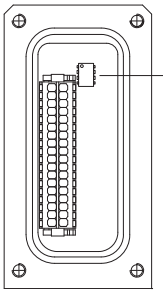


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 22



Fieldbus terminator only for BC and BP executions **(1)**



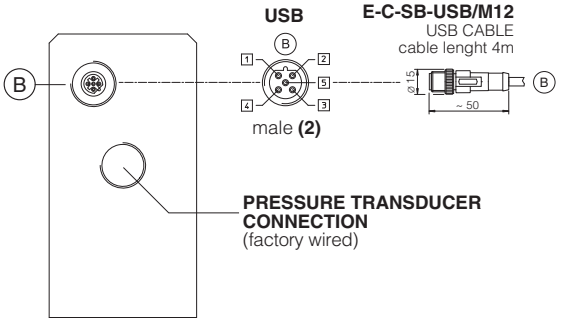
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

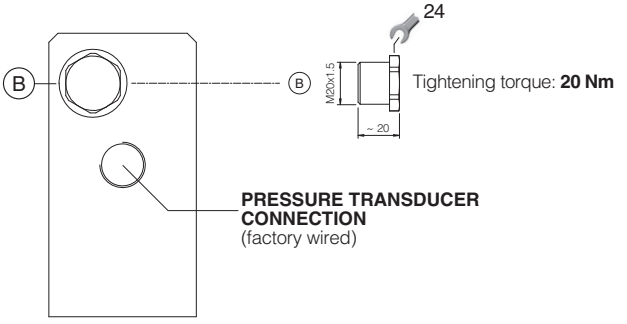
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

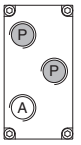
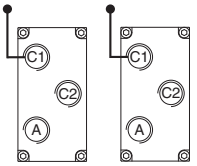
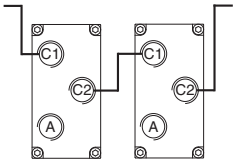


METALLIC PROTECTION CAP - supplied with the valves



(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

24.1 Cable glands and threaded plug - see tech table **KX800**

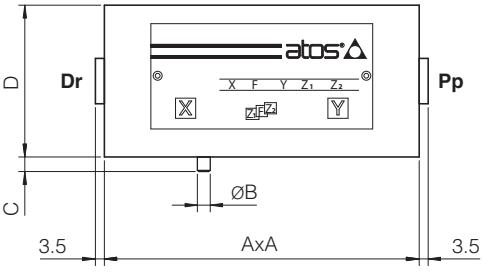
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

25 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZA **LICZA** **LIRZA**	**1** = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZA **LICZA**	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZA	**6** = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

26 COVERS DIMENSIONS [mm]

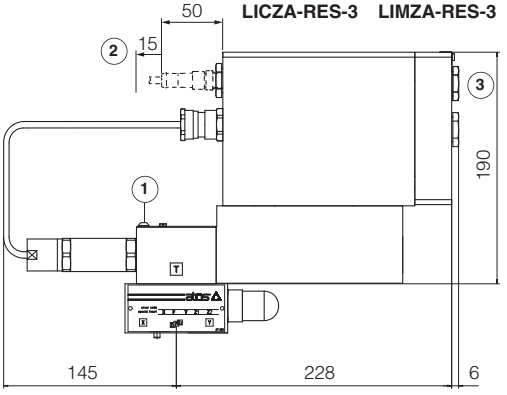
Size	AxA	øB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4"
5 = 50	140x140	6	4	70	G 1/4"
6 = 63	180x180	6	4	80	G 3/8"
8 = 80	ø250	8	6	80	G 3/8"



Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

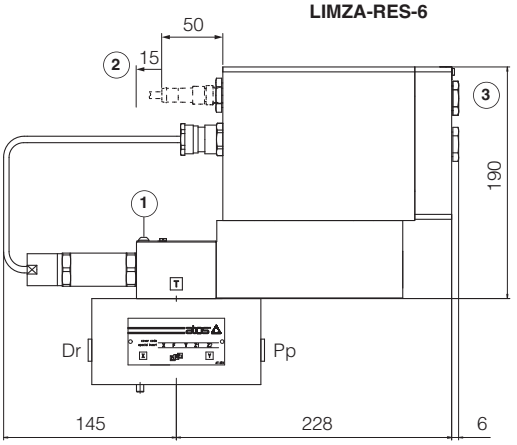
27 INSTALLATION DIMENSIONS [mm]

LICZA-RES-1 LIMZA-RES-1 LIRZA-RES-1
LICZA-RES-2 LIMZA-RES-2 LIRZA-RES-2
LICZA-RES-3 LIMZA-RES-3 LIRZA-RES-3

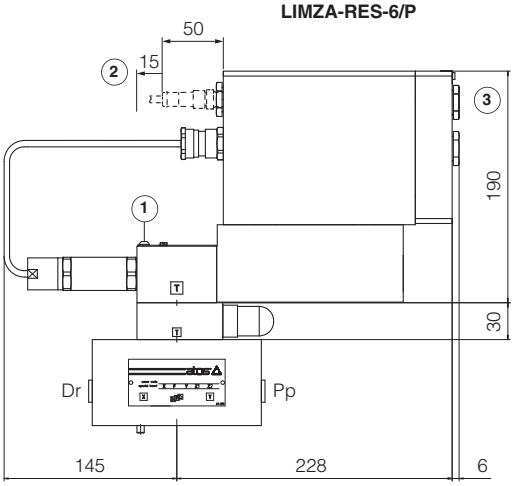


Mass [kg]			
	LICZA, LIMZA, LIRZA		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	11	-	0,2
2 = 25	11,5	-	0,5
3 = 32	12,8	-	0,9
4 = 40	18,2	12,5	1,7
5 = 50	21,7	16	2,9
6 = 63	31,2	25,5	6,7
8 = 80	39,8	34,1	13,1

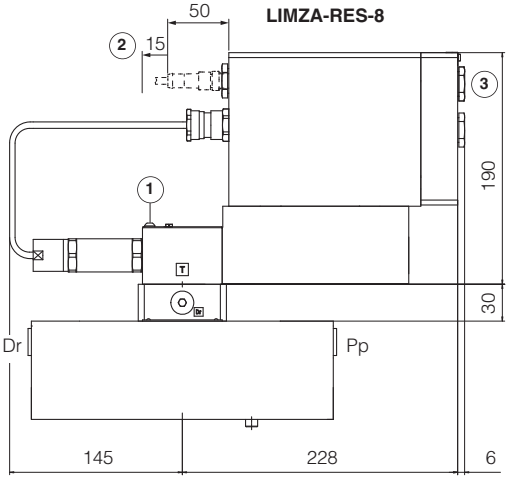
LICZA-RES-4 LIMZA-RES-4 LIRZA-RES-4
LICZA-RES-5 LIMZA-RES-5
LIMZA-RES-6



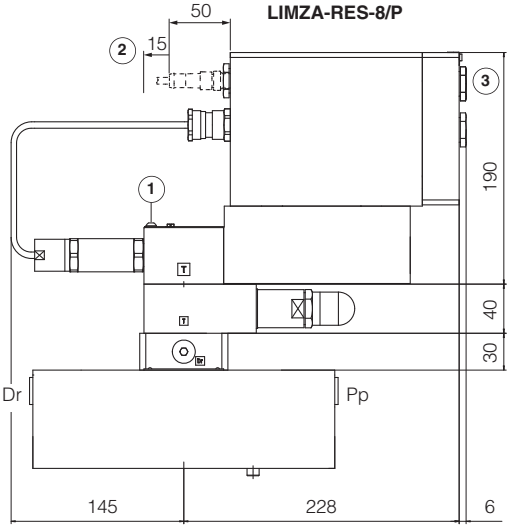
LICZA-RES-4/P LIMZA-RES-4/P LIRZA-RES-4/P
LICZA-RES-5/P LIMZA-RES-5/P
LIMZA-RES-6/P



LIMZA-RES-8



LIMZA-RES-8/P



Note: for ISO 7368 mounting surface and cavity dimensions, see tech. table P006

(1) = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw

(2) = Space to remove the USB connector

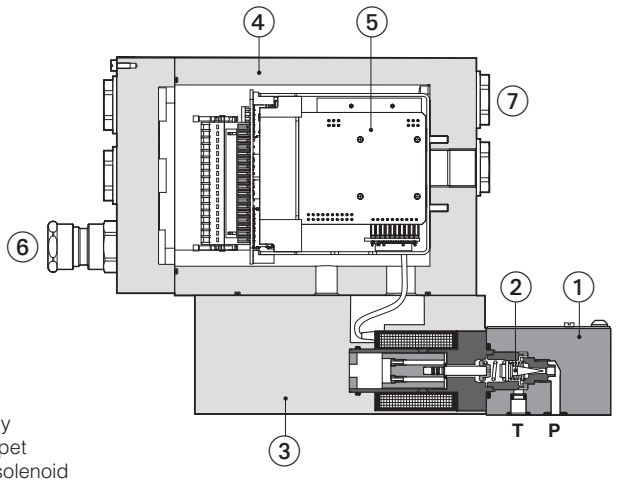
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

28 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GX800**	Ex-proof pressure transducer type E-ATRA-7
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P006**	Mounting surfaces and cavities for cartridge valves
GS500	Programming tools		
GS510	Fieldbus		

Ex-proof digital proportional relief valves

direct or piloted, with on-board driver and without transducer - **ATEX and IECEx**



① valve body
② main poppet
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof cable glands (to be ordered separately)
⑦ USB port always present (factory plugged)

RZMA-AES-NP-10-*

RZMA-AES, AGMZA-AES

Ex-proof digital proportional relief valves direct or piloted without transducer for pressure open loop controls.

They are equipped with ex-proof on-board digital driver and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECE**x for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

RZMA, direct or piloted:
Size: **06** -ISO 4401
Max flow: **4** and **40 l/min**

AGMZA, piloted:
Size: **10**, **20** and **32** -ISO 6264
Max flow: **200**, **400** and **600 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZMA	-	AES	-	NP	-	010	/	250	/	M	/	*	*	/	*

RZMA Ex-proof proportional pressure relief valves
RZMA = subplate size 06
AGMZA = subplate size 10, 20, 32

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size and configuration:
RZMA: direct **010** = Qmax 4 l/min
RZMA: piloted **030** = Qmax 40 l/min
AGMZA: piloted **10, 20, 32** = Qmax 200, 400, 600 l/min

Max regulated pressure:
80 = 80 bar **180** = 180 bar **250** = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options - only AGMZA **(1)**:
E = external pilot
Y = external drain

Electronic options (1):
I = current reference input 4÷20 mA (omit for std voltage 0÷10VDC)

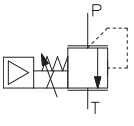
Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

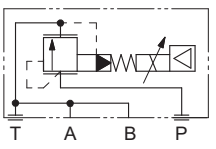
(1) Possible combined options: /EY, /EI, /YI

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

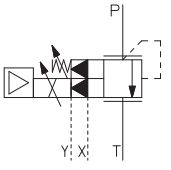
RZMA-AES-*-010



RZMA-AES-*-030



AGMZA-AES-*



3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

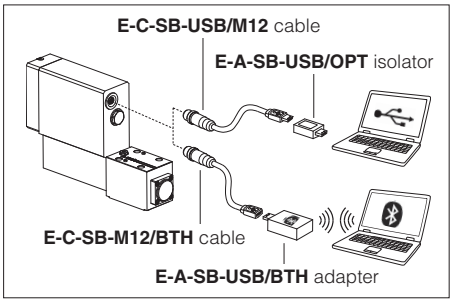
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	RZMA-010 150 years, RZMA-030 and AGMZA 75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZMA		AGMZA		
Size code		**010**	**030**	**10**	**20**	**32**
Valve size		06		10	20	32
Max regulated pressure	[bar]	**80**	**180**	**250**		
Min regulated pressure	[bar]	see min. pressure / flow diagrams at sections 18 19 20				
Max pressure at port P, A, B, X	[bar]	315				
Max pressure at port T, Y	[bar]	210				
Max flow	[l/min]	4	40	200	400	600
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 80		≤ 130	≤ 145	≤ 160
Hysteresis [% of the max pressure]		≤ 1,5				
Linearity [% of the max pressure]		≤ 3				
Repeatability [% of the max pressure]		≤ 2				

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: maximum range ± 5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	RZMA, AGMZA			
Certifications	Multicertification Group II **ATEX IECEx**			
Solenoid certified code	**OZA-AES**			
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**		**T4**
Surface temperature	≤ 85 °C	≤ 100 °C		≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C		-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

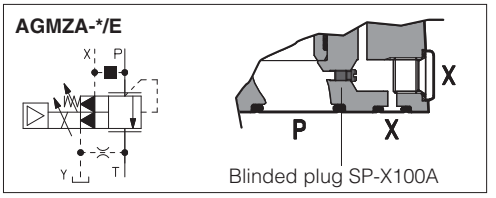
Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS - only for AGMZA

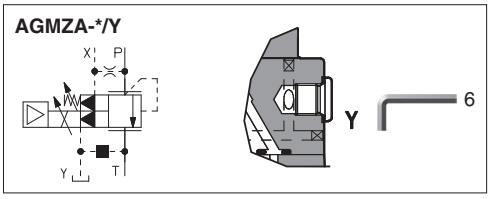
E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").

Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.



14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.



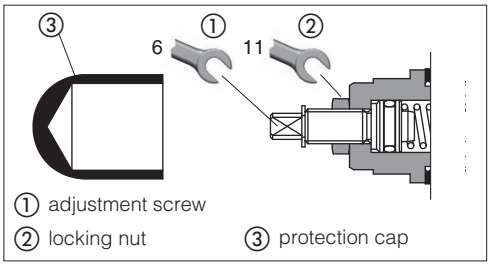
15 POSSIBLE COMBINED OPTIONS

/EY, /EI, /YI

16 MECHANICAL PRESSURE LIMITER - only for AGMZA

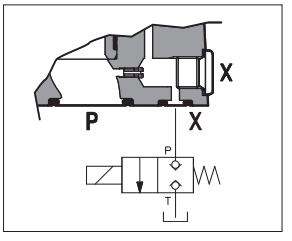
The AGMZA are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



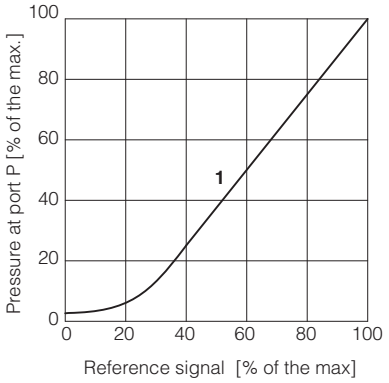
17 REMOTE PRESSURE UNLOADING - only for AGMZA

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).
This function can be used in emergency to unload the system pressure by-passing the proportional control.

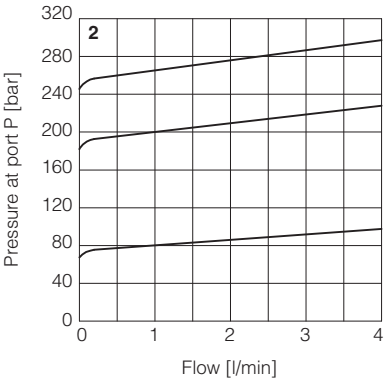


18 DIAGRAMS RZMA-010 (based on mineral oil ISO VG 46 at 50 °C)

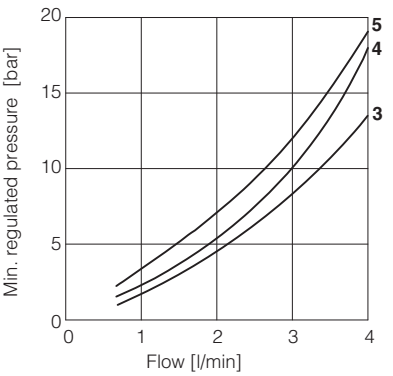
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-5 Min. pressure/flow diagrams
with zero reference signal

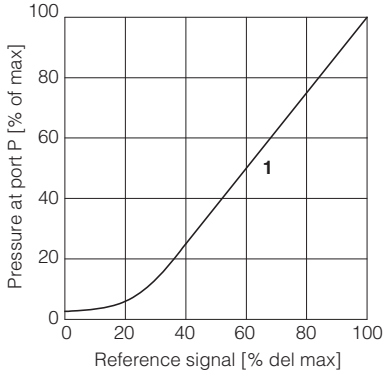


3 = RZMA/80
4 = RZMA/180
5 = RZMA/250

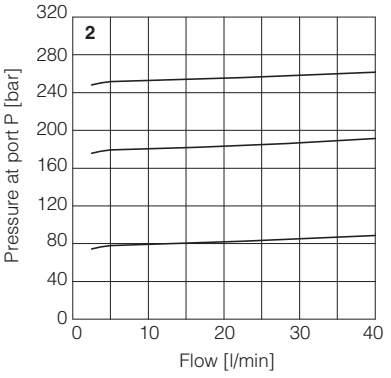
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

19 DIAGRAMS RZMA-030 (based on mineral oil ISO VG 46 at 50 °C)

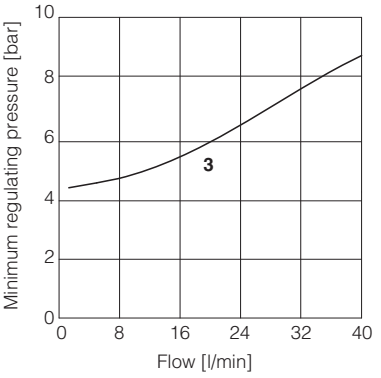
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



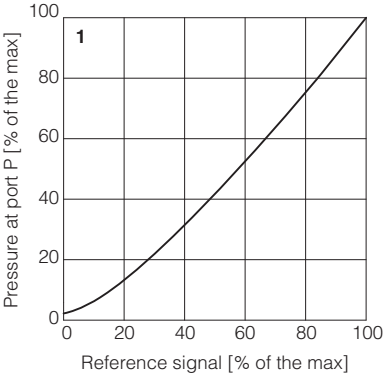
3 Min. pressure/flow diagrams
with zero reference signal



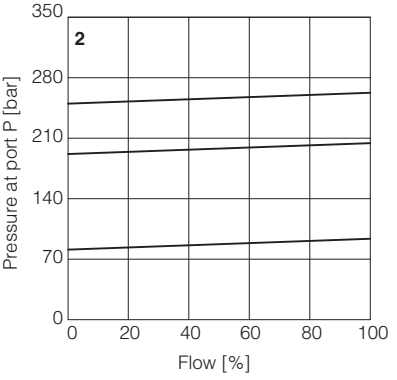
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

20 DIAGRAMS AGMZA (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

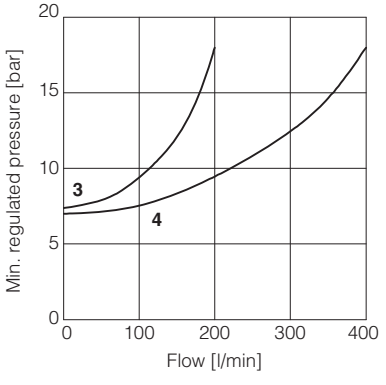


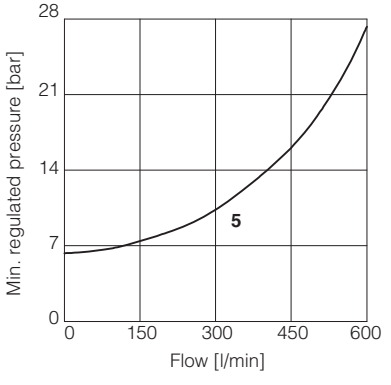
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



3-5 = Min. pressure/flow diagrams
with zero reference signal

3 = AGMZA-*-10
4 = AGMZA-*-20
5 = AGMZA-*-32





21 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

21.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

21.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

21.3 Flow reference input signal (INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

21.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

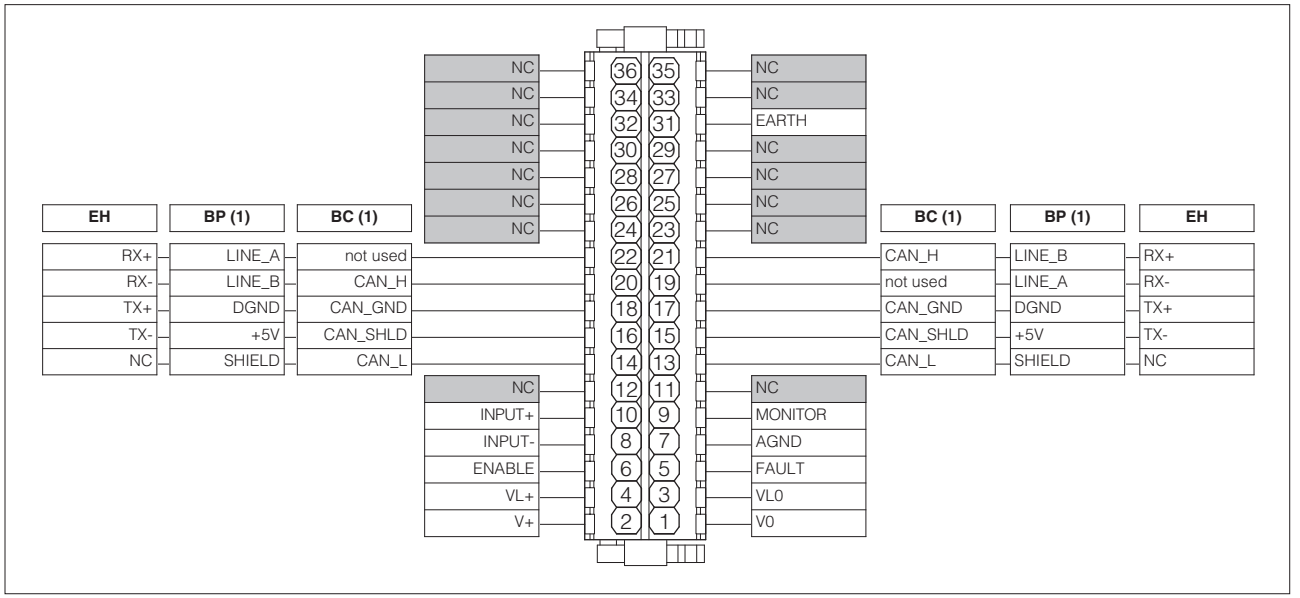
21.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

21.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

22 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

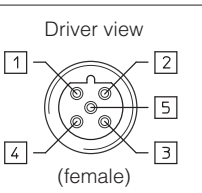
23 ELECTRONIC CONNECTIONS

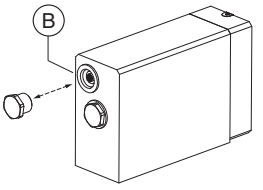
23.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to AGND Default is: ±5 VDC	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

23.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





23.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

23.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

23.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

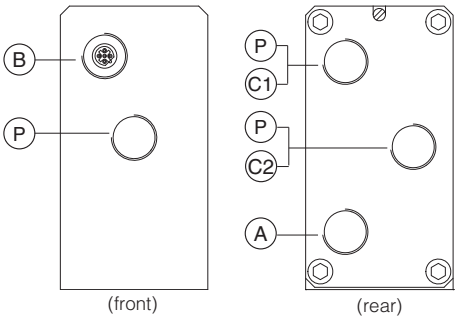
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

24 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

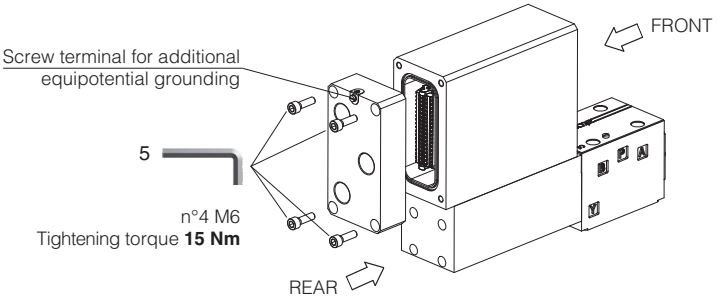
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug



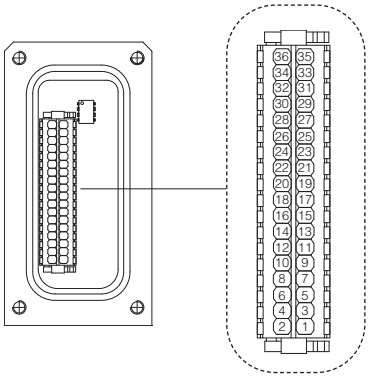
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

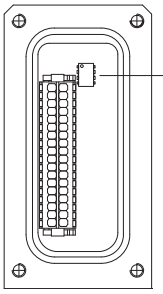


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 22

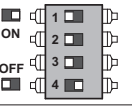


Fieldbus terminator only for BC and BP executions **(1)**



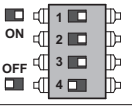
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

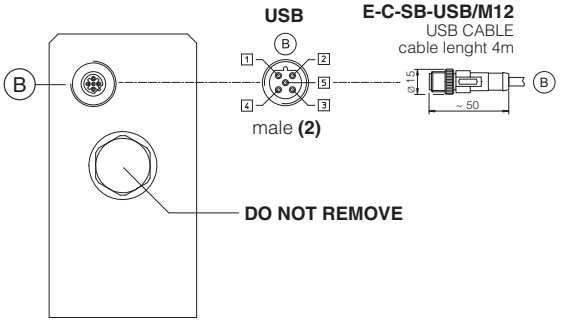


BP - PROFIBUS DP setting:

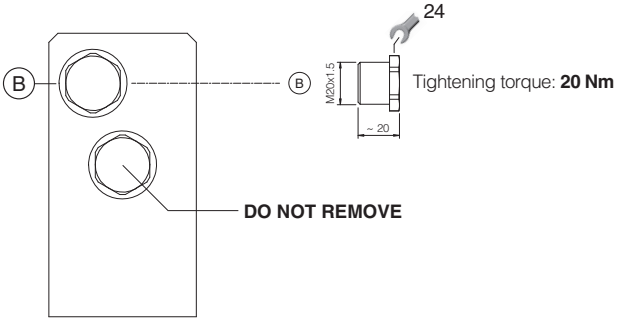
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

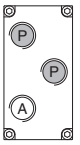
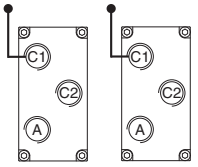
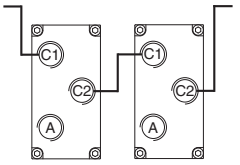


METALLIC PROTECTION CAP - supplied with the valves



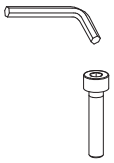
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

24.1 Cable glands and threaded plug - see tech table **KX800**

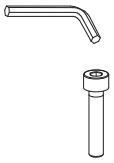
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

25 FASTENING BOLTS AND SEALS

25.1 RZMA valves

	RZMA-AES-*-010	**RZMA-AES-*-030**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm

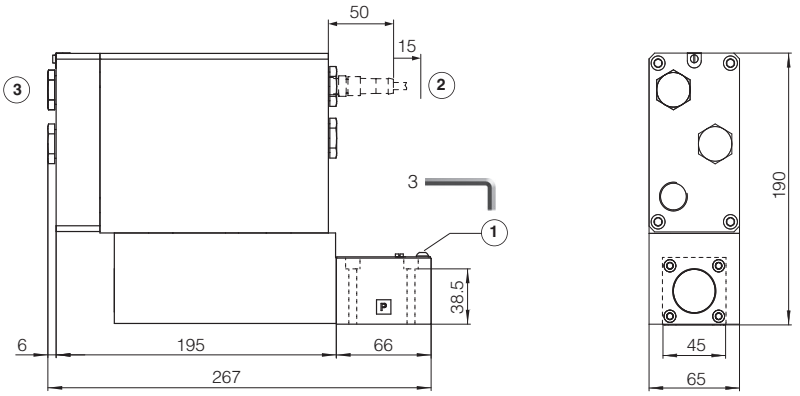
25.2 AGMZA valves

	AGMZA-AES-*-10	**AGMZA-AES-*-20**	**AGMZA-AES-*-32**
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**Seals:** 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

RZMA-AES-*-010

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

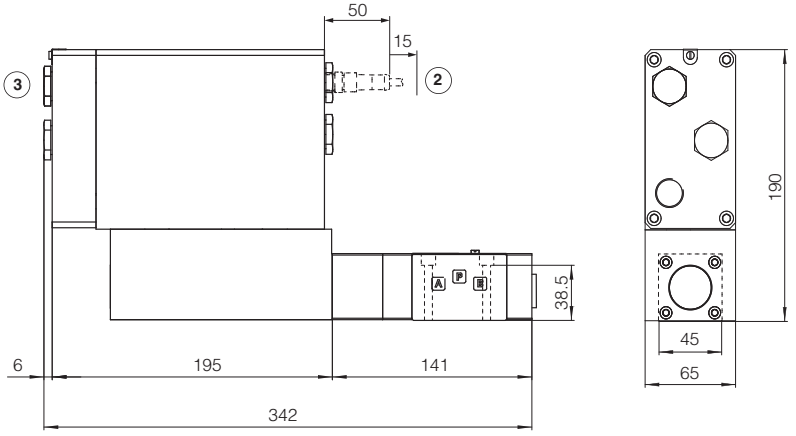
Mass [kg]	
RZMA-AES-*-010	8



RZMA-AES-*-030

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(ports A and B connected to port T)

Mass [kg]	
RZMA-AES-*-030	9



(1) = Air bleed off

(2) = Space to remove the USB connector

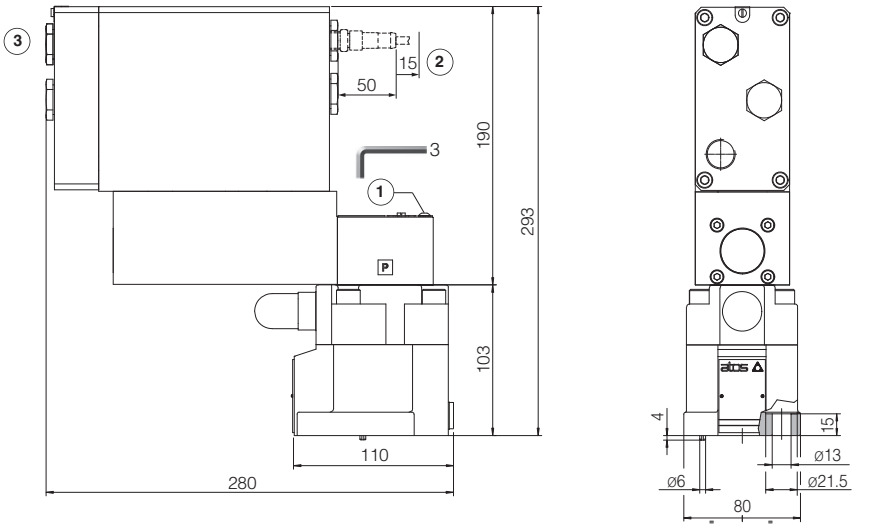
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

27 INSTALLATION DIMENSIONS FOR AGMZA [mm]

AGMZA-AES-*-10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

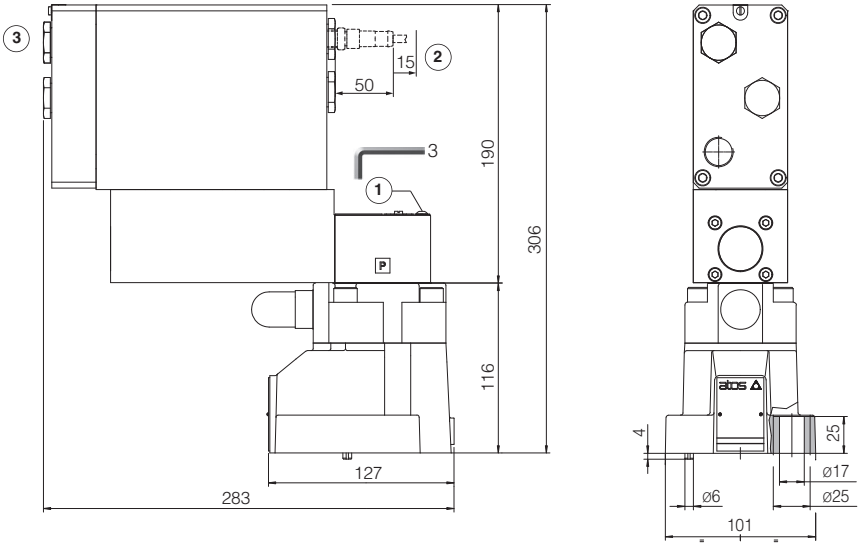
Mass [kg]	
AGMZA-AES-*-10	11,6



AGMZA-AES-*-20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

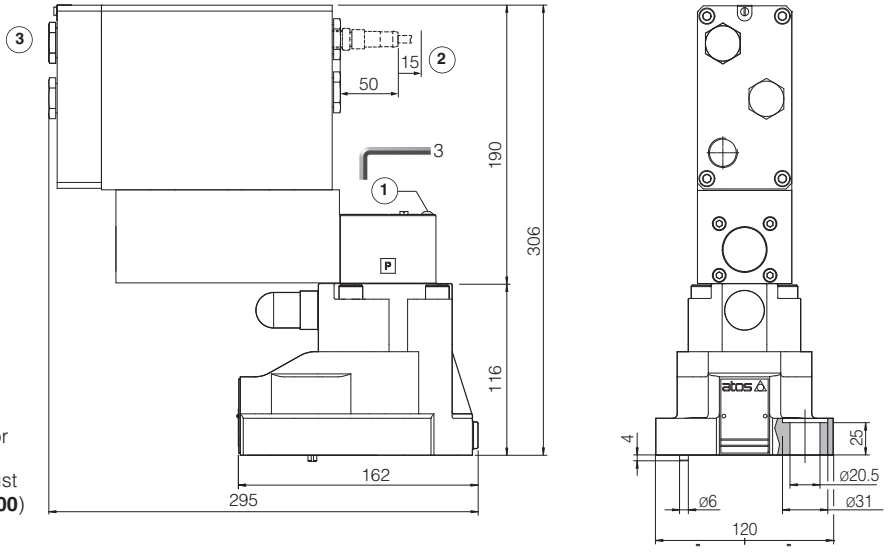
Mass [kg]	
AGMZA-AES-*-20	12,8



AGMZA-AES-*-32

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)

Mass [kg]	
AGMZA-AES-*-32	14,8



(1) = Air bleed off

(2) = Space to remove the USB connector

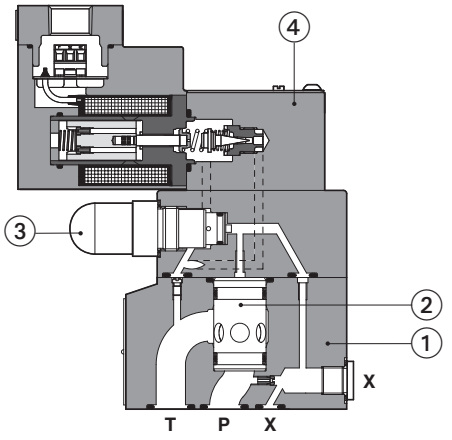
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

28 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		

Ex-proof proportional relief valves

direct or piloted, without transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



AGMZA-A-10-*

① valve main body
② cartridge
③ mechanical pressure limiter
④ ex-proof pilot valve

RZMA-A, HZMA-A, AGMZA-A

Ex-proof proportional relief valves direct or piloted, without transducer for open loop pressure controls.
They are equipped with ex-proof proportional solenoid, certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

RZMA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **4** and **40 l/min**

HZMA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **40 l/min**

AGMZA, piloted:
Size: **10**, **20** and **32** - ISO 6264
Max flow: **200**, **400** and **600 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZMA	/	*	-	A	-	10	-	250	/	GK	/	*	/	*	*	/	*

RZMA Ex-proof proportional pressure relief valves
RZMA = subplate size 06
HZMA = modular size 06
AGMZA = subplate size 10, 20, 32

Certification type:
Multicertification:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

Valve size and configuration:

010	= RZMA direct	size 06	Qmax 4 l/min
030	= RZMA piloted	size 06	Qmax 40 l/min
030	= HZMA piloted	size 06	Qmax 40 l/min
10	= AGMZA piloted	size 10	Qmax 200 l/min
20	= AGMZA piloted	size 20	Qmax 400 l/min
32	= AGMZA piloted	size 32	Qmax 600 l/min

Max regulated pressure:
80 = 80 bar **180** = 180 bar **250** = 250 bar

Series number

Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR **(2)**

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

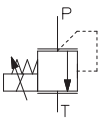
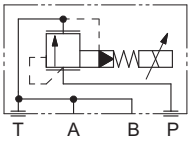
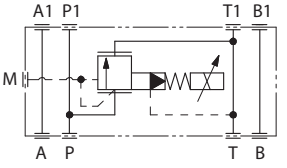
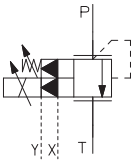
Options (3):
E = external pilot (only for AGMZA)
O = horizontal cable entrance **(2)**
Y = external drain (only for AGMZA)

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /EO, /EY, /OY **(4)** Approved only for the Italian market

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

RZMA-A-010	RZMA-A-030	HZMA-A-030	AGMZA-A-*
			

3 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years; 150 years only for RZMA-010, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZMA		HZMA	AGMZA		
Size code		**010**	**030**	**030**	**10**	**20**	**32**
Valve size		06			10	20	32
Max regulated pressure	[bar]	**80** **180** **250**					
Min regulated pressure	[bar]	see min. pressure / flow diagrams at sections 15 16 17					
Max pressure at port P, A, B, X	[bar]	315					
Max pressure at port T, Y	[bar]	210					
Max flow	[l/min]	4	40	40	200	400	600
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 80			≤ 130	≤ 145	≤ 160
Hysteresis[% of the max pressure]		≤ 1,5					
Linearity[% of the max pressure]		≤ 3					
Repeatability[% of the max pressure]		≤ 2					

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

6 ELECTRICAL CHARACTERISTICS

Max. power	35W	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

8 CERTIFICATION DATA

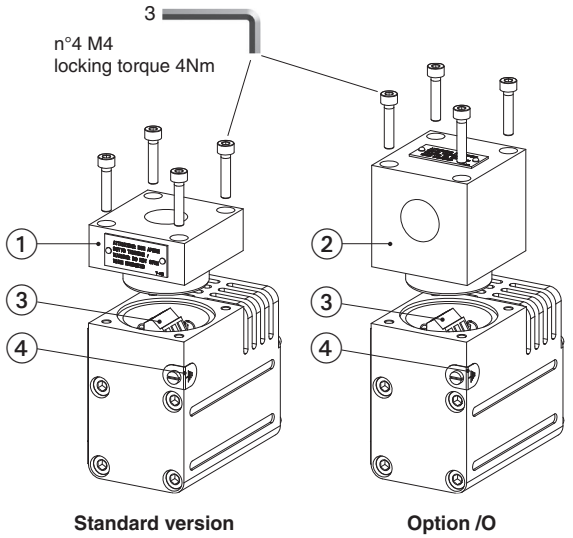
Valve type	RZMA, HZMA, AGMZA		RZMA**/M**, HZMA**/M**, AGMZA**/M**	RZMA**/UL**, HZMA**/UL**, AGMZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**MZA-A**		**MZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX 2014/34/EU Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

9 EX PROOF SOLENOIDS WIRING

Multicertification



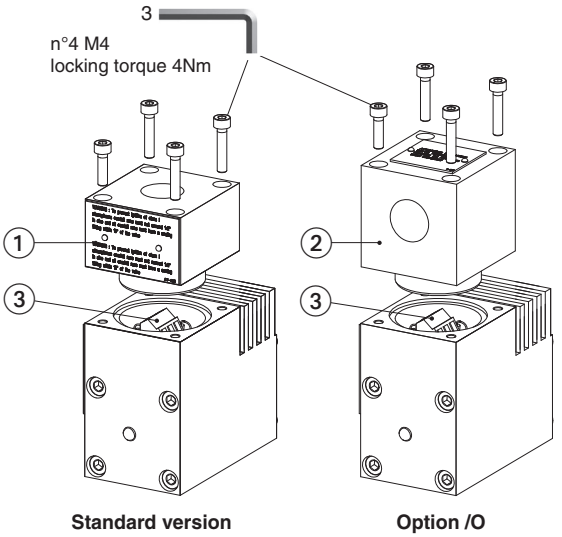
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

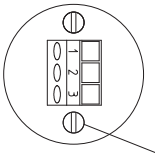
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring



⚠ **Pay attention to respect the polarity**

1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section [10] note 1

alternative GND screw terminal connected to solenoid housing

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	-	90 °C	-
45 °C	-	T4	150 °C	135 °C	-	90 °C
55 °C	-	T3	150 °C	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

11 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

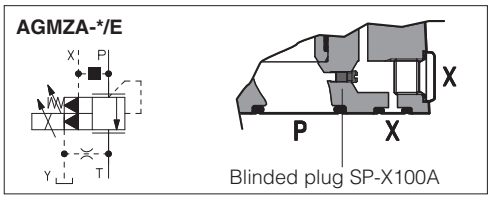
12 OPTIONS

For alla valves:

O = Horizontal cable entrance to be selected in case of limited vertical space.

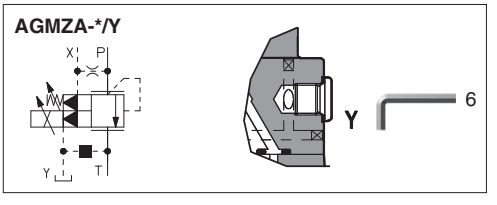
Only for AGMZA:

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").



Only for AGMZA:

Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.

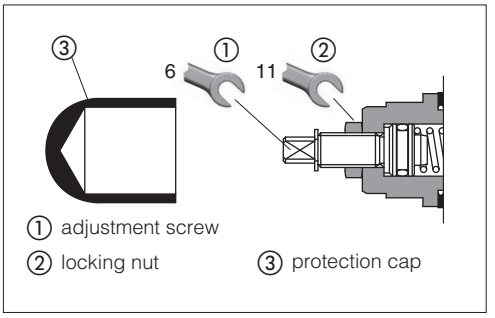


12.1 Possible combined options: /EO, /EY, /OY

13 MECHANICAL PRESSURE LIMITER - only for AGMZA

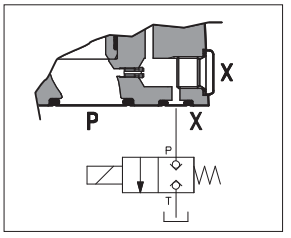
The AGMZA are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



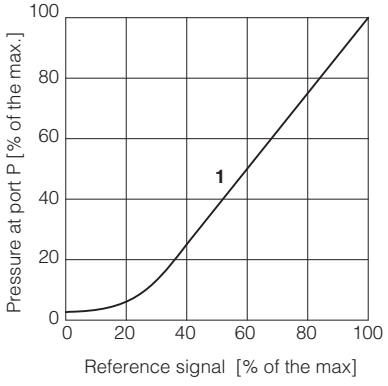
14 REMOTE PRESSURE UNLOADING - only for AGMZA

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).
This function can be used in emergency to unload the system pressure by-passing the proportional control.

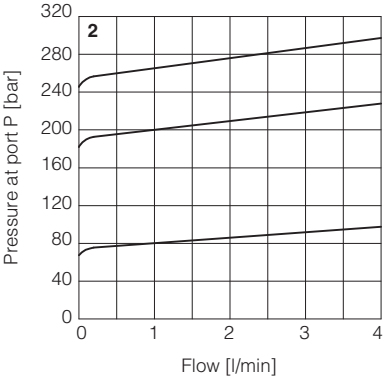


15 DIAGRAMS RZMA-010 (based on mineral oil ISO VG 46 at 50 °C)

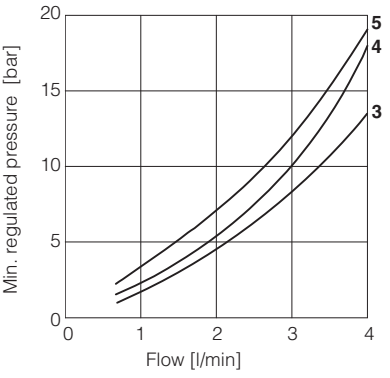
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-5 Min. pressure/flow diagrams
with zero reference signal

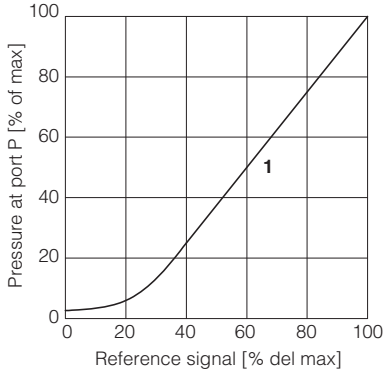


3 = RZMA/80
4 = RZMA/180
5 = RZMA/250

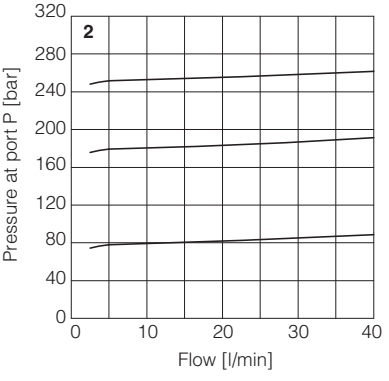
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

16 DIAGRAMS RZMA-030, HZMA-030 (based on mineral oil ISO VG 46 at 50 °C)

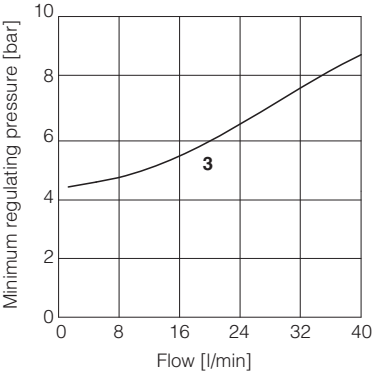
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



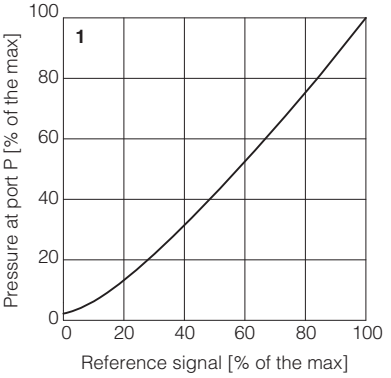
3 Min. pressure/flow diagrams
with zero reference signal



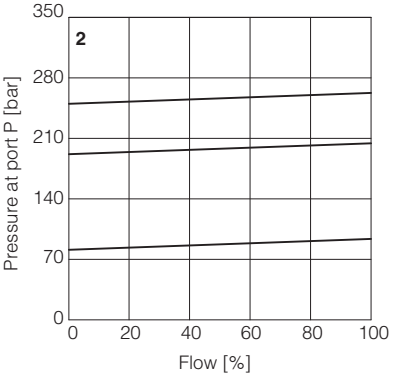
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

17 DIAGRAMS AGMZA (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

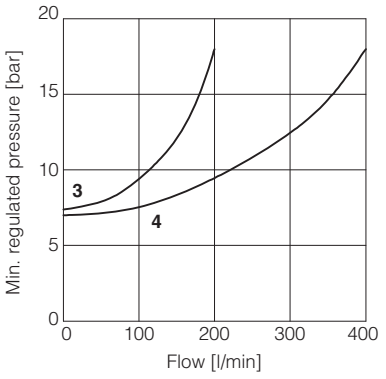


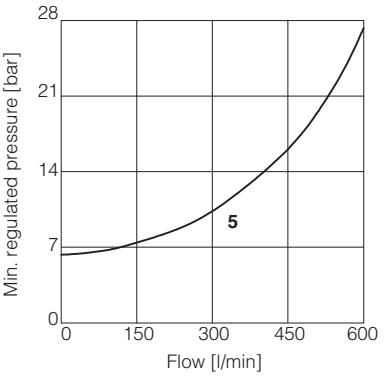
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



3-5 = Min. pressure/flow diagrams
with zero reference signal

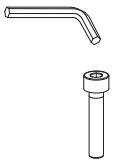
3 = AGMZA-*-10
4 = AGMZA-*-20
5 = AGMZA-*-32



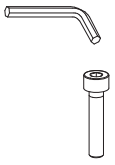


18 FASTENING BOLTS AND SEALS

18.1 RZMA and HZMA valves

	RZMA-A-010	RZMA-A-030	HZMA-A-030
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5 class 12.9 Tightening torque = 8 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm	**Seals:** 4 OR 108 Diameter of ports P, A, B, T: Ø 6,5 mm

18.2 AGMZA valves

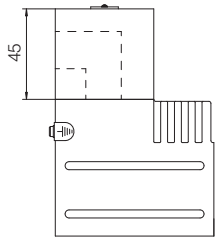
	AGMZA-A-10	AGMZA-A-20	AGMZA-A-32
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**Seals:** 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

RZMA-A-010

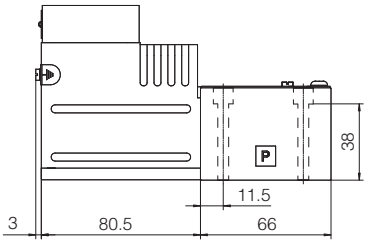
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(without ports A and B)

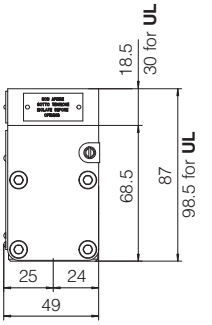
Mass [kg]	
RZMA-A-010	2,7
Option /O	+0,35

option /O



RZMA-A-010*



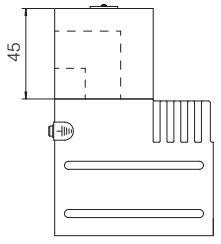


RZMA-A-030

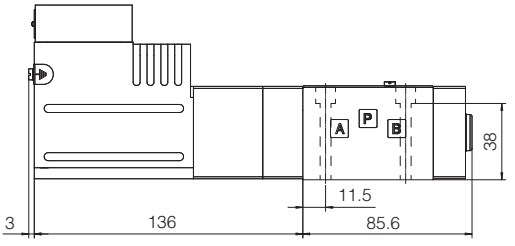
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(ports A and B connected to port T)

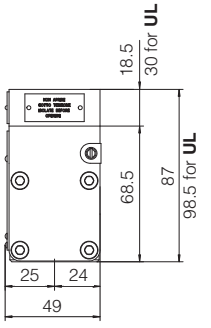
Mass [kg]	
RZMA-A-030	3,7
Option /O	+0,35

option /O



RZMA-A-030*



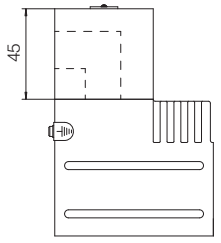


HZMA-A-030

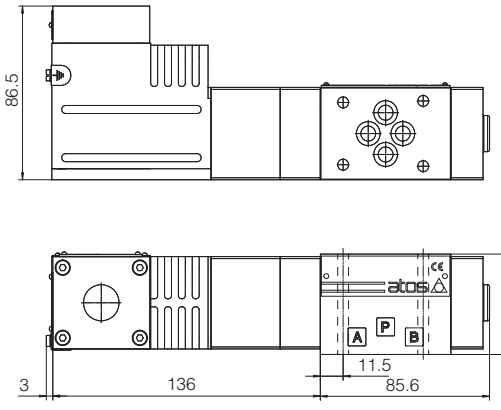
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05

Mass [kg]	
HZMA-A-030	3,7
Option /O	+0,35

option /O



HZMA-A-030*

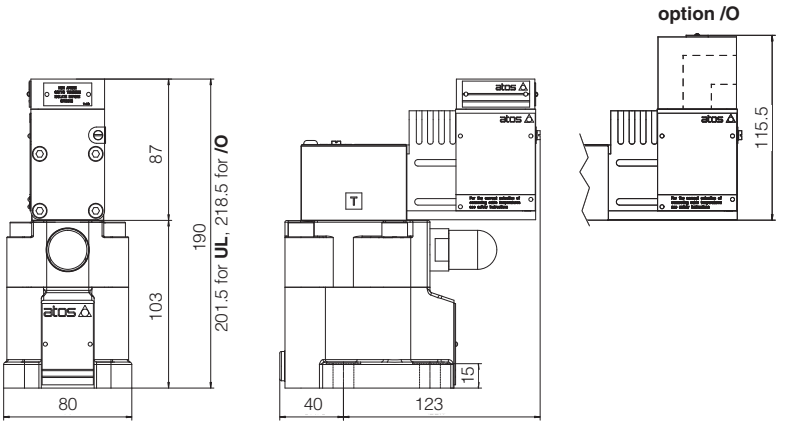


20 INSTALLATION DIMENSIONS FOR AGMZA [mm]

AGMZA-A-10

ISO 6264: 2007 (see table P005)
Mounting surface: 6264-06-09-1-97

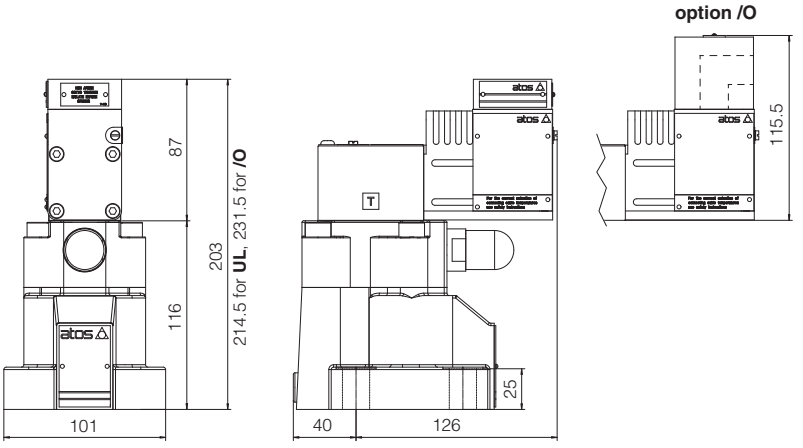
Mass [kg]	
AGMZA-A-10	6,3
Option /O	+0,35



AGMZA-A-20

ISO 6264: 2007 (see table P005)
Mounting surface: 6264-08-13-1-97

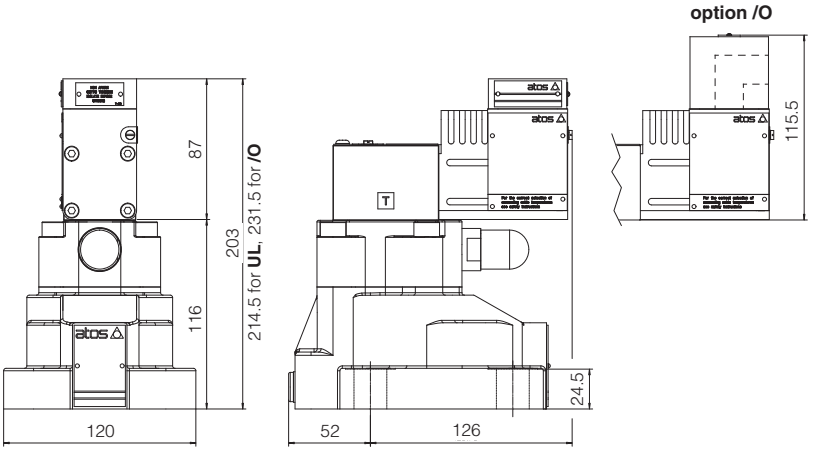
Mass [kg]	
AGMZA-A-20	7,5
Option /O	+0,35



AGMZA-A-32

ISO 6264: 2007 (see table P005)
Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)

Mass [kg]	
AGMZA-A-32	8,9
Option /O	+0,35

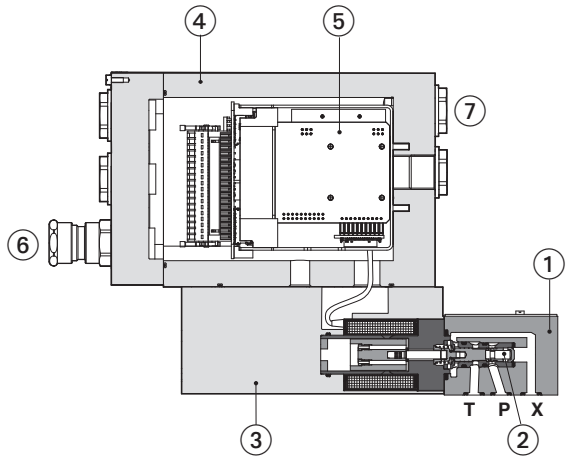


21 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional reducing valves

direct or piloted, with on-board driver and without pressure transducer - **ATEX and IECEx**



① valve body
② spool
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof cable glands (to be ordered separately)
⑦ USB port always present (factory plugged)

RZGA-AES-BC-10-*

RZGA-AES, AGRCZA-AES

Ex-proof digital proportional reducing valves, direct or piloted, whithout transducer for pressure open loop controls.

They are equipped with ex-proof on-board digital driver and proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of integral digital driver and solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

RZGA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **12** and **40 l/min**

AGRCZA, piloted:
Size: **10** and **20** - ISO 5781
Max flow: **160** and **300 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZGA	-	AES	-	NP	-	010	/	210	/	M	/	*	*	/	*

RZGA = Ex-proof proportional pressure reducing valves
RZGA = subplate size 06
AGRCZA = subplate size 10, 20

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size and configuration:
RZGA: direct **010** = Qmax 12 l/min
RZGA: piloted **033** = Qmax 40 l/min
AGRCZA: piloted **10, 20** = Qmax 160, 300 l/min

Max regulated pressure:
only for RZGA-010
32 = 32 bar **100** = 100 bar **210** = 210 bar
only for RZGA-033 and AGRCZA
80 = 80 bar **180** = 180 bar **250** = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options - only AGRCZA **(1)**:
P = with integral mechanical pressure limiter
R = with integral check valve for free reverse flow

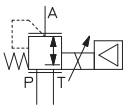
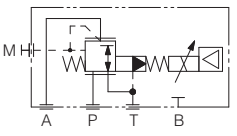
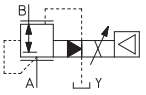
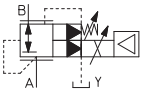
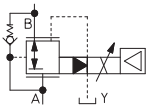
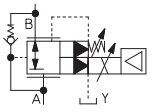
Electronic options (1):
I = current reference input 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)

Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /IP, /IR, /PR

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

RZGA-AES-010	RZGA-AES-033	AGRCZA-AES	AGRCZA-AES-*/P	AGRCZA-AES-*/R	AGRCZA-AES-*/PR
					

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: The below operation must be performed in a safety area

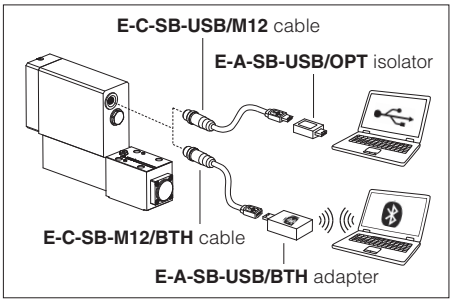
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	RZGA-010 150 years, RZGA-033 and AGRCZA 75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section [10] -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZGA				AGRCZA	
Size code		010			033	10	20
Valve size		06			06	10	20
Max regulated pressure	[bar]	**32**	**100**	**210**	**80**	**180**	**250**
Min regulated pressure	[bar]	see min. pressure / flow diagrams at sections [16] [17] [18]					
Max pressure at port P, A, B, X	[bar]	315					
Max pressure at port T, Y	[bar]	210					
Max flow	[l/min]	12			40	160	300
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 55				≤ 70	
Hysteresis[% of the max pressure]		≤ 1,5					
Linearity[% of the max pressure]		≤ 3					
Repeatability[% of the max pressure]		≤ 2					

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: maximum range ± 5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	RZMA, AGMZA			
Certifications	Multicertification Group II **ATEX IECEx**			
Solenoid certified code	**OZA-AES**			
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**		**T4**
Surface temperature	≤ 85 °C	≤ 100 °C		≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C		-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

19 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Flow reference input signal (INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 10VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

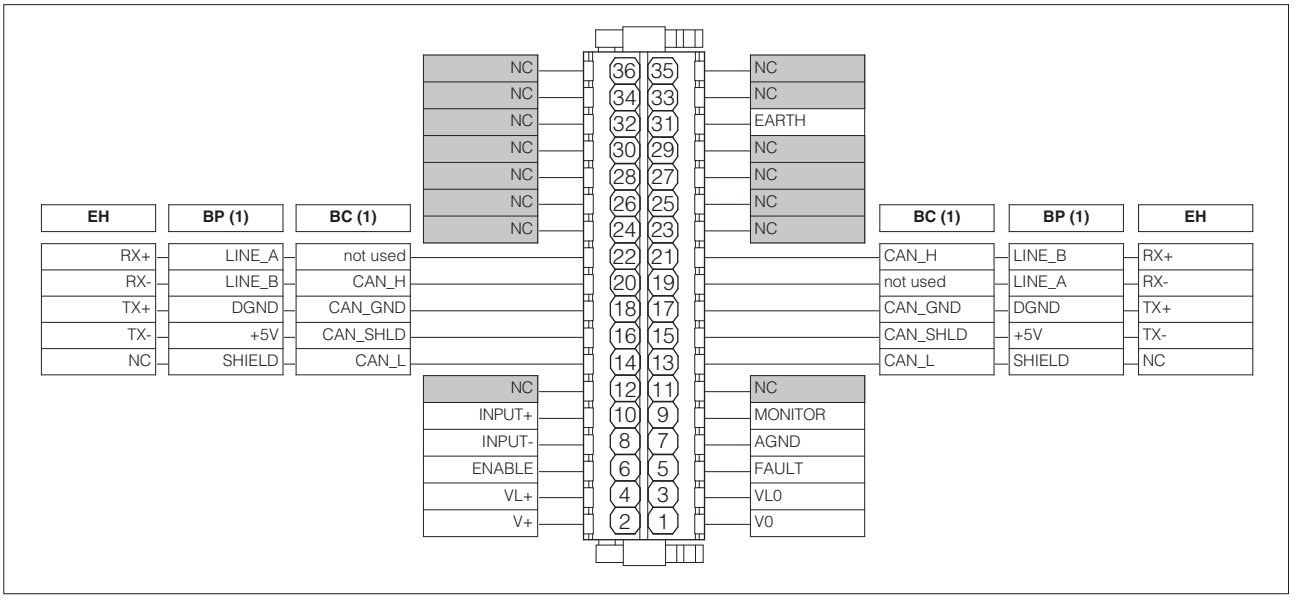
19.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

19.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

20 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

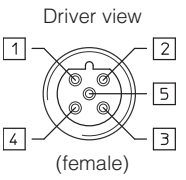
21 ELECTRONIC CONNECTIONS

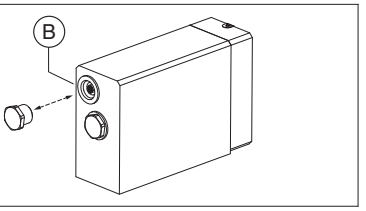
21.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to AGND Default is: ±5 VDC	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

21.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





21.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

21.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

21.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

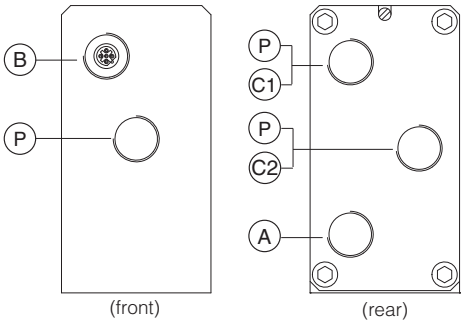
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

22 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

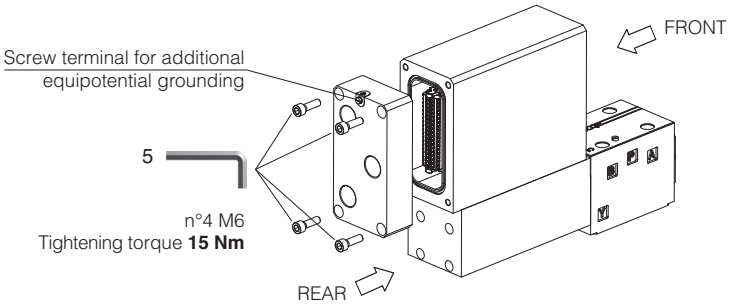
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug



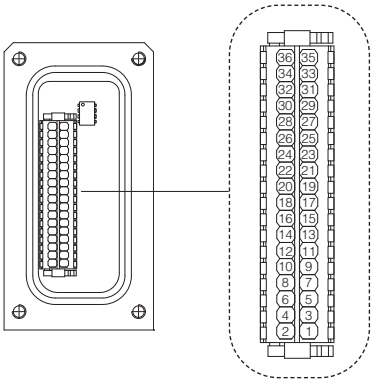
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

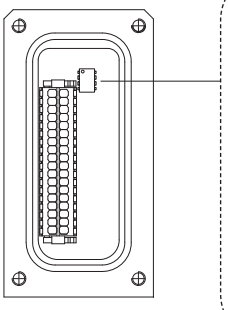


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 20

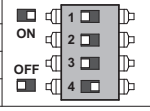


Fieldbus terminator only for BC and BP executions **(1)**



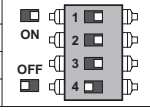
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

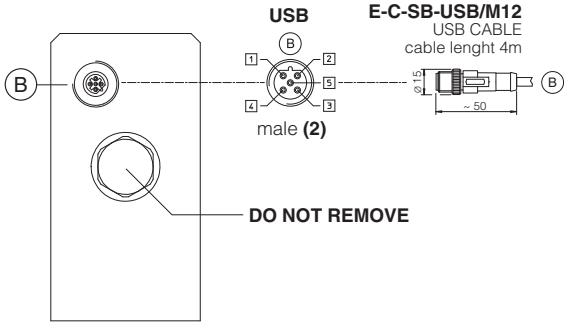


BP - PROFIBUS DP setting:

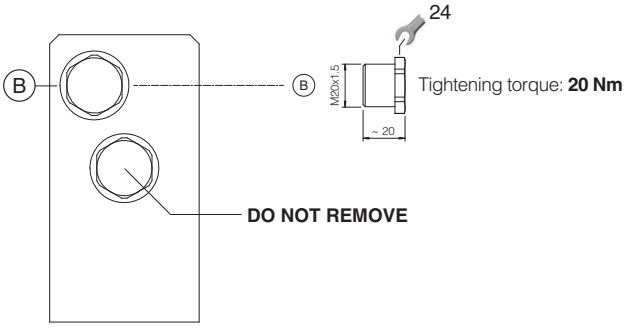
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

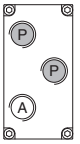
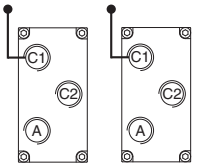
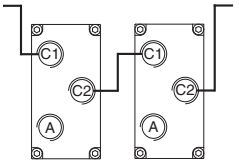


METALLIC PROTECTION CAP - supplied with the valves



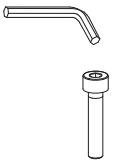
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

22.1 Cable glands and threaded plug - see tech table **KX800**

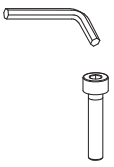
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

23 FASTENING BOLTS AND SEALS

23.1 RZGA valves

	RZGA-AES-*-010	RZGA-AES-*-033
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm

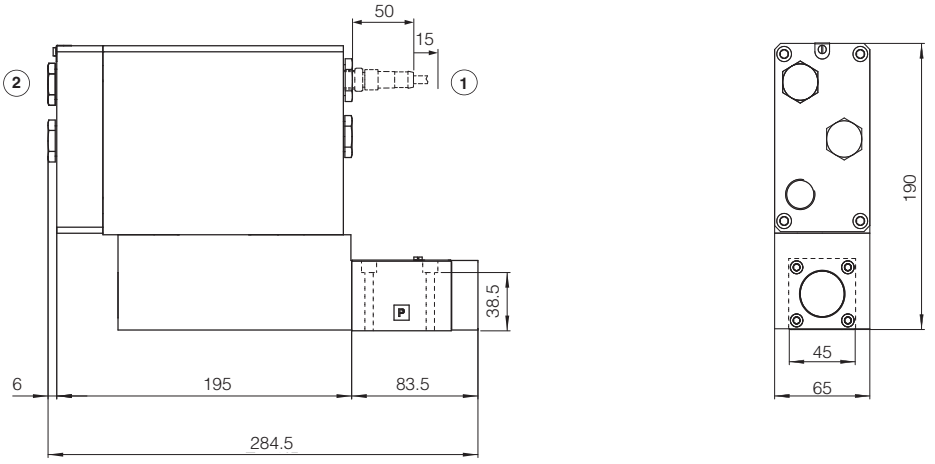
23.2 AGRCZA valves

	AGRCZA-AES-*-10	AGRCZA-AES-*-20
	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm
	**Seals:** 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm

RZGA-AES-*-010

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(port B not used)

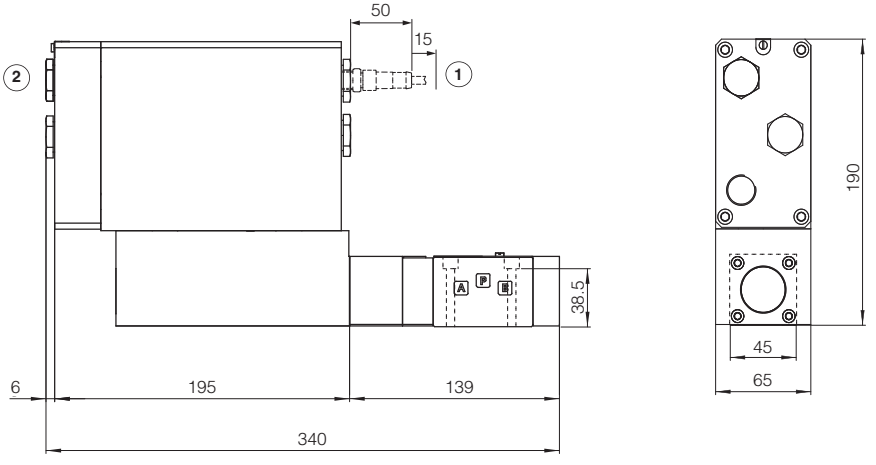
Mass [kg]	
RZGA-AES-*-010	8,2



RZGA-AES-*-033

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(ports A and B connected to port T)

Mass [kg]	
RZGA-AES-*-033	9



(1) = Space to remove the USB connector

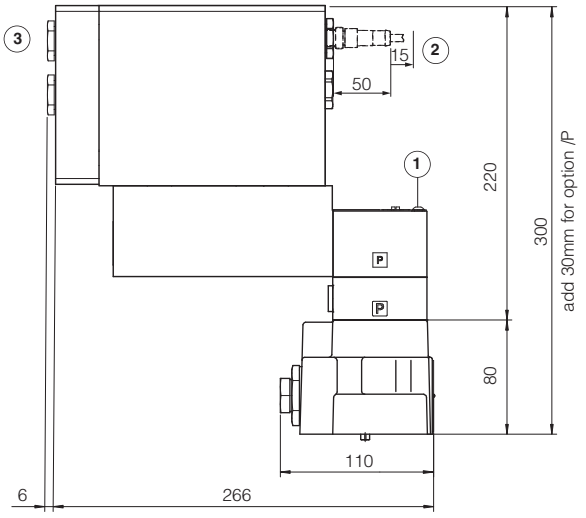
(2) = The dimensions of cable glands must be considered (see tech table **KX800**)

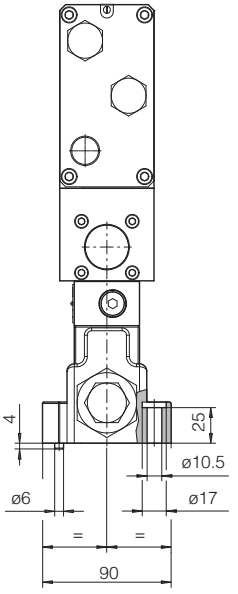
25 INSTALLATION DIMENSIONS FOR AGRCZA [mm]

AGRCZA-AES-*-10

ISO 5781: 2000
Mounting surface: 5781-06-07-0-00 (see table P005)

Mass [kg]	
AGRCZA-AES-*-10	11,6

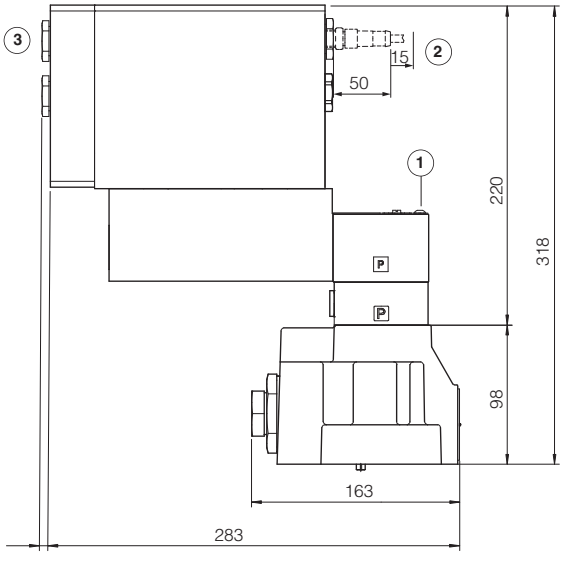


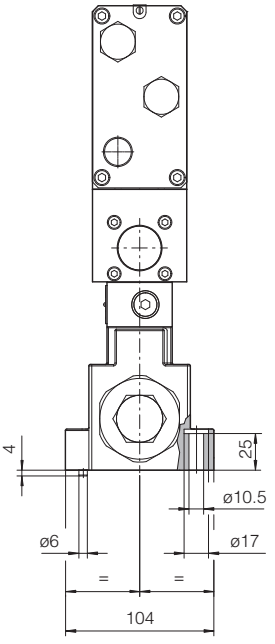


AGRCZA-AES-*-20

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00 (see table P005)

Mass [kg]	
AGRCZA-AES-*-20	12,8





(1) = Air bleed off

(2) = Space to remove the USB connector

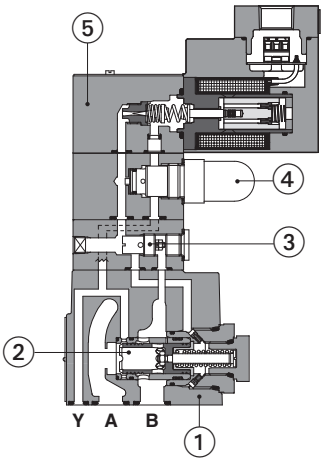
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

26 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		

Ex-proof proportional reducing valves

direct or piloted, without transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



AGRCZA-A-010*

① main valve body
② main spool
③ pilot flow compensator
④ mechanical pressure limiter
⑤ ex-proof pilot relief valve

RZGA-A, HZGA-A
KZGA-A, AGRCZA-A

Ex-proof proportional reducing valves direct or piloted, for open loop pressure controls.
They are equipped with ex-proof proportional solenoid, certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

RZGA, HZGA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **12** and **40 l/min**

KZGA, piloted:
Size: **10** - ISO 4401
Max flow: **100 l/min**

AGRCZA, piloted:
Size: **10** and **20** - ISO 5781
Max flow: **160** and **300 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZGA	/	*	-	A	-	010	/	250	/	M	/	*	/	*	*	/	*

RZGA
Ex-proof proportional pressure reducing valves
RZGA = subplate size 06
HZGA = modular size 06
KZGA = modular size 10
AGRCZA = subplate size 10, 20

Certification type
Multicertification:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

Valve size and configuration:

010 = RZGA direct	size 06	Qmax 12 l/min
033 = RZGA piloted	size 06	Qmax 40 l/min
031 = HZGA piloted	size 06	Qmax 40 l/min
031 = KZGA piloted	size 10	Qmax 100 l/min
10 = AGRCZA piloted	size 10	Qmax 160 l/min
20 = AGRCZA piloted	size 20	Qmax 300 l/min

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
O = horizontal cable entrance **(2)**
P = with integral mechanical pressure limiter (only for AGRCZA)
R = with check valve (only for AGRCZA)

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = with 24 VDC coils

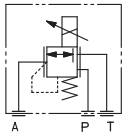
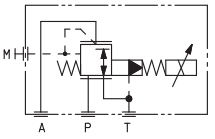
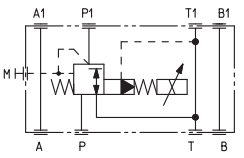
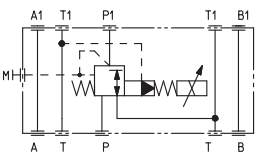
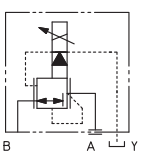
Series number

Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR **(2)**

Max regulated pressure:
for all versions except RZGA-010
80 = 80 bar **180** = 180 bar **250** = 250 bar
only for RZGA-010
32 = 32 bar **100** = 100 bar **210** = 210 bar

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /OP, /OR, /PR, /OPR **(4)** Approved only for the Italian market

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

RZGA*-A-010	RZGA*-A-033	HZGA*-A-031	KZGA*-A-031	AGRCZA*-A-*
				

3 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years; 150 years only for RZGA-010, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZGA		HZGA	KZGA	AGRCZA	
Size code		**010**	**033**	**031**		**10**	**20**
Valve size		06		10			20
Max regulated pressure	[bar]	**32; 100; 210**		**80**	**180**	**250**	
Max pressure at port P, A, B, X	[bar]	315					
Max pressure at port T, Y	[bar]	210					
Min regulated pressure	[bar]	0,8	2,5	2,5	3	1,0	
Max flow	[l/min]	12	40	40	100	160	300
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 55			≤ 70		
Hysteresis[% of the max pressure]		≤ 1,5					
Linearity[% of the max pressure]		≤ 3					
Repeatability[% of the max pressure]		≤ 2					

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

6 ELECTRICAL CHARACTERISTICS

Max. power	35W	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

8 CERTIFICATION DATA

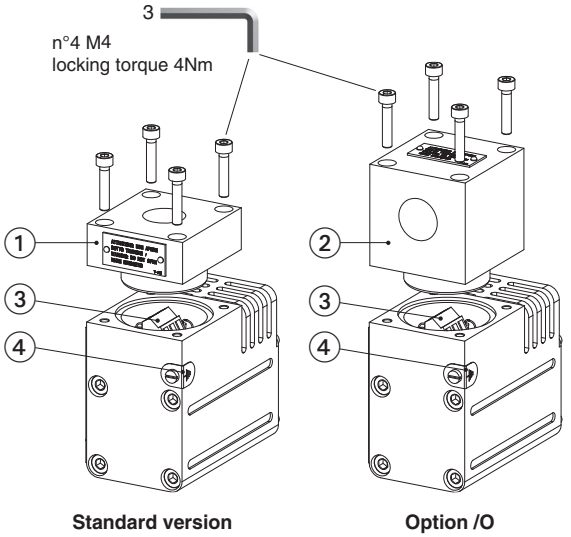
Valve type	RZGA, HZGA, KZGA, AGRCZA		RZGA/**M**, HZGA/**M**, KZGA/**M**, AGRCZA/**M**	RZGA/**UL**, HZGA/**UL**, KZGA/**UL**, AGRCZA/**UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**MZA-A**		**MZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

9 EX PROOF SOLENOIDS WIRING

Multicertification



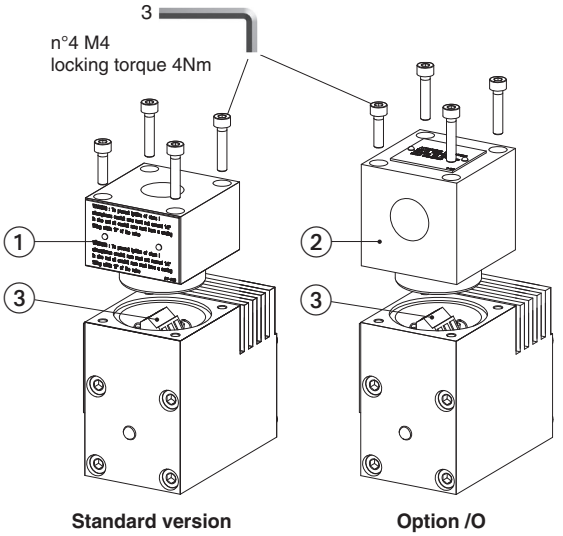
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

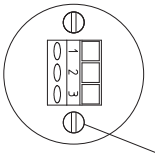
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	-	90 °C	-
45 °C	-	T4	150 °C	135 °C	-	90 °C
55 °C	-	T3	150 °C	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

11 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

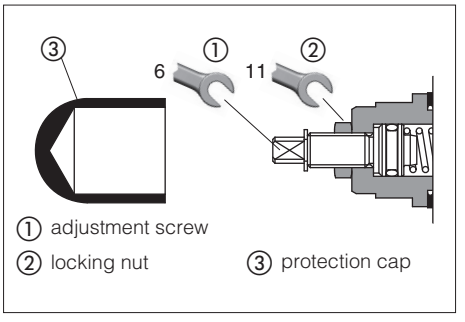
12 OPTIONS

O = Horizontal cable entrance , to be selected in case of limited verical space.

P = Integral mechanical pressure limiter

The AGRCZA-*/**P** are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

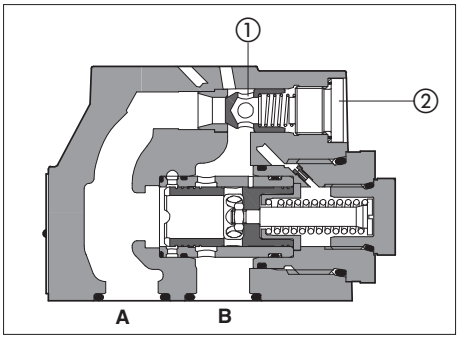
- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



R = Integral check valve for free reverse flow

The AGRCZA-*/**R** are provided with integral check valve for free reverse flow A→B

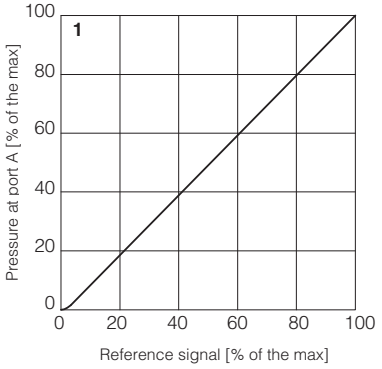
① Check valve - cracking pressure = 0,5 bar
② Plug



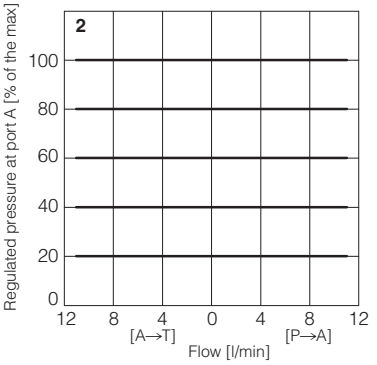
12.1 Possible combined options: /OP, /OR, /PR, /OPR

13 DIAGRAMS RZGA-010 (based on mineral oil ISO VG 46 at 50 °C)

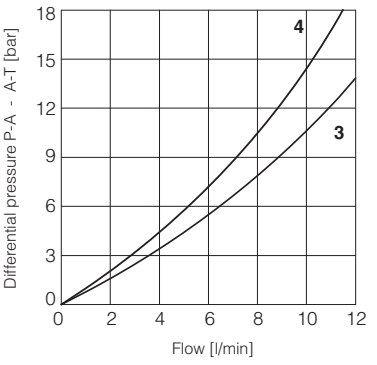
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



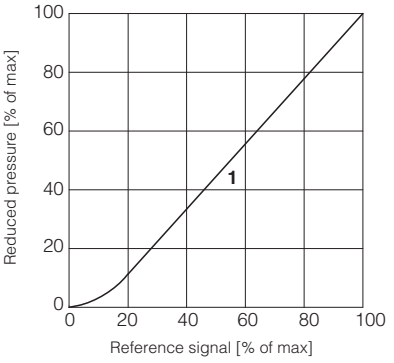
3 = Pressure drops vs. flow P→A
4 = Pressure drops vs. flow A→T

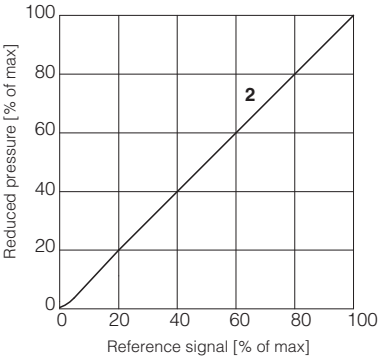
14 DIAGRAMS RZGA-033, HZGA, KZGA (based on mineral oil ISO VG 46 at 50 °C)

14.1 Regulation diagrams
with flow rate Q = 10 l/min

1 = RZGA, HZGA
2 = KZGA

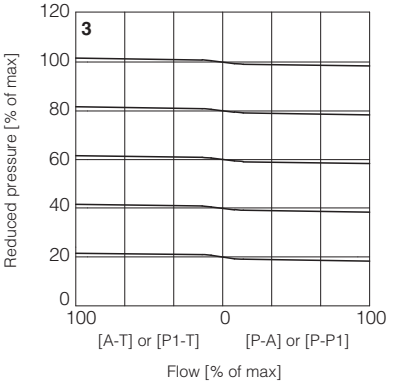
Note:
The presence of counter pressure at port T can affect the effective pressure regulation.





14.2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min

3 = RZGA, KZGA

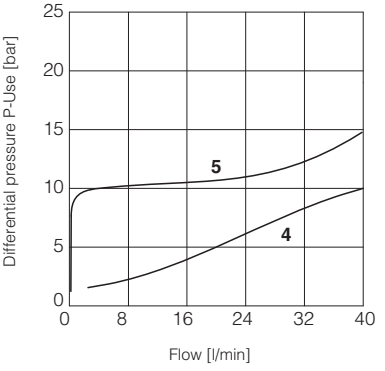


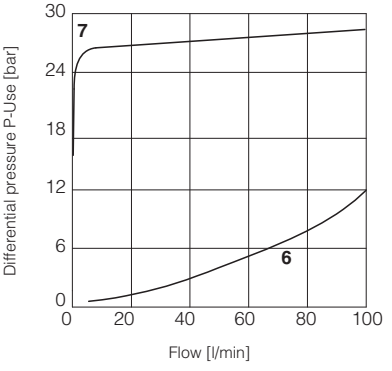
14.3 Pressure drop/flow diagram
RZGA, HZGA

4 = A-T or P1-T
5 = P-P1 or P-A

KZGA

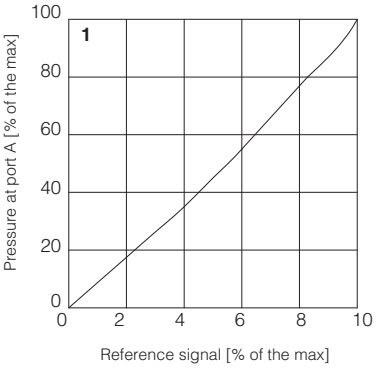
6 = P1-T
7 = P-P1



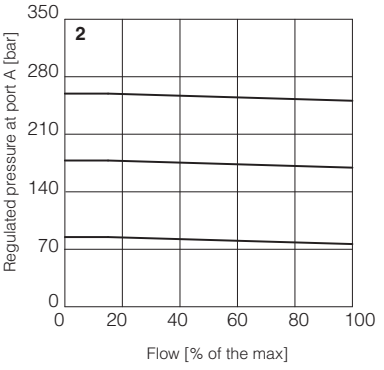


15 DIAGRAMS AGRCZA (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams
with flow rate Q = 10 l/min

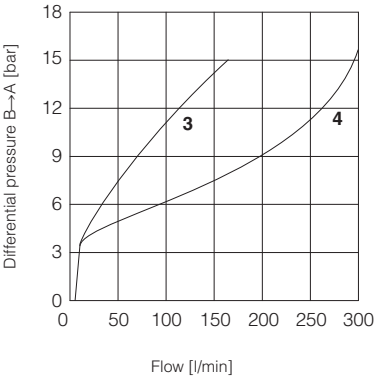


2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min

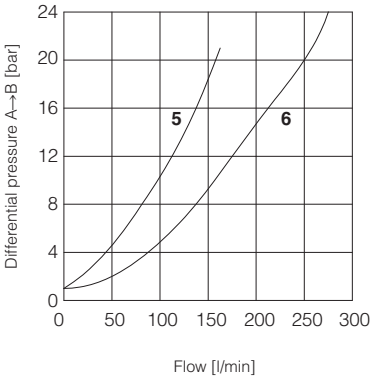


3-6 Pressure drop/flow diagrams
with zero reference signal

Differential pressure B→A
3 = AGRCZA-*-10
4 = AGRCZA-*-20

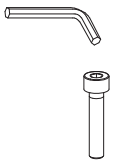


Differential pressure A→B (through check valve)
5 = AGRCZA-*-10/*/R
6 = AGRCZA-*-20/*/R

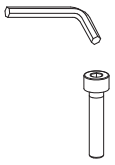


16 FASTENING BOLTS AND SEALS

16.1 RZGA, HZGA and KZGA valves

	RZGA-A-010	RZGA-A-033	HZGA-A-031	KZGA-A-031
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6 class 12.9 Tightening torque = 16 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 5 mm (max)	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm (max)	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm	**Seals:** 5 OR 2050 Diameter of ports P, A, B, T: Ø 11,5 mm (max) 1 OR 108 Diameter of port Y: Ø 5 mm

16.2 AGRCZA valves

	AGRCZA-A-10	AGRCZA-A-20
	**Fastening bolts:** 4 socket head screws M110x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M110x45 class 12.9 Tightening torque = 70 Nm
	**Seals:** 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of ports X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of ports X, Y: Ø 5 mm

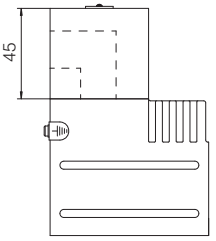
17 INSTALLATION DIMENSIONS FOR RZGA [mm]

RZGA-A-010

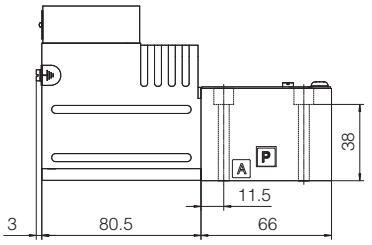
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(without port B)

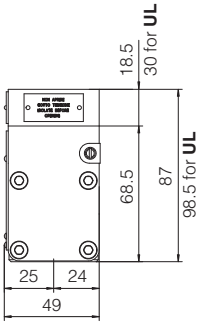
Mass [kg]	
RZGA-A-010	2,7
Option /O	+0,35

option /O



RZGA-A-010*



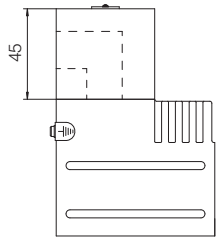


RZGA-A-033

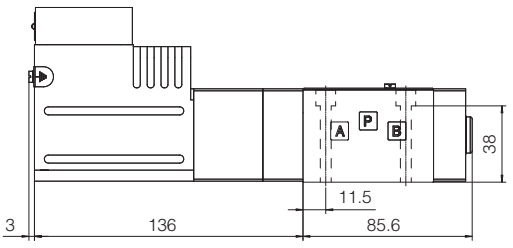
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(ports A and B connected to port T)

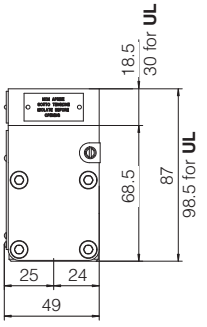
Mass [kg]	
RZGA-A-033	3,7
Option /O	+0,35

option /O



RZGA-A-033*



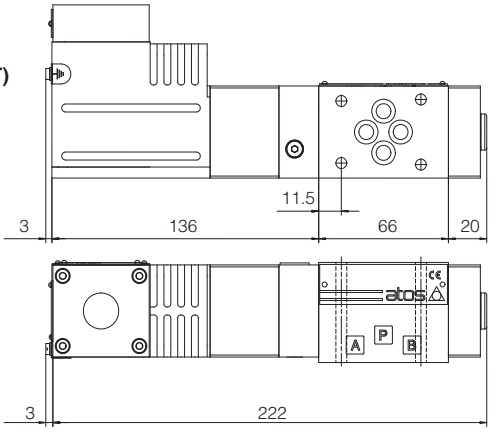


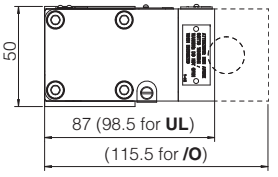
18 INSTALLATION DIMENSIONS FOR HZGA and KZGA [mm]

HZGA-A-031

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(ports A and B connected to port T)

Mass [kg]	
HZGA-A-031	3,7
Option /O	+0,35

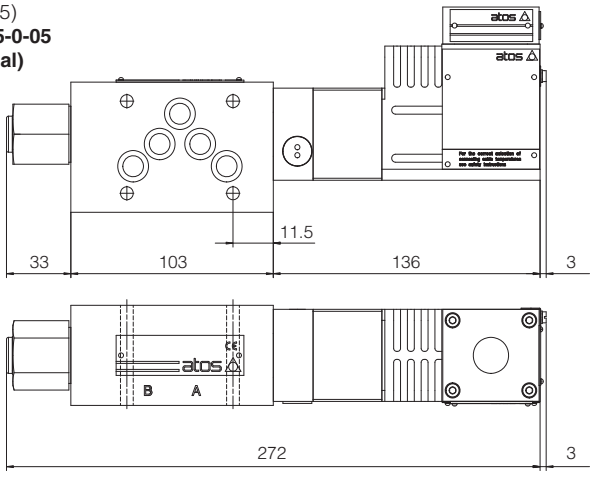


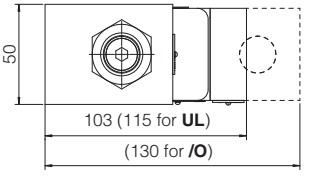


KZGA-A-031

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-05-05-0-05
(without X port, Y port optional)

Mass [kg]	
KZGA-A-031	3,7
Option /O	+0,35





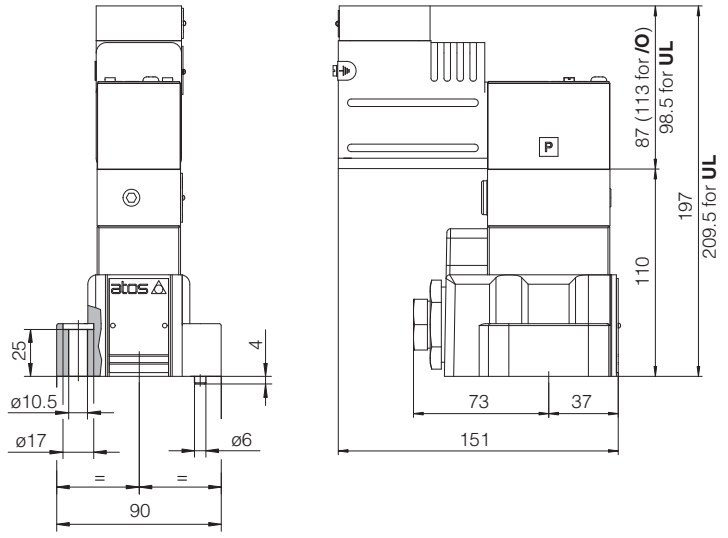
19 INSTALLATION DIMENSIONS FOR AGRCZA [mm]

AGRCZA-A-10

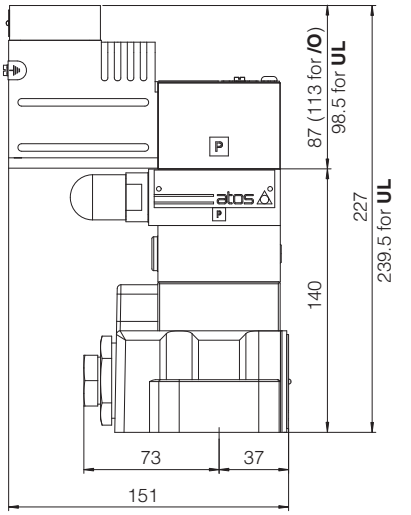
ISO 5781: 2000 (see table P005)
Mounting surface: 5781-06-07-0-00

Mass [kg]	
AGRCZA-A-10	5,7
Option /P	+0,5

AGRCZA-A-10



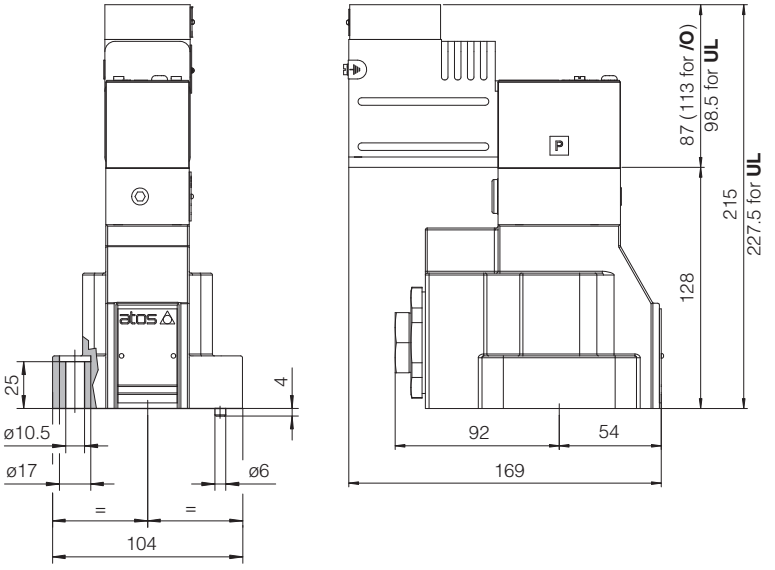
option /P

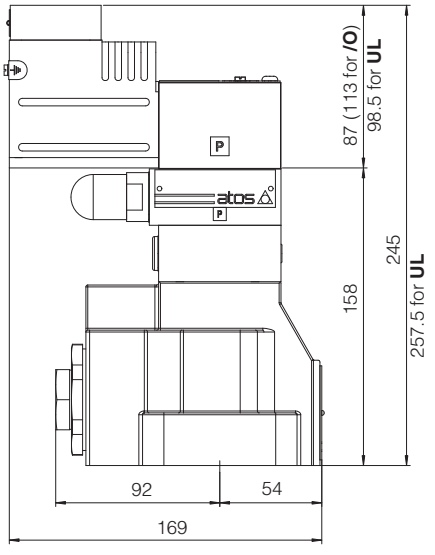


AGRCZA-A-20

ISO 5781: 2000 (see table P005)
Mounting surface: 5781-08-10-0-00

Mass [kg]	
AGRCZA-A-20	8,2
Option /P	+0,5



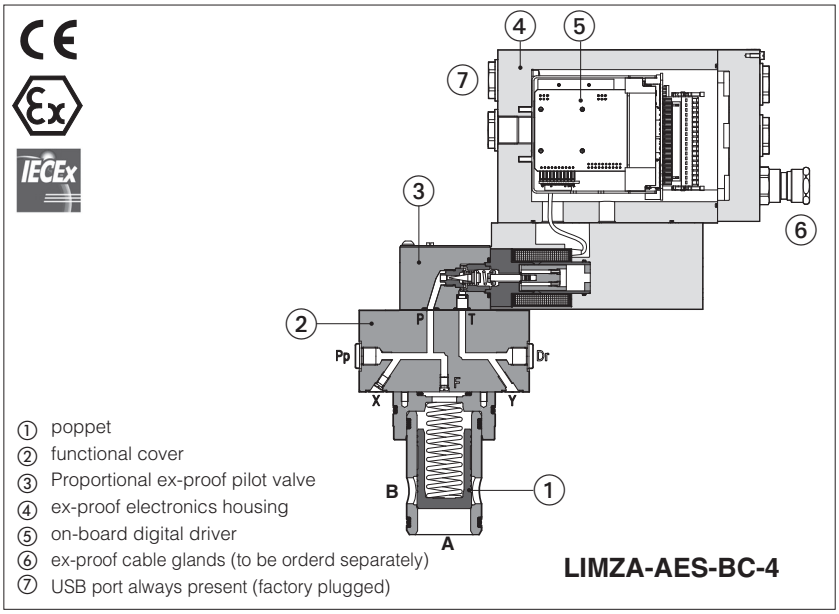


20 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance norms for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional pressure cartridges

with on-board driver and without transducer - **ATEX and IECEx**



① poppet
② functional cover
③ Proportional ex-proof pilot valve
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof cable glands (to be orderd separately)
⑦ USB port always present (factory plugged)

LIMZA-AES-BC-4

LICZA-AES, LIMZA-AES, LIRZA-AES

2-way ex-proof digital proportional pressure cartridges without transducer respectively performing: pressure compensator, relief or reducing functions.

They are equipped with ex-proof on-board digital driver and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **16** ÷ **80** -ISO7368

Max flow: up to **4500 l/min**

Max pressure: **250 bar**

1 **MODEL CODE OF COVERS**

LIMZA	- AES - NP - 3 / 315 / M / *	* / *

LIMZA
Ex-proof proportional pressure cartridges
LICZA = pressure compensator
LIMZA = pressure relief
LIRZA = pressure reducing

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 7368:
1 = 16
2 = 25
3 = 32
4 = 40
5 = 50 (not for LIRZA)
6 = 63 (only for LIMZA)
8 = 80; (only for LIMZA)

Max regulated pressure:
80 = 80 bar
180 = 180 bar
250 = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (1):
P =with integral mechanical pressure limiter (standard for size 1, 2, 3)

Electronics options (1):
I = current reference input 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)

Series number

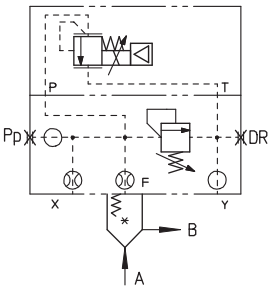
Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /IP

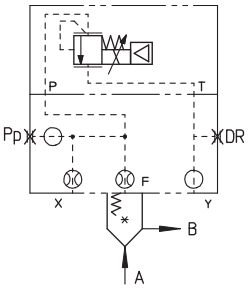
2 HYDRAULICS SYMBOLS

LICZA

LICZA-AES-1÷3
LICZA-AES-4÷5 /P

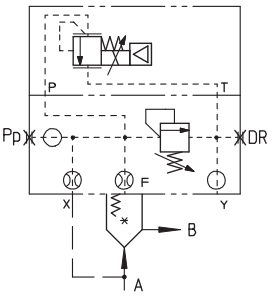


LICZA-AES-4÷5

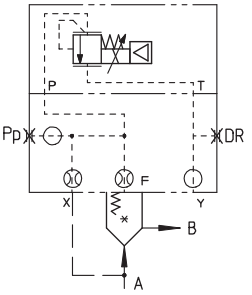


LIMZA

LIMZA-AES-1÷3
LIMZA-AES-4÷8 /P

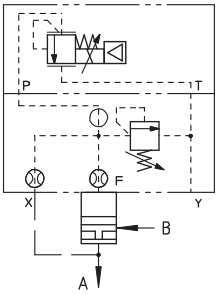


LIMZA-AES-4÷8

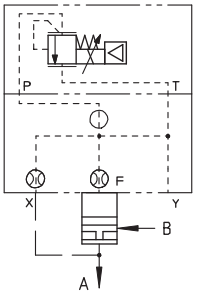


LIRZA

LIRZA-AES-1÷3
LIRZA-AES-4 /P



LIRZA-AES-4



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	**	/	*

Cartridge according to ISO 7368

Cartridges size ISO 7368:
16
25
32
40
50
63
80

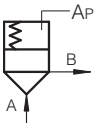
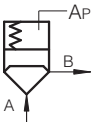
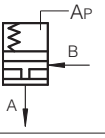
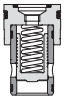
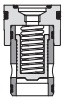
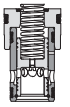
Type of poppet:
31 = for LIMZA and LICZA
36 = for LICZA
37 = for LIRZA

Spring cracking pressure:
2 = 1,5 bar for poppet 31
3 = 3 bar
4 = 4 bar
6 = 6 bar for poppet 31 and 36
7 = 7 bar for poppet 37

Series number

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

4 TYPE OF POPPET

Type of poppet	**31**	**36**	**37**
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	**1:1**	**1:1**	**1:1**

5 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

6 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

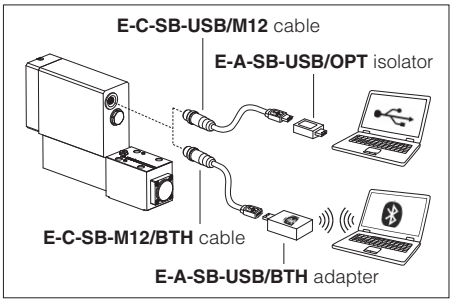
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

7 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 12 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		LICZA					LIMZA							LIRZA			
Valve size	[l/min]	1	2	3	4	5	1	2	3	4	5	6	8	1	2	3	4
Max flow	[bar]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pressure		see section 18															
Max regulated pres. at port A	[bar]	80; 180; 250					80; 180; 250							80; 180; 250			
Max pressure	[bar]	Ports: T, Y = 210															
		Ports: P, A, B, X = 350															
Response time 0-100% step signal **(1)** (depending on installation)	[ms]	≤ 120 ÷ 430					≤ 120 ÷ 480							≤ 120 ÷ 380			
Hysteresis	[% of regulated max pres.]	≤ 2					≤ 1,5							≤ 2			
Linearity	[% of regulated max pres.]	≤ 3					≤ 3							≤ 3			
Repeatibility	[% of regulated max pres.]	≤ 2					≤ 2							≤ 2			

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: maximum range ± 5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

12 CERTIFICATION DATA

Valve type	LICZA, LIMZA, LIRZA			
Certifications	Multicertification Group II **ATEX IECEx**			
Solenoid certified code	**OZA-AES**			
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**		**T4**
Surface temperature	≤ 85 °C	≤ 100 °C		≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C		-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

13 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

13.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

14 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

15 HYDRAULIC OPTIONS

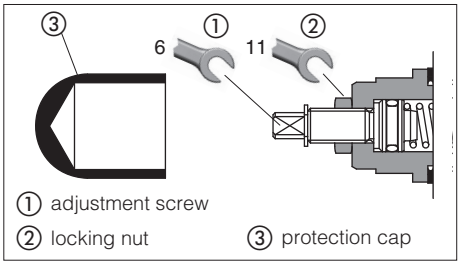
P = Integral mechanical pressure limiter (standard for size 1, 2 and 3)

The LICZA, LIMZA and LIRZA standard size 1, 2, 3 and option /P are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).

At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



16 ELECTRONIC OPTIONS

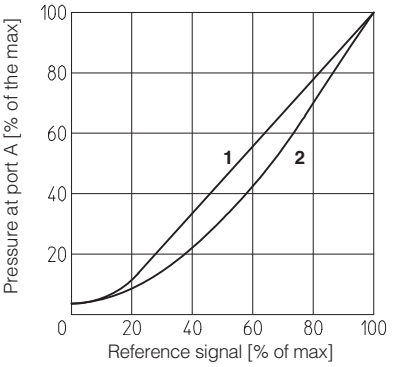
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

17 POSSIBLE COMBINED OPTIONS

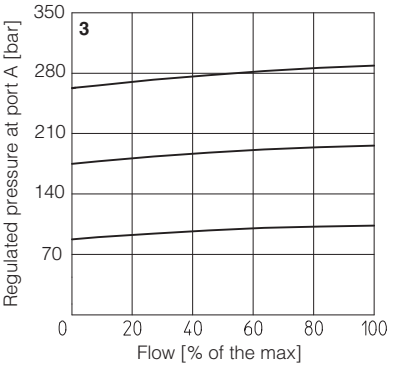
/IP

18 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams LIMZA
2 Regulation diagrams LICZA



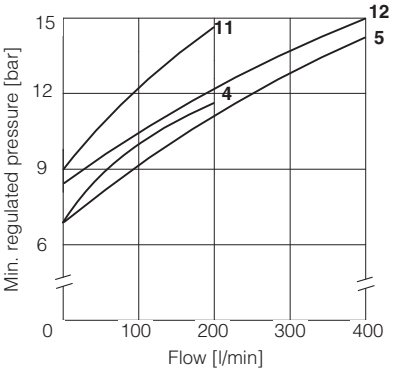
3 Pressure/flow diagrams LICZA, LIMZA

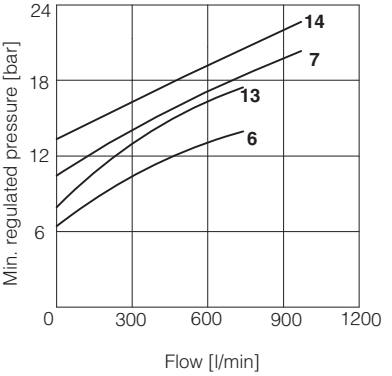


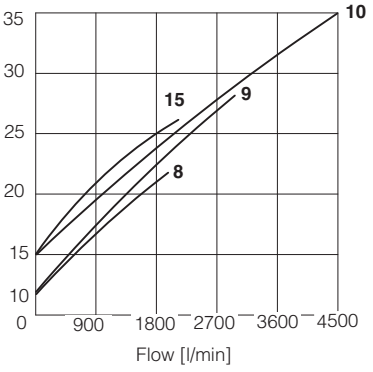
4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZA-*-1
5 = LIMZA-*-2
6 = LIMZA-*-3
7 = LIMZA-*-4
8 = LIMZA-*-5
9 = LIMZA-*-6
10 = LIMZA-*-8

11 = LICZA-*-1
12 = LICZA-*-2
13 = LICZA-*-3
14 = LICZA-*-4
15 = LICZA-*-5





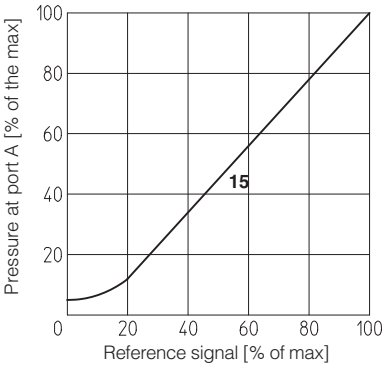


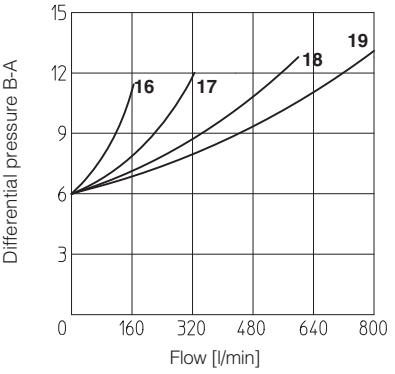
Regulation diagrams LIRZA

15 = LIRZA-A

16-19 Min. pressure/flow diagrams
with reference signal “null”

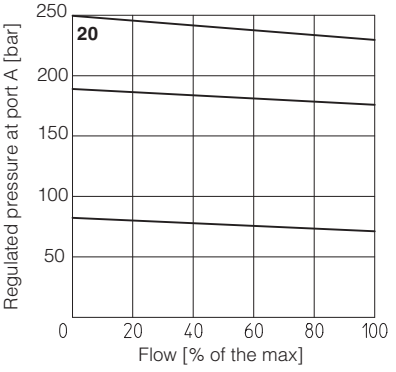
16 = LIRZA-*-1
17 = LIRZA-*-2
18 = LIRZA-*-3
19 = LIRZA-*-4





Pressure/flow diagrams

20 = LIRZA-A



19 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Flow reference input signal (INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5VDC.

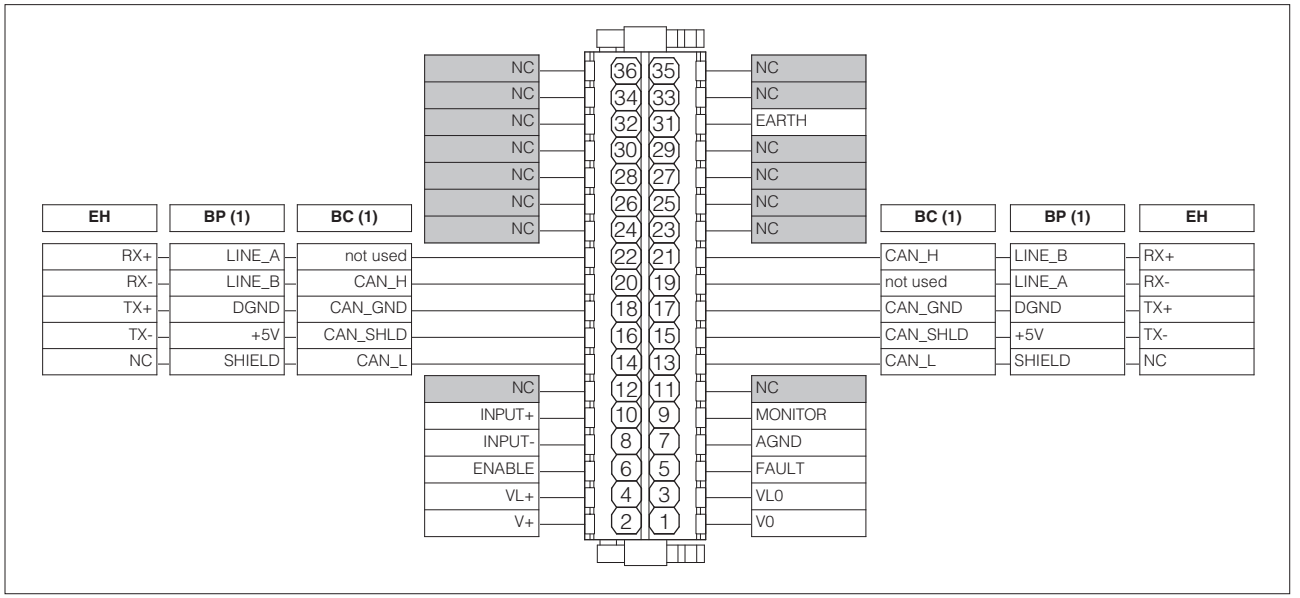
19.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

19.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

20 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

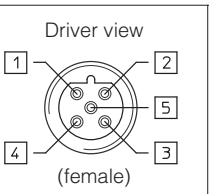
21 ELECTRONIC CONNECTIONS

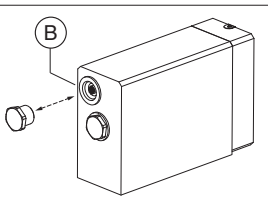
21.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to AGND Default is: ±5 VDC	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

21.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





21.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

21.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

21.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

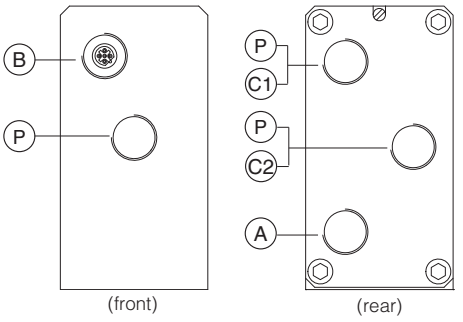
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

22 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

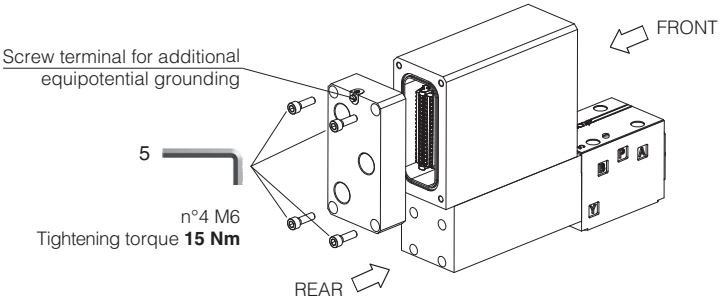
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug



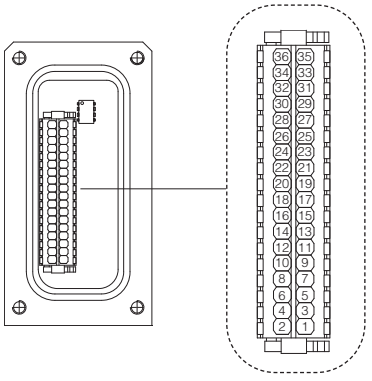
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

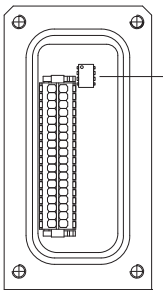


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 20

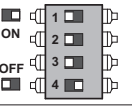


Fieldbus terminator only for BC and BP executions **(1)**



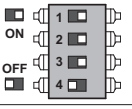
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

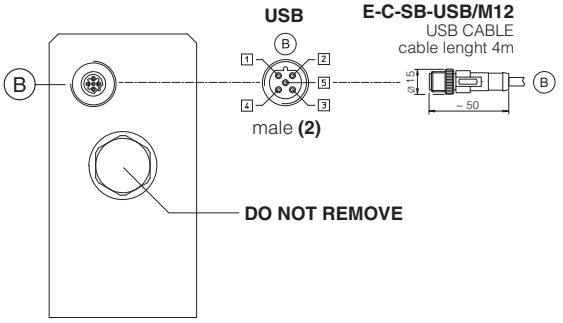


BP - PROFIBUS DP setting:

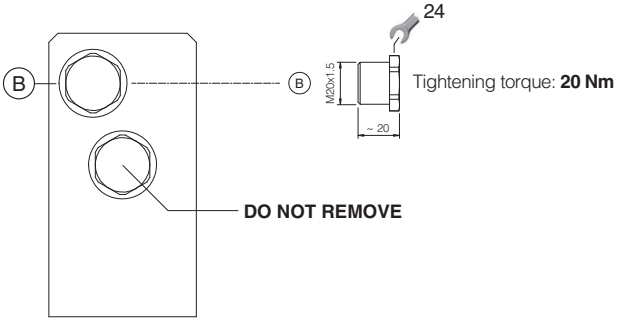
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

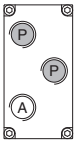
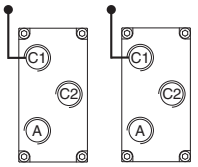
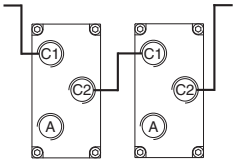


METALLIC PROTECTION CAP - supplied with the valves



(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

22.1 Cable glands and threaded plug - see tech table **KX800**

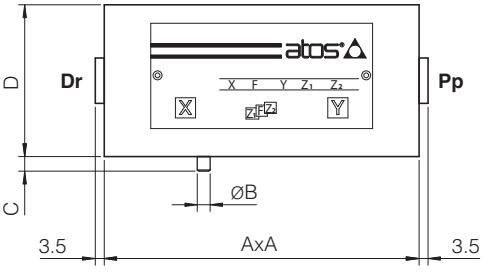
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

23 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZA **LICZA** **LIRZA**	**1** = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZA **LICZA**	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZA	**6** = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

24 COVERS DIMENSIONS [mm]

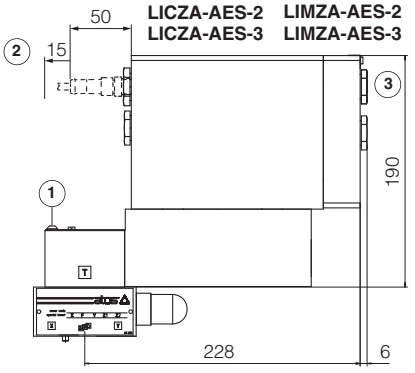
Size	AxA	øB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4"
5 = 50	140x140	6	4	70	G 1/4"
6 = 63	180x180	6	4	80	G 3/8"
8 = 80	ø250	8	6	80	G 3/8"



Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

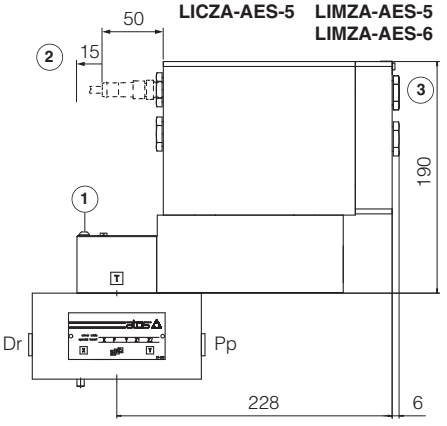
25 INSTALLATION DIMENSIONS [mm]

LICZA-AES-1 LIMZA-AES-1 LIRZA-AES-1
LICZA-AES-2 LIMZA-AES-2 LIRZA-AES-2
LICZA-AES-3 LIMZA-AES-3 LIRZA-AES-3

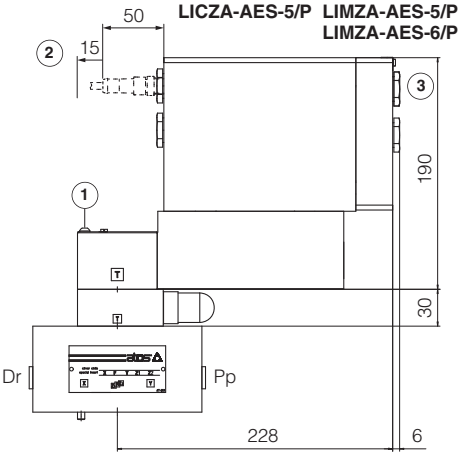


Mass [kg]			
	LICZA, LIMZA, LIRZA		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	10,5	-	0,2
2 = 25	11	-	0,5
3 = 32	12,3	-	0,9
4 = 40	17,7	12,5	1,7
5 = 50	21,2	16	2,9
6 = 63	30,7	25,5	6,7
8 = 80	39,3	34,1	13,1

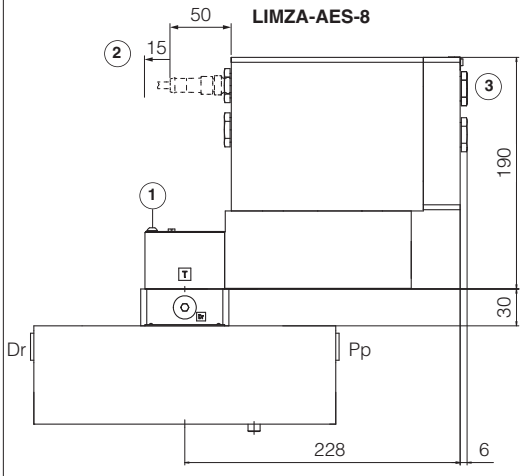
LICZA-AES-4 LIMZA-AES-4 LIRZA-AES-4
LICZA-AES-5 LIMZA-AES-5
LIMZA-AES-6



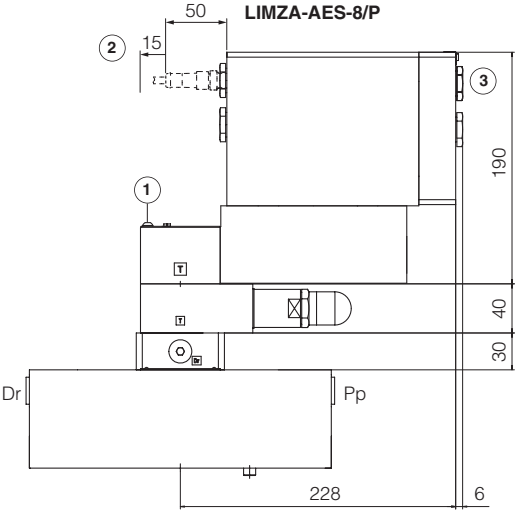
LICZA-AES-4/P LIMZA-AES-4/P LIRZA-AES-4/P
LICZA-AES-5/P LIMZA-AES-5/P
LIMZA-AES-6/P



LIMZA-AES-8



LIMZA-AES-8/P



Note: for ISO 7368 mounting surface and cavity dimensions, see tech. table P006

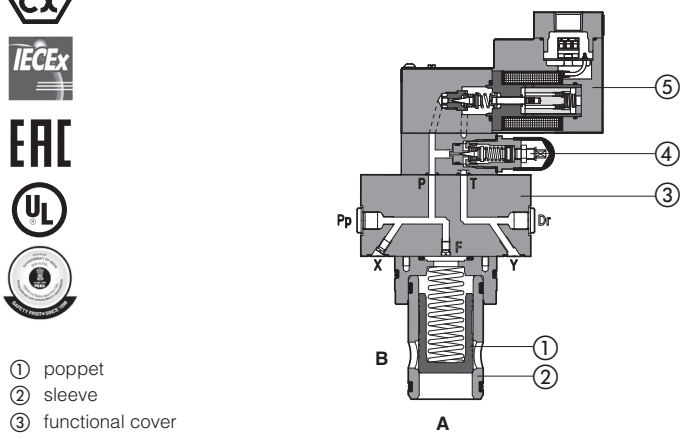
(1) = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw
(2) = Space to remove the USB connector
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

26 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P006**	Mounting surfaces and cavities for cartridge valves
GS500	Programming tools		

Ex-proof proportional pressure cartridges

without transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



① poppet
② sleeve
③ functional cover
④ mechanical pressure limiter
⑤ proportional ex-proof pilot valve

LIMZA-A-4

LICZA-A, LIMZA-A, LIRZA-A

2-way ex-proof proportional pressure cartridges without transducer respectively performing: pressure compensator, relief or reducing functions.

They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **16** ÷ **80** - ISO 7368

Max flow: up to **4500 l/min**

Max pressure: **250 bar**

1 MODEL CODE OF FUNCTIONAL COVERS

LIMZA	/	*	-	A	-	3	/	180	/	M	/	*	/	*	*	/	*

Ex-proof proportional pressure cartridges valves:
LICZA = pressure compensator
LIMZA = pressure relief
LIRZA = pressure reducing

Certification type:
Multicertification ATEX, IECEx, EAC:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

Valve size ISO 7368:
1 = size 16
2 = size 25
3 = size 32
4 = size 40
5 = size 50 (not for LIRZA)
6 = size 63 (only for LIMZA)
8 = size 80 (only for LIMZA)

Max regulated pressure:
80 = 80 bar
180 = 180 bar
250 = 250 bar

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
O = horizontal cable entrance **(2)**
P =with integral mechanical pressure limiter (standard. for size 1, 2 and 3)

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR **(2)**

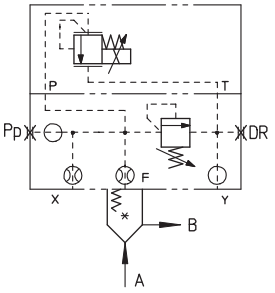
(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /OP **(4)** Approved only for italian market

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

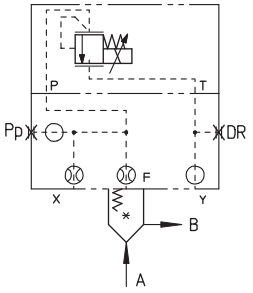
2 HYDRAULICS SYMBOLS

LICZA

LICZA-A-1÷3
LICZA-A-4÷5 /P

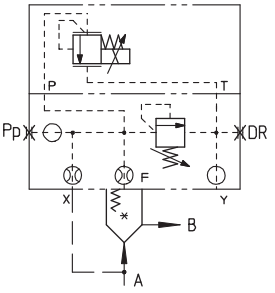


LICZA-A-4
LICZA-A-5

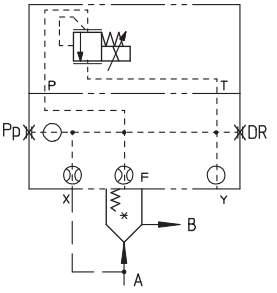


LIMZA

LIMZA-A-1÷3
LIMZA-A-4÷8 /P

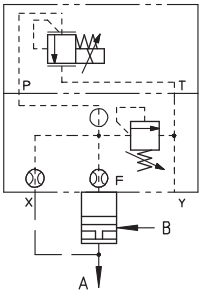


LIMZA-A-4÷8

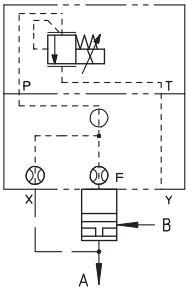


LIRZA

LIRZA-A-1÷3
LIRZA-A-4 /P



LIRZA-A-4



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	**	/	*

Cartridge according to ISO 7368

Cartridges size ISO 7368:
16
25
32
40
50
63
80

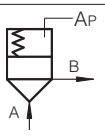
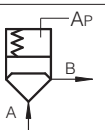
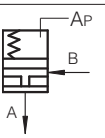
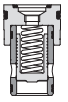
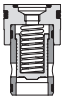
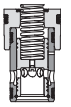
Type of poppet:
31 = for LIMZA and LICZA
36 = for LICZA
37 = for LIRZA

Spring cracking pressure:
2 = 1,5 bar for poppet 31
3 = 3 bar
4 = 4 bar
6 = 6 bar for poppet 31 and 36
7 = 7 bar for poppet 37

Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

4 TYPE OF POPPET

Type of poppet	**31**	**36**	**37**
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	**1:1**	**1:1**	**1:1**

5 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		LICZA					LIMZA							LIRZA			
Valve size	[l/min]	1	2	3	4	5	1	2	3	4	5	6	8	1	2	3	4
Max flow	[bar]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pressure		see section 15															
Max regulated pres. at port A	[bar]	80; 180; 250					80; 180; 250							80; 180; 250			
Max pressure	[bar]	Ports: T, Y = 210															
		Ports: P, A, B, X = 315															
Response time 0-100% step signal **(1)** (depending on installation)	[ms]	≤ 120 ÷ 430					≤ 120 ÷ 480							≤ 120 ÷ 380			
Hysteresis	[% of regulated max pres.]	≤ 2					≤ 1,5							≤ 2			
Linearity	[% of regulated max pres.]	≤ 3					≤ 3							≤ 3			
Repeatibility	[% of regulated max pres.]	≤ 2					≤ 2							≤ 2			

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 5

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

8 ELECTRICAL CHARACTERISTICS

Max. power	35W	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

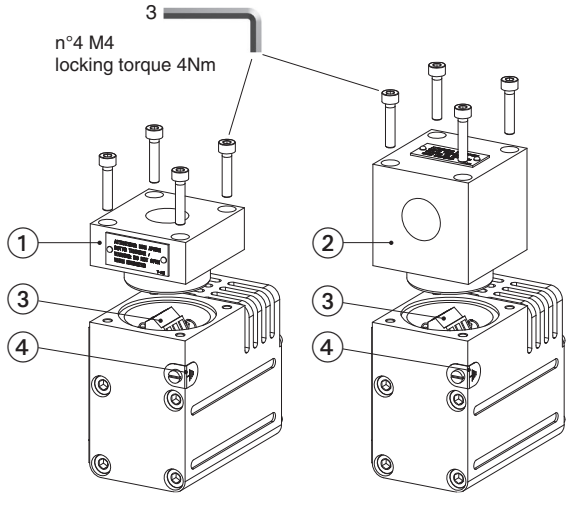
Valve type	DPZA		DPZA/**M**	DPZA/**UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • EAC Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 EX PROOF SOLENOIDS WIRING OF VALVES -A without integral driver

Multicertification



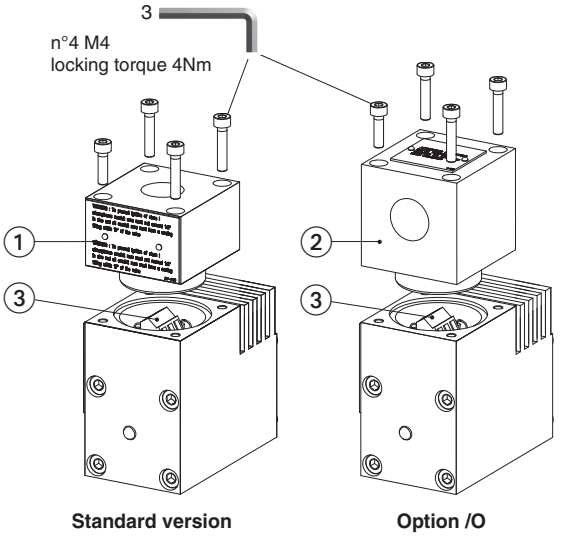
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

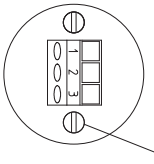
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

13 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

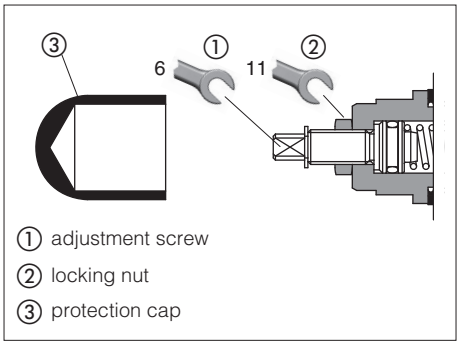
14 OPTIONS

O = Horizontal cable entrance , to be selected in case of limited verical space.

P = Integral mechanical pressure limiter (standard for size 1, 2 and 3)

The LICZA-A*, LIMZA-A* and LIRZA-A* standard size 1, 2, 3 and option /P are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

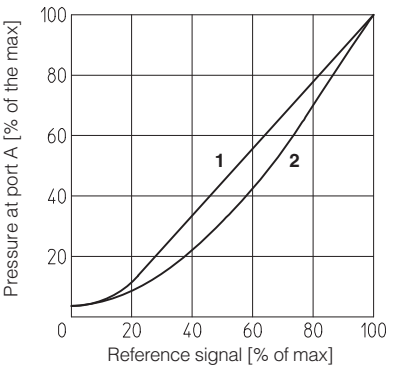
- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



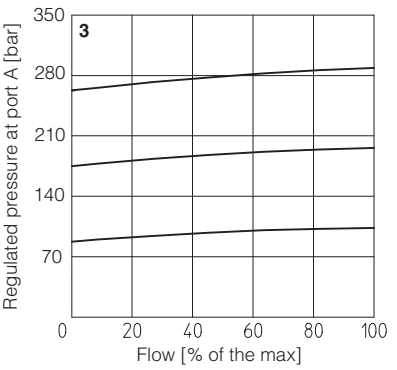
14.1 Possible combined options: /OP

15 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams LIMZA
2 Regulation diagrams LICZA

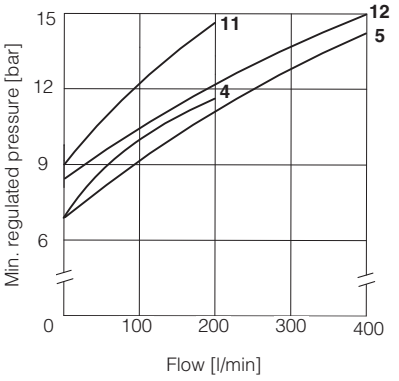


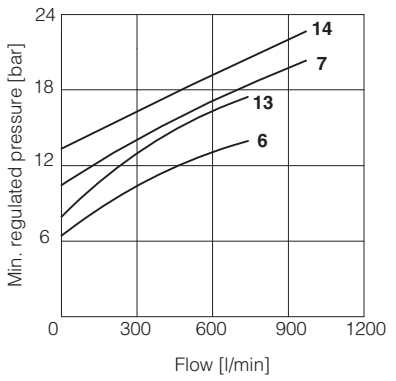
3 Pressure/flow diagrams LICZA, LIMZA

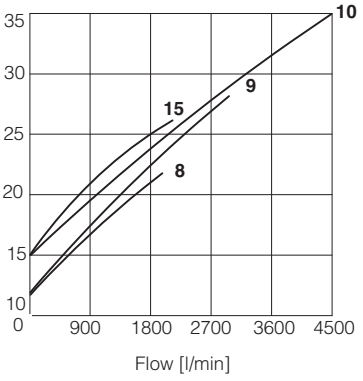


4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZA-*-1
5 = LIMZA-*-2
6 = LIMZA-*-3
7 = LIMZA-*-4
8 = LIMZA-*-5
9 = LIMZA-*-6
10 = LIMZA-*-8
11 = LICZA-*-1
12 = LICZA-*-2
13 = LICZA-*-3
14 = LICZA-*-4
15 = LICZA-*-5





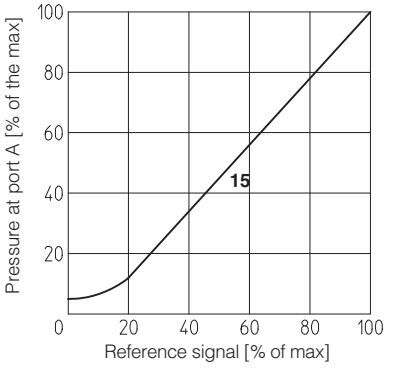


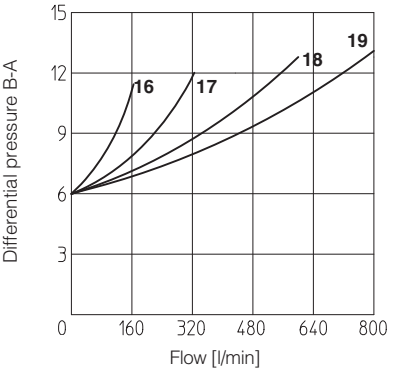
Regulation diagrams LIRZA

15 = LIRZA-A

16-19 Min. pressure/flow diagrams
with reference signal “null”

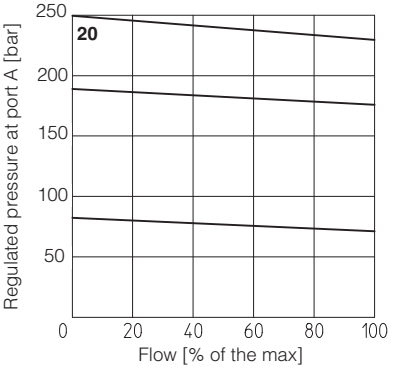
16 = LIRZA-*-1
17 = LIRZA-*-2
18 = LIRZA-*-3
19 = LIRZA-*-4





Pressure/flow diagrams

20 = LIRZA-A

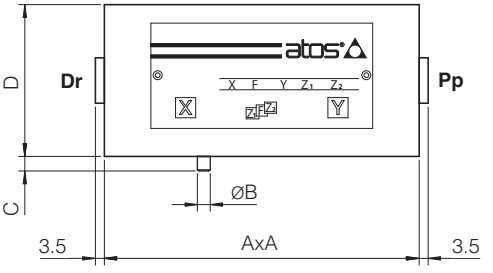


16 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZA **LICZA** **LIRZA**	**1** = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZA **LICZA**	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZA	**6** = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

17 COVERS DIMENSIONS [mm]

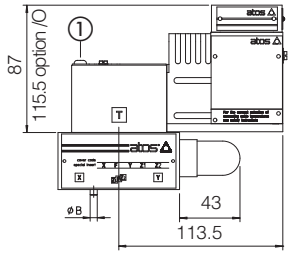
Size	AxA	øB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4”
5 = 50	140x140	6	4	70	G 1/4”
6 = 63	180x180	6	4	80	G 3/8”
8 = 80	ø250	8	6	80	G 3/8”



Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

18 COVERS INSTALLATION DIMENSIONS [mm]

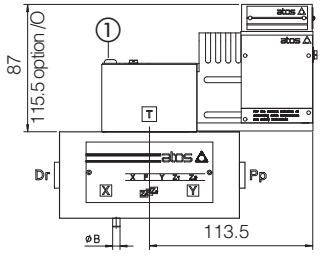
LICZA-A-1 LIMZA-A-1 LIRZA-A-1
LICZA-A-2 LIMZA-A-2 LIRZA-A-2
LICZA-A-3 LIMZA-A-3 LIRZA-A-3



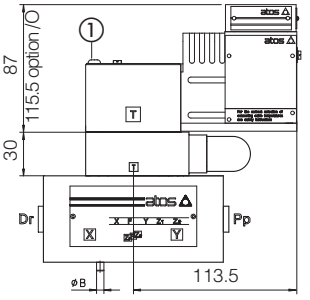
Mass [kg]			
LICZA, LIMZA, LIRZA			Cartridge
Size	Standard	Option /P	SC LI
1	4,1	standard	0,2
2	4,8	standard	0,5
3	6,1	standard	0,9
4	11,5	12,5	1,7
5	15	16	2,9
6	24,5	25,5	6,7
8	33,1	34,1	13,1

① = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ①

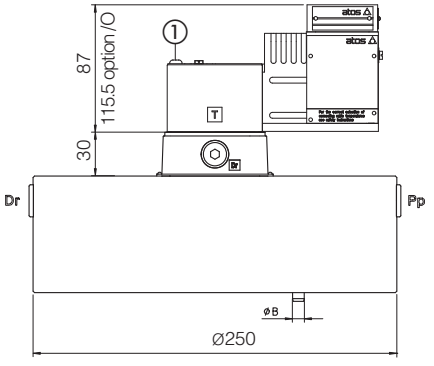
LICZA-A-4 LIMZA-A-4 LIRZA-A-4
LICZA-A-5 LIMZA-A-5
LIMZA-A-6



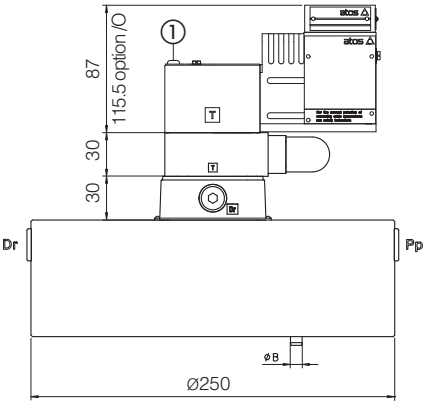
LICZA-A-4/P LIMZA-A-4/P LIRZA-A-4/P
LICZA-A-5/P LIMZA-A-5/P
LIMZA-A-6/P



LIMZA-A-8



LIMZA-A-8/P



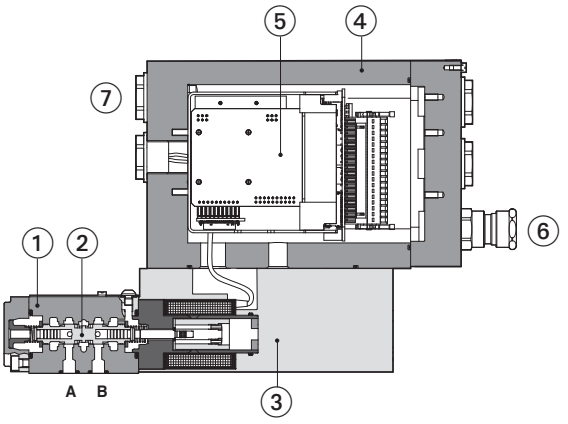
Note: for mounting surface and cavity dimensions, see tech. table P006

19 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P006	Mounting surfaces and cavities for cartridge valves

Ex-proof digital proportional reducing valves

direct, with on-board driver and without transducer - **ATEX and IECEx**



DHRZA-AES-010/25

① valve body
② spool
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof cable glands (to be ordered separately)
⑦ USB port always present (factory plugged)

DHRZA-AES

Ex-proof digital proportional pressure reducing valves, direct, without transducer, for pressure reduction in low flow systems or piloting lines.

They are equipped with ex-proof on-board digital driver and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **06** - ISO 4401
Max flow: **24 l/min**
Max pressure: **25 bar**

1 MODEL CODE

DHRZA	- AES	- NP	- 010	/ 25	- M	/ *	*	/ *

DHRZA = Ex-proof proportional pressure reducing valves, direct, size 06

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

010 = reduced port A
012 = reduced ports A and B

25 = reduced pressure range 3÷25 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (1):
B = flow reduced on port B (solenoid on side A)

Electronic options (1):
I = current reference input 4 ÷ 20 mA (omit for std voltage ±10 VDC)

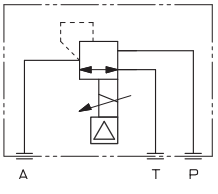
Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

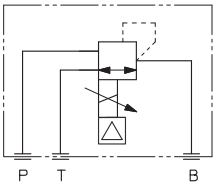
(1) Possible combined options: /BI

2 CONFIGURAZIONS AND HYDRAULIC SYMBOLS (rapresentation according to ISO 1219-1)

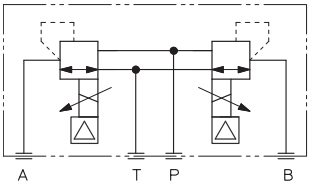
DHRZA-AES-*-010/25*



DHRZA-AES-*-010/25/B*



DHRZA-AES-*-012/25*



3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

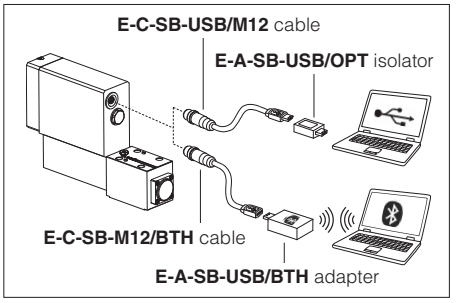
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS

Max regulated pressure (Q=1 l/min) [bar]	25
Min. regulated pressure (Q=1 l/min) [bar]	3
Max. pressure at port P [bar]	315
Max. pressure at port T [bar]	210
Max. flow [l/min]	24
Response time 0-100% step signal (depending on installation) [ms]	≤ 45
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3
Repeatability [% of the max pressure]	≤ 2

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: maximum range ± 5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	DHRZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-AES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-31 EN 60079-1	IEC 60079-0 IEC 60079-31:2013 IEC 60079-1	
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

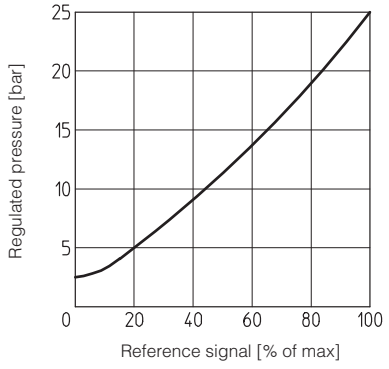
13 HYDRAULIC OPTIONS

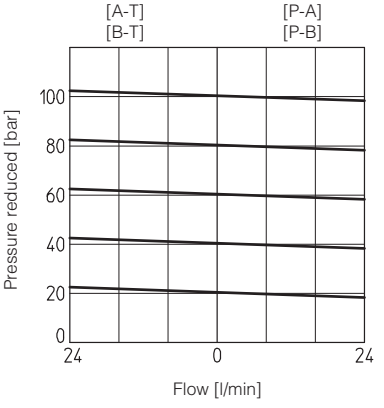
B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 15.1

14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

15 DIAGRAMS based on mineral oil ISO VG 46 at 50°C





16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

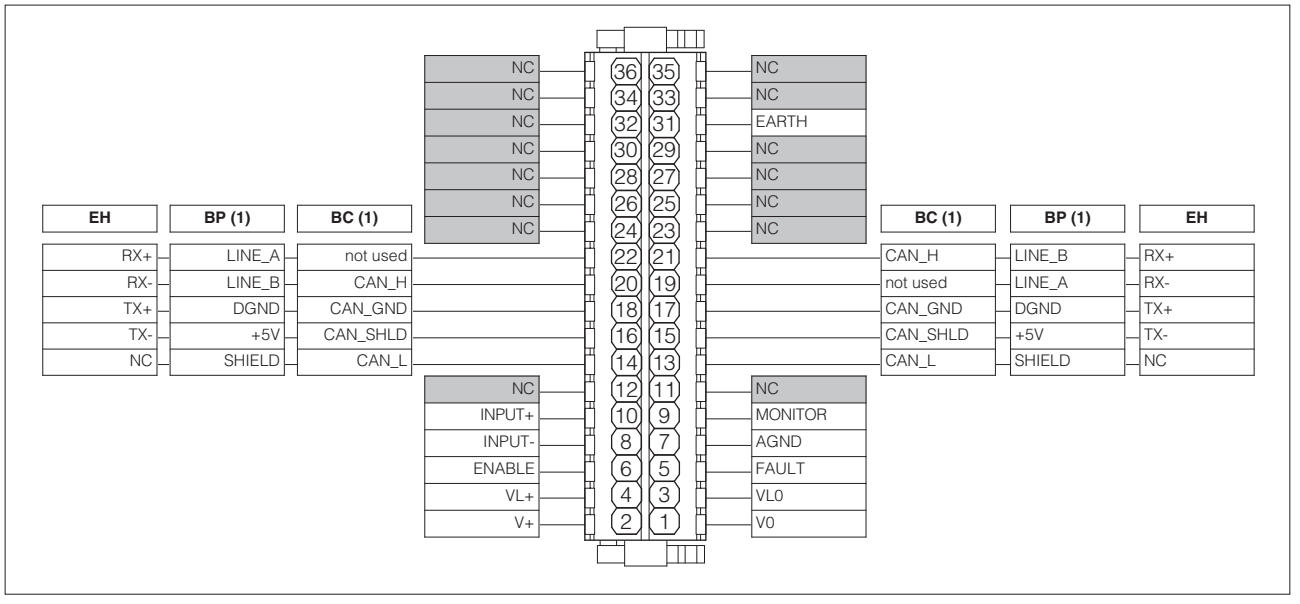
16.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

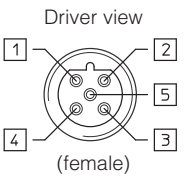
18 ELECTRONIC CONNECTIONS

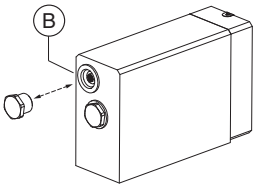
18.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to AGND Default is: ±5 VDC	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

18.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





18.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

18.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

18.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

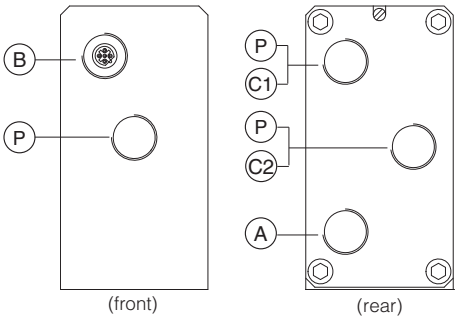
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

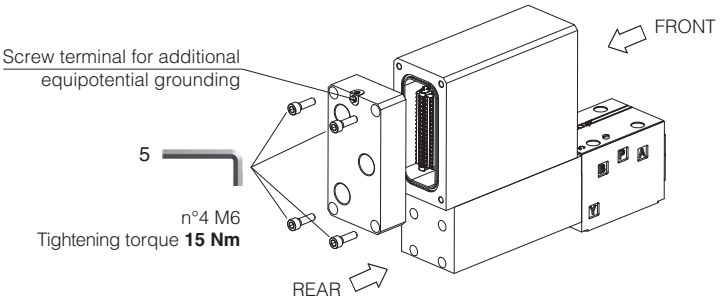
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug



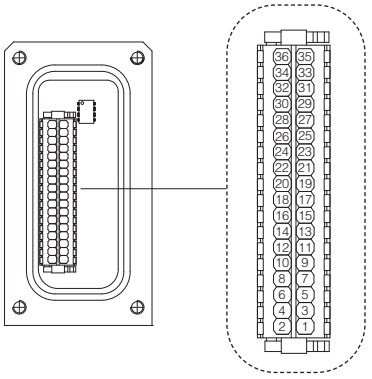
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

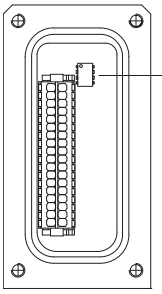


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 17

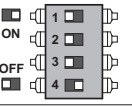


Fieldbus terminator only for BC and BP executions **(1)**



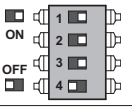
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

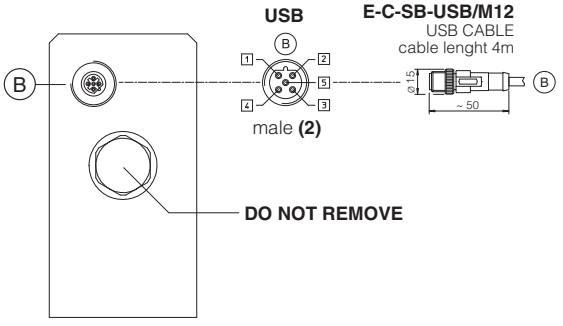


BP - PROFIBUS DP setting:

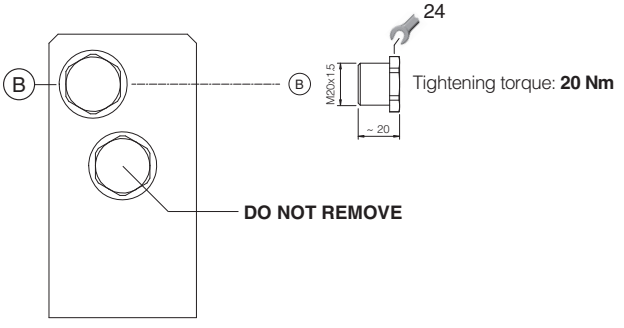
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

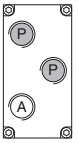
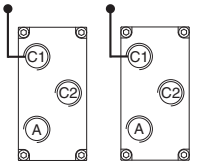
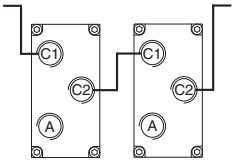


METALLIC PROTECTION CAP - supplied with the valves

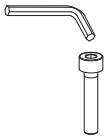


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

19.1 Cable glands and threaded plug - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

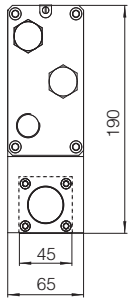
20 FASTENING BOLTS AND SEALS



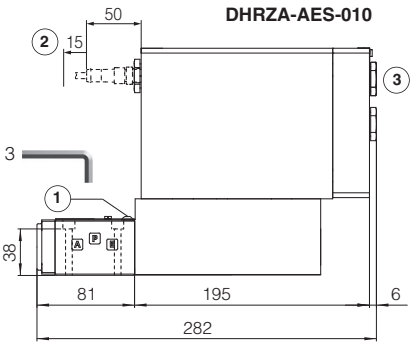
Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm

Seals:
4 OR 108;
Diameter of ports P, A, B, T: Ø 7,5 mm (max)
1 OR 2025
Diameter of port Y: Ø = 3,2 mm (only for /Y option)

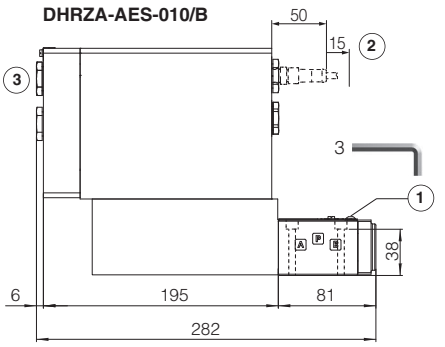
21 INSTALLATION DIMENSIONS FOR DHRZA [mm]



DHRZA-AES-010



DHRZA-AES-010/B

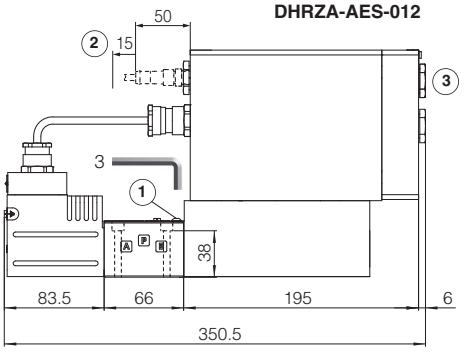


ISO 4401: 2005
(see table P005)

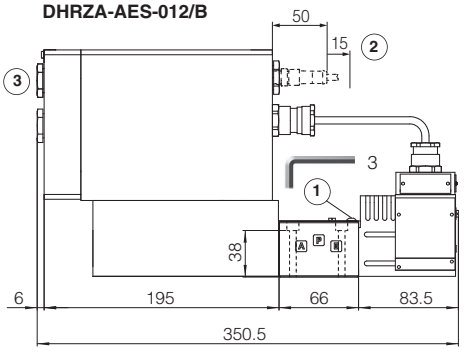
Mounting surface:
4401-03-02-0-05

Mass [kg]	
DHRZA-A-010	8,2
DHRZA-A-012	9,9

DHRZA-AES-012



DHRZA-AES-012/B

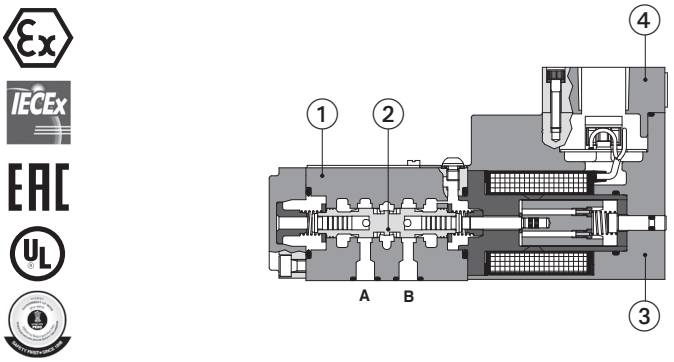


22 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		

Ex-proof proportional reducing valves

direct, without transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



DHRZA-A-010/25

① valve body
② spool
③ ex-proof solenoid
④ threaded connections for cable clamp or conduit pipe

DHRZA-A

Ex-proof proportional pressure reducing valves, direct, without transducer, for pressure reduction in low flow systems or piloting lines.

They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **06** - ISO 4401
Max flow: **24 l/min**
Max pressure: **25 bar**

1 MODEL CODE

DHRZA	/	*	-	A	-	010	/	25	-	M	/	*	/	*	*	/	*

DHRZA = Ex-proof proportional pressure reducing valves, direct, size 06

Certification type:
Multicertification:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

010 = reduced port A
012 = reduced ports A and B

25 = reduced pressure range 3÷25 bar

Options (3):
B = flow reduced on port B (solenoid on side A)
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: all combinations are available
(4) Approved only for italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

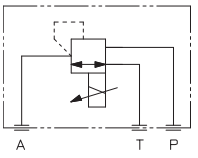
Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

3 GENERAL CHARACTERISTICS

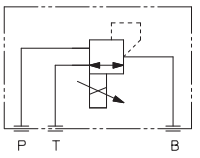
Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

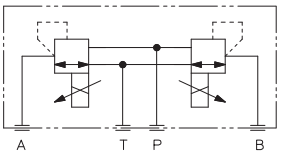
Hydraulic symbols



DHRZA-A-010/25*



DHRZA-A-010/25/B*



DHRZA-A-012/25*

Max regulated pressure (Q=1 l/min) [bar]	25
Min. regulated pressure (Q=1 l/min) [bar]	3
Max. pressure at port P [bar]	315
Max. pressure at port T [bar]	210
Max. flow [l/min]	24
Response time 0-100% step signal (depending on installation) [ms]	≤ 45
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3
Repeatability [% of the max pressure]	≤ 2

Above performance data refer to valves coupled with Atos electronic drivers, see section 2

5 ELECTRICAL CHARACTERISTICS

Max. power	35W	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

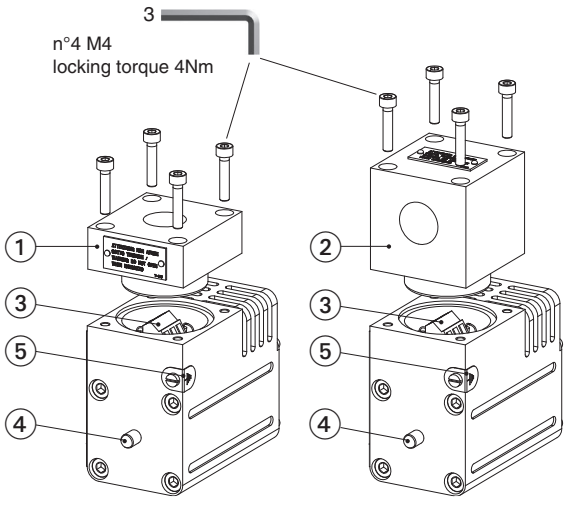
Valve type	DHRZA, DKZA		DHRZA**/M**, DKZA**/M**	DHRZA**/UL**, DKZA**/UL**	
Certifications	Multicertification Group II **TEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX PROOF SOLENOIDS WIRING

Multicertification



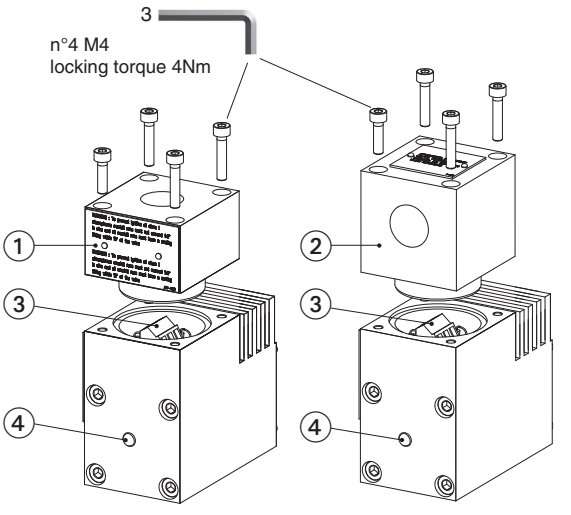
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

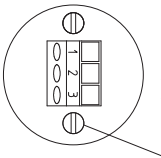
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override



⚠ **Pay attention to respect the polarity**

1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section [9] note 1

alternative GND screw terminal connected to solenoid housing

9 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

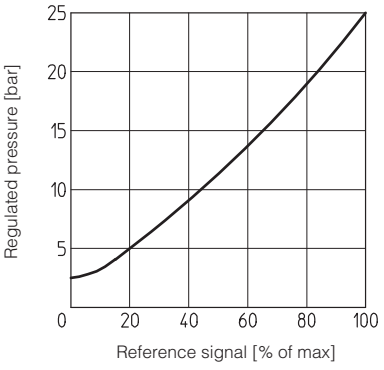
Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

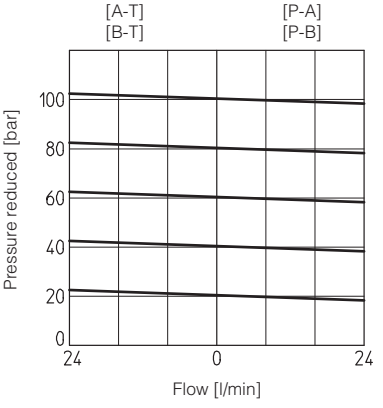
10 **CABLE GLANDS** - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

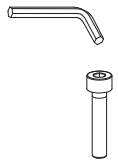
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 **DIAGRAMS** based on mineral oil ISO VG 46 at 50°C





12 FASTENING BOLTS AND SEALS

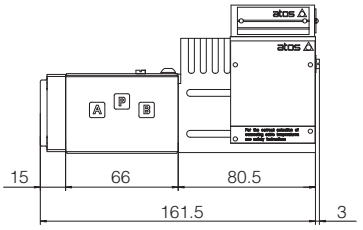
	DHZA	DKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports P, A, B, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports P, A, B, T: Ø 11,5 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

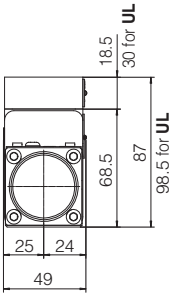
13 INSTALLATION DIMENSIONS FOR DHRZO [mm]

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(for /Y surface: 4401-03-03-0-05 without port X)

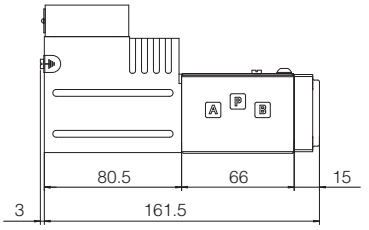
Mass [kg]	
DHRZA-A-05	2,65
DHRZA-A-07	4,3
Option /O	+0,35
Option /WP	+0,25

DHRZA-A-010

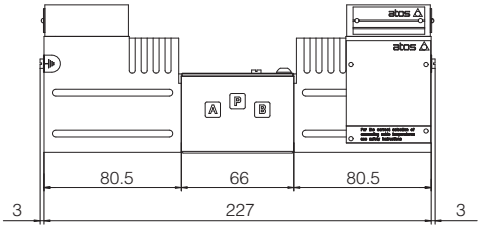




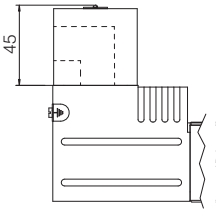
DHRZA-A-010/B



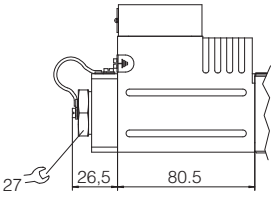
DHRZA-A-012



option /O



option /WP

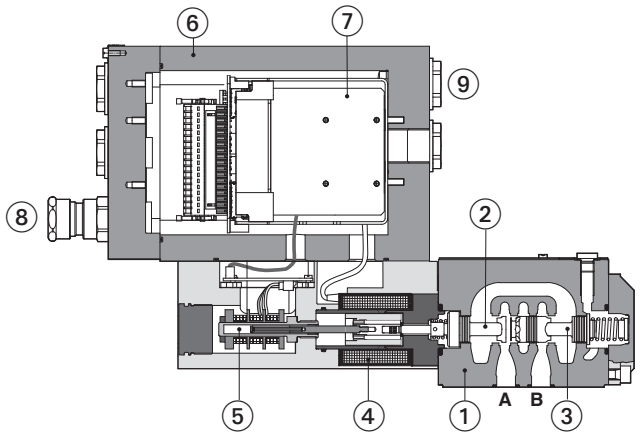


14 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional flow valves high performance

pressure compensated, with on-board driver and LVDT transducer - **ATEX and IECEx**



QVKZA-TES-SN-NP-10

① valve body
② throttle
③ compensator
④ ex-proof solenoid
⑤ ex-proof LVDT transducer
⑥ ex-proof electronics housing
⑦ on-board digital drivers
⑧ ex-proof cable glands (to be ordered separately)
⑨ USB port always present (factory plugged)

QVHZA-TES, QVKZA-TES

Ex-proof digital high performance proportional flow valves, with LVDT position transducer for pressure compensated flow regulations.

They are equipped with ex-proof on-board digital driver, LVDT transducer and solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

QVHZA:	**QVKZA**:
Size: **06** - ISO4401	Size: **10** - ISO4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZA	- TES	- SN	- NP	- 10	/ 65	/ M	*	* /	*

Ex-proof pressure compensated proportional flow valves, direct
QVHZA = size 06
QVKZA = size 10

TES = on-board driver and LVDT transducer

Alternated P/Q controls:
SN = none

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
06 = size 06
10 = size 10

Max regulated flow:
QVHZA:
3 = 3,5 l/min
12 = 12 l/min
18 = 18 l/min
36 = 35 l/min
45 = 45 l/min
QVKZA:
65 = 65 l/min
90 = 90 l/min

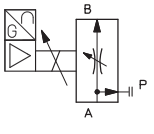
Cable entrance threaded connection:
M = M20x1,5

Electronic options:
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)

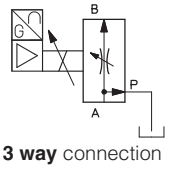
Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines

The port T must be always not connected (blocked)

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

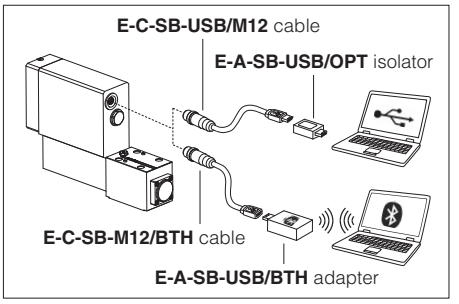
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		QVHZA					QVKZA	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating Δp	[bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A **(1)**	[l/min]	40			50	55	70	100
Max pressure	[bar]	210						
Response time 0÷100% step signal	[ms]	≤ 30					≤ 45	
Hysteresis		≤ 0,5 [% of the regulated max flow]						
Linearity		≤ 0,5 [% of the regulated max flow]						
Repeatability		≤ 0,1 [% of the regulated max flow]						

(1) for different Δp, the max flow is in accordance to diagrams in section 14.3

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	QVHZA, QVKZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-TES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

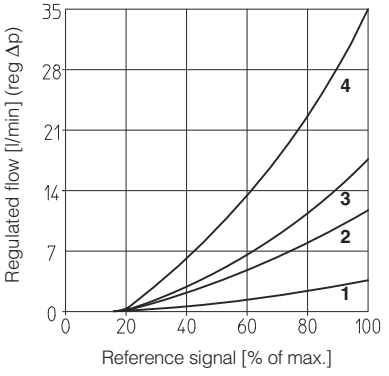
13 ELECTRONIC OPTIONS

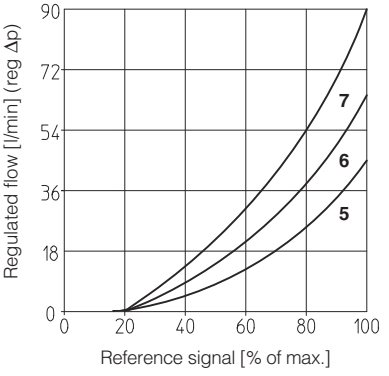
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

14 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

14.1 Regulation diagrams

1 = QVHZA-*-06**/3**
2 = QVHZA-*-06**/12**
3 = QVHZA-*-06**/18**
4 = QVHZA-*-06**/36**
5 = QVHZA-*-06**/45**
6 = QVKZA-*-10**/65**
7 = QVKZA-*-10**/90**



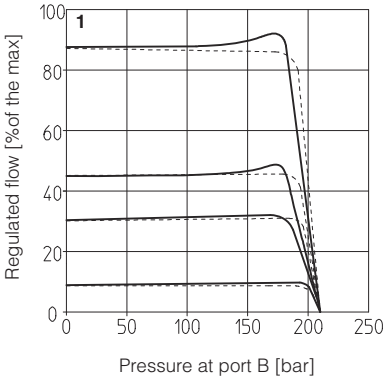


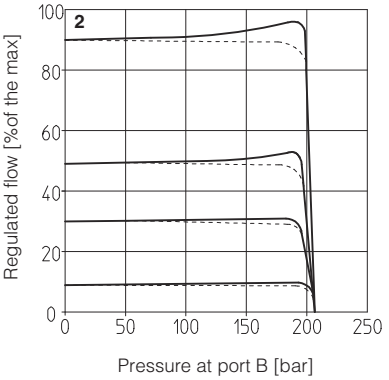
14.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

1 = QVHZA
2 = QVKZA

Dotted line for 3-way versions

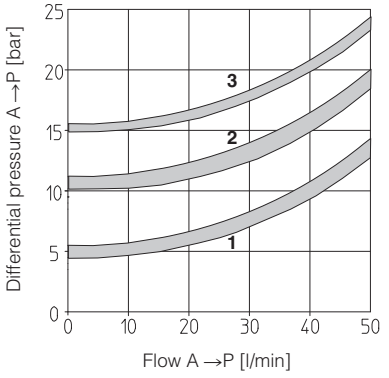


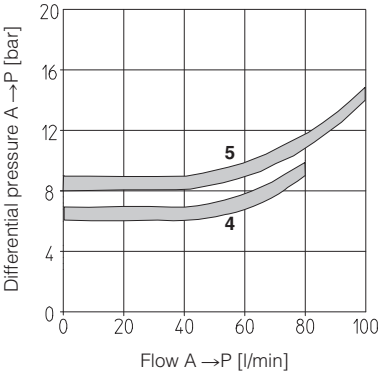


14.3 Flow A → P/Δp diagrams

3-way configuration

1 = QVHZA-*-06**/3**
QVHZA-*-06**/12**
2 = QVHZA-*-06**/18**
QVHZA-*-06**/36**
3 = QVHZA-*-06**/45**
4 = QVKZA-*-10**/65**
5 = QVKZA-*-10**/90**





15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

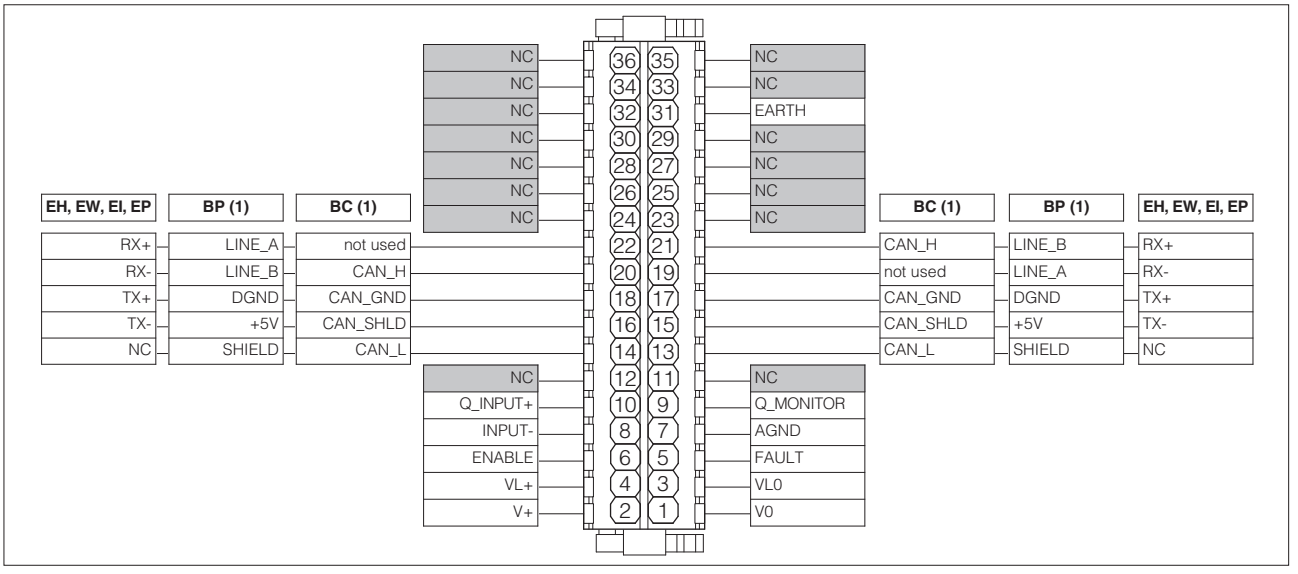
15.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 5: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

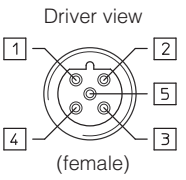
17 ELECTRONIC CONNECTIONS

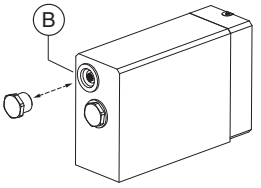
17.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

17.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





17.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

17.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

17.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

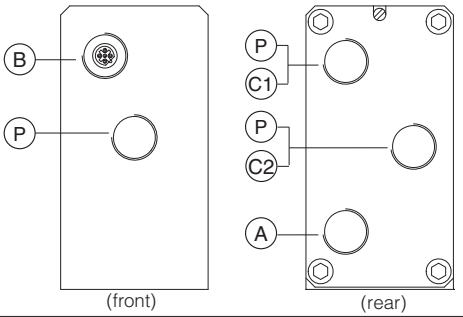
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

18 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

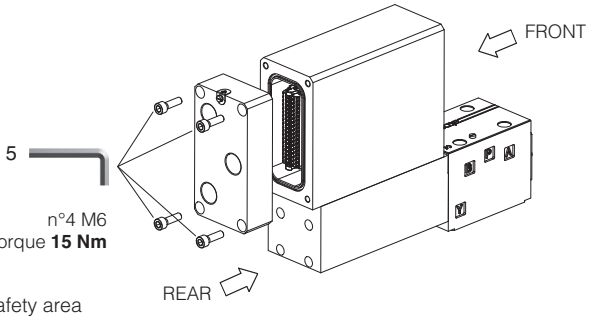
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



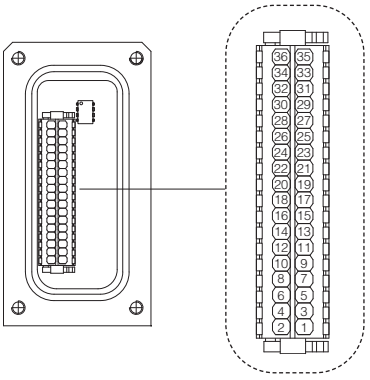
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

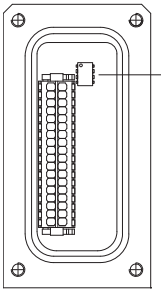


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 16

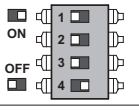


Fieldbus terminator only for BC and BP executions **(1)**



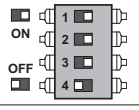
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

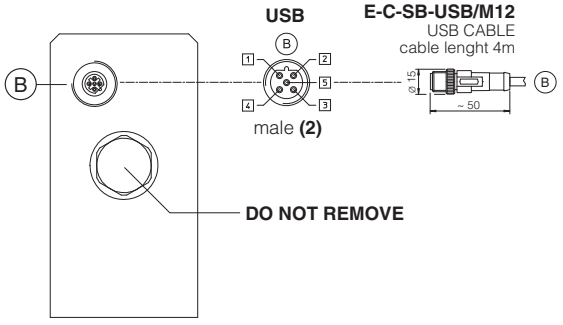


BP - PROFIBUS DP setting:

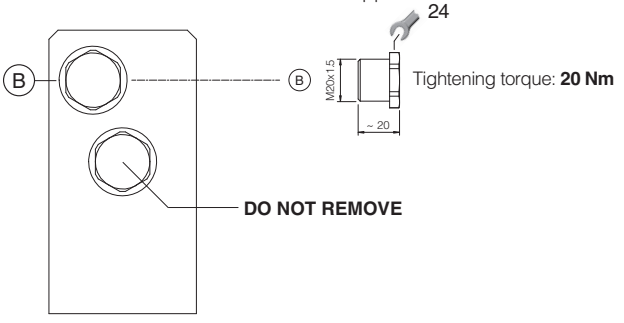
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

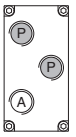
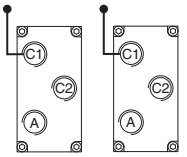
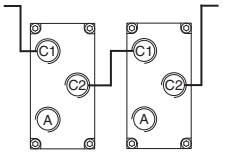


METALLIC PROTECTION CAP - supplied with the valves

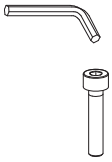


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

18.1 Cable glands and threaded plug - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

19 FASTENING BOLTS AND SEALS

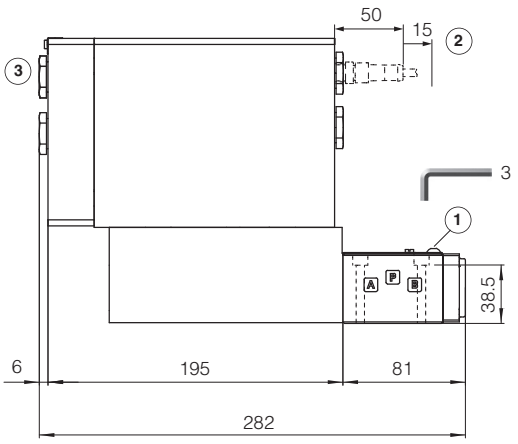
	QVHZA	QVKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

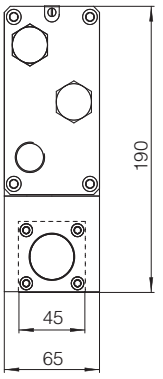
20 INSTALLATION DIMENSIONS [mm]

QVHZA-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZA-TES	7,2

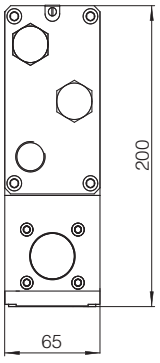


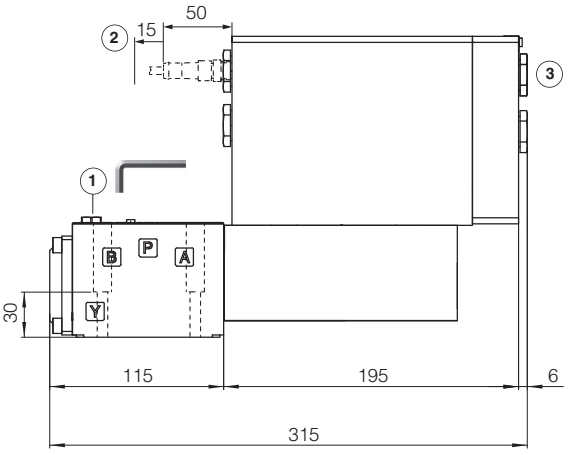


QVKZA-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZA	9





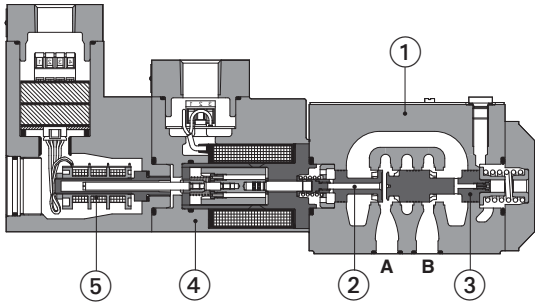
(1) = Air bleed off
(2) = Space to remove the USB connector
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

21 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GX800**	Ex-proof pressure transducer type E-ATRA-7
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		
GS510	Fieldbus		

Ex-proof proportional flow valves high performance

pressure compensated, with LVDT transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



① valve body
② throttle
③ compensator
④ ex-proof proportional solenoid
⑤ ex-proof LVDT transducer

QVKZA-T-10

QVHZA-T, QVKZA-T

Ex-proof high performance proportional flow control valves, with LVDT position transducer for pressure compensated flow regulations.
They are equipped with ex-proof proportional solenoids LVDT transducer certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid and transducer prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

QVHZA:
Size: **06** - ISO 4401
Max flow: **45 l/min**
Max pressure: **210 bar**

QVKZA:
Size: **10** - ISO 4401
Max flow: **90 l/min**
Max pressure: **210 bar**

1 MODEL CODE

QVKZA	/	*	-	T	-	10	/	90	/	M	/	*	*	/	*

QVKZA

Ex-proof pressure compensated proportional flow valves, direct
QVHZA = size 06
QVKZA = size 10

Certification type:
Multicertification
ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

T = with LVDT transducer

Valve size ISO 4401:
06 = size 06 **10** = size 10

Max regulated flow:

QVHZA:
3 = 3,5 l/min
12 = 12 l/min
18 = 18 l/min
36 = 35 l/min
45 = 45 l/min

QVKZA:
65 = 65 l/min
90 = 90 l/min

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

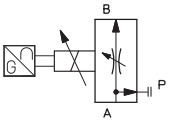
Options (3):
C = position transducer with current feedback 4 ÷ 20mA
D = quick venting of port B

Series number

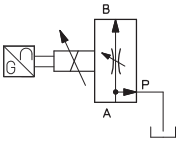
Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /CD **(4)** Approved only for the Italian market

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.
In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines
The port T must be always not connected (blocked)
For application examples of 2 and 3 way connections, see section

3 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		QVHZA					QVKZA	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating Δp	[bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A	[l/min]	40			50	55	70	100
Max pressure	[bar]	210						
Response time **(1)**	[ms]	≤ 30					≤ 40	
Hysteresis		≤ 0,5 [% of the regulated max flow]						
Linearity		≤ 0,5 [% of the regulated max flow]						
Repeatability		≤ 0,1 [% of the regulated max flow]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3
(1) 0 ÷100 % step signal

6 ELECTRICAL CHARACTERISTICS

Max. power	35W
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 180 bar
-max fluid temperature = 50°C

8 CERTIFICATION DATA

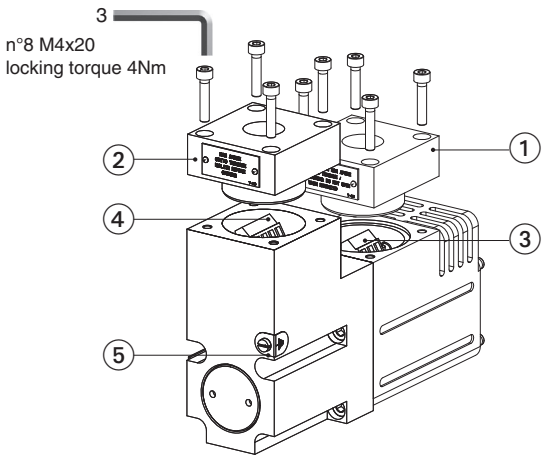
Valve type	QVHZA, QVKZA		QVHZA**/M**, QVHZA**/M**	QVHZA**/UL**, QVHZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid cerified code	**OZA-T**		**OZAM-T**	**OZA-T/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135°C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

9 EX PROOF SOLENOIDS AND LVDT TRANSDUCER WIRING

Multicertification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

Solenoid wiring

1 = Coil
2 = GND
3 = Coil

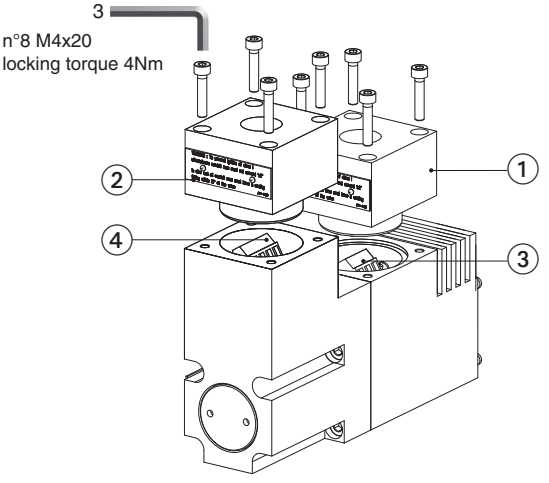
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

Position transducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

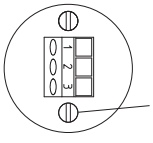
cULus certification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring

Solenoid wiring

⚠ **Pay attention to respect the polarity**

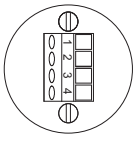


1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	-	90 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

11 CABLE GLANDS - only **Multicertification**

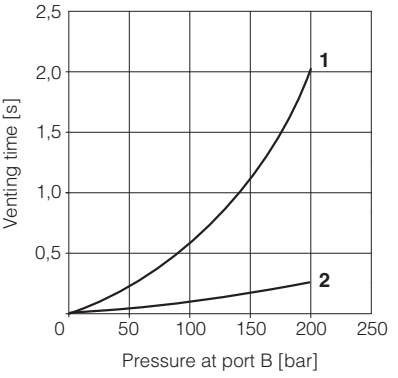
Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 OPTIONS

C = Position transducer with current feedback 4÷20 mA, suggested in case of long distance between the electronic driver and the proportional valve

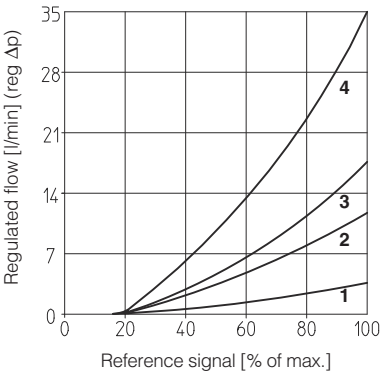
D = This option provides a quick venting of the use port B when the valve is closed or de-energized. The valve must be connected in 3 way, with P port connected to tank. When the proportional throttle is fully closed, the valve's port B is internally connected to port P (tank), permitting a quickly decompression of the pressure in the use line.
In the diagram aside are represented the venting times of **QVHZA** and **QVKZA** option **/D** respect to standard versions:
1 = standard versions
2 = option /D

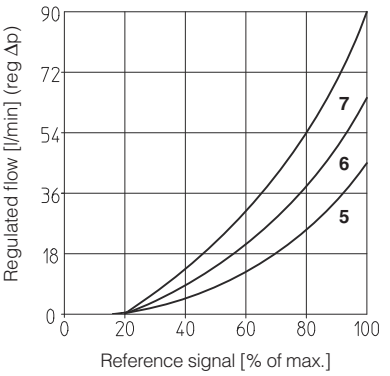


13 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

13.1 Regulation diagrams

1 = QVHZA-*-06**/3**
2 = QVHZA-*-06**/12**
3 = QVHZA-*-06**/18**
4 = QVHZA-*-06**/36**
5 = QVHZA-*-06**/45**
6 = QVKZA-*-10**/65**
7 = QVKZA-*-10**/90**

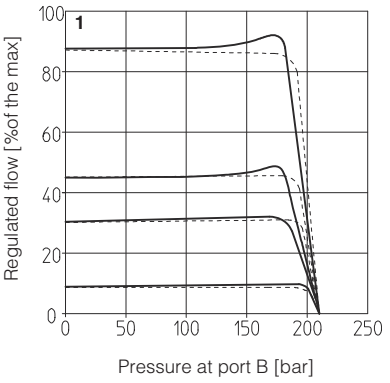


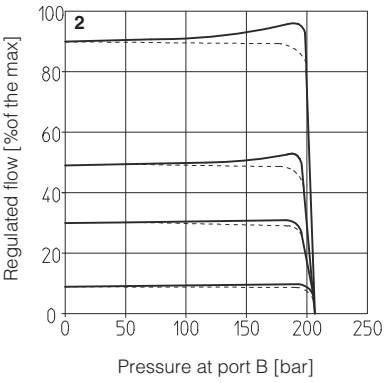


13.2 Regulated flow/outlet pressure diagrams
with inlet pressure = 210 bar

1 = QVHZA
2 = QVKZA

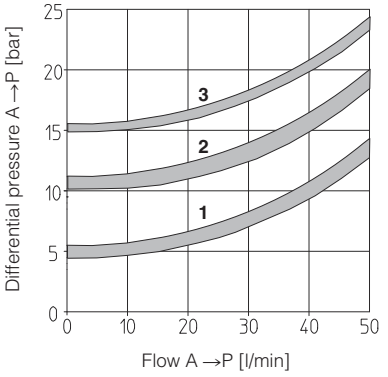
Dotted line for 3-way versions

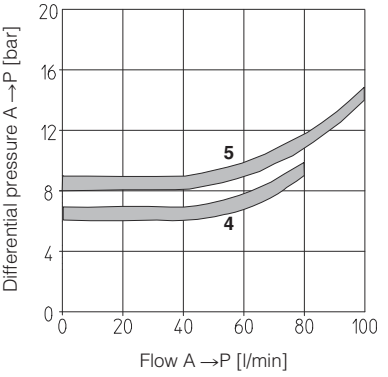




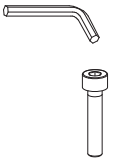
13.3 Flow A → P/Δp diagrams
3-way configuration

1 = QVHZA-*-06**/3**
QVHZA-*-06**/12**
2 = QVHZA-*-06**/18**
QVHZA-*-06**/36**
3 = QVHZA-*-06**/45**
4 = QVKZA-*-10**/65**
5 = QVKZA-*-10**/90**





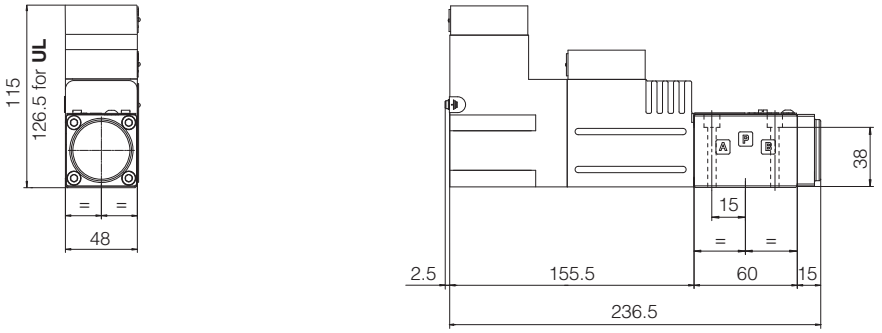
14 FASTENING BOLTS AND SEALS

	QVHZA	QVKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

15 INSTALLATION DIMENSIONS FOR QVHZA [mm]

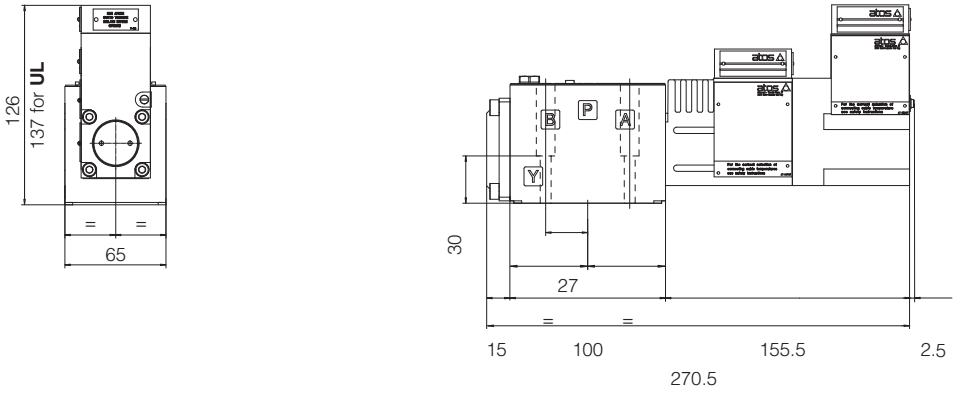
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZA	3,4



ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZA	4,9

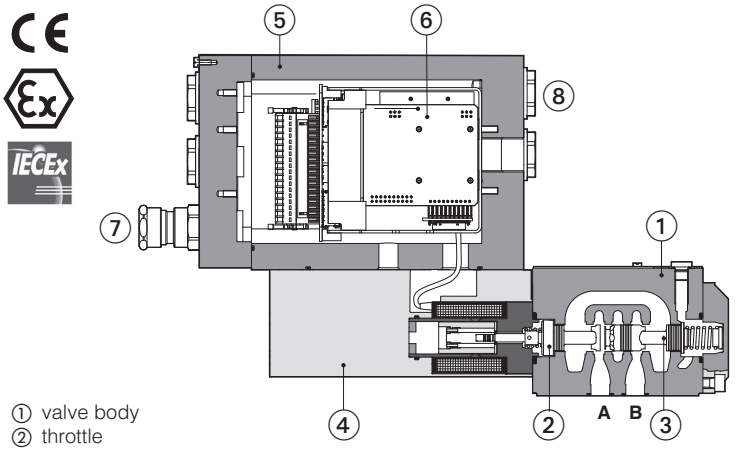


16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional flow valves

pressure compensated with on-board driver and without transducer - **ATEX and IECEx**



① valve body
② throttle
③ compensator
④ ex-proof solenoid
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

QVKZA-AES-NP-10

QVHZA-AES, QVKZA-AES

Ex-proof digital proportional flow valves, without position transducer for pressure compensated flow regulations.

They are equipped with ex-proof on-board digital driver and solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

QVHZA:	**QVKZA**:
Size: **06** - ISO4401	Size: **10** - ISO4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZA	- AES - NP - 10 / 65 / M / *	* /	*

QVKZA
Ex-proof
pressure compensate
proportional flow valve, direct
QVHZA = size 06
QVKZA = size 10

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 4401:
06 = size 06
10 = size 10

Max regulated flow:

QVHZA:		QVKZA:
3 = 3,5 l/min	**36** = 35 l/min	**65** = 65 l/min
12 = 12 l/min	**45** = 45 l/min	**90** = 90 l/min
18 = 18 l/min		

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (1):
D = quick venting of port B

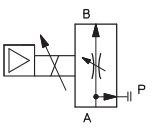
Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **W** (omit for std voltage 0 ÷ 10 VDC)
I = current reference input 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)
W = power limitation function

Series number

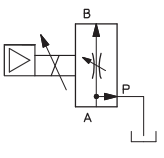
Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

(1) For possible combined options, see section 15

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines
The port T must be always not connected (blocked)

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

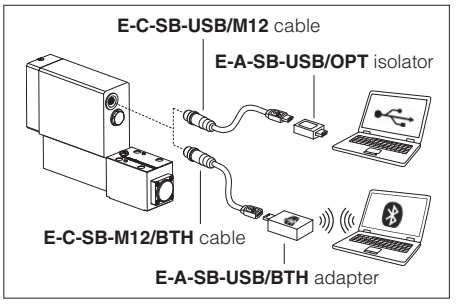
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		QVHZA					QVKZA	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating Δp	[bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A **(1)**	[l/min]	40			50	55	70	100
Max pressure	[bar]	210						
Response time 0÷100% step signal	[ms]	≤ 35					≤ 50	
Hysteresis		≤ 5 [% of the regulated max flow]						
Linearity		≤ 3 [% of the regulated max flow]						
Repeatability		≤ 1 [% of the regulated max flow]						

(1) for different Δp, the max flow is in accordance to diagrams in section 16.3

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Voltage: maximum range ± 5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply (only /W option)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	QVHZA, QVKZA			
Certifications	Multicertification Group II **ATEX IECEx**			
Solenoid certified code	**OZA-AES**			
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**		**T4**
Surface temperature	≤ 85 °C	≤ 100 °C		≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C		-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

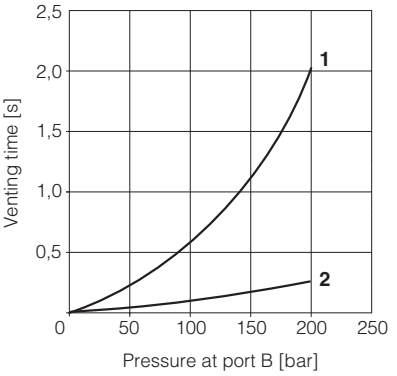
Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS

D = This option provides a quick venting of the use port B when the valve is closed or de-energized. The valve must be connected in 3 way, with P port connected to tank. When the proportional throttle is fully closed, the valve's port B is internally connected to port P (tank), permitting a quickly decompression of the pressure in the use line.
In the diagram aside are represented the venting times of **QVHZA** and **QVKZA** option **/D** respect to standard versions:

1 = standard versions
2 = option /D



14 ELECTRONIC OPTIONS

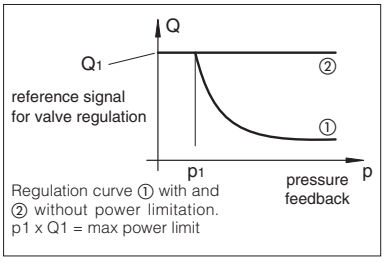
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only in combination with option **/W**
It is available to connect pressure transducer with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10VDC .Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator type HC-011 or KC-011 (see tech table D150).
It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} ; \text{Flow Reference [INPUT+]} \right)$$

Hydraulic Power Limitation - option /W



Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

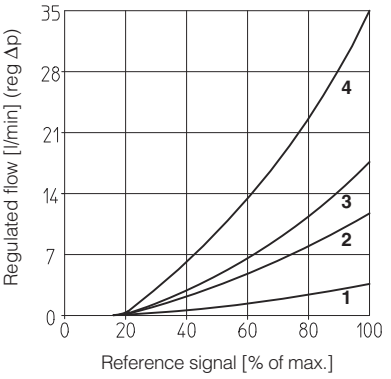
15 POSSIBLE COMBINED OPTIONS

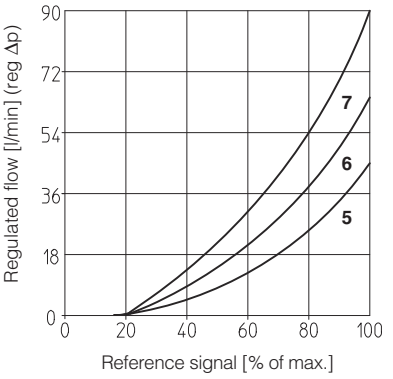
/DI, /DW, /IW, /ICW, /ICWD

16 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

16.1 Regulation diagrams

1 = QVHZA-*-06**/3**
2 = QVHZA-*-06**/12**
3 = QVHZA-*-06**/18**
4 = QVHZA-*-06**/36**
5 = QVHZA-*-06**/45**
6 = QVKZA-*-10**/65**
7 = QVKZA-*-10**/90**



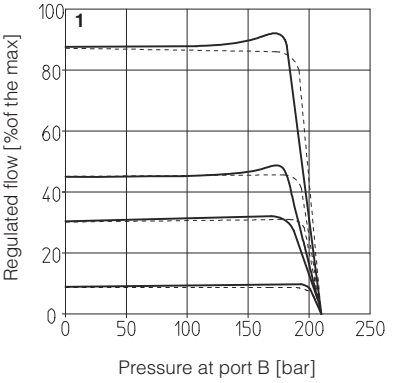


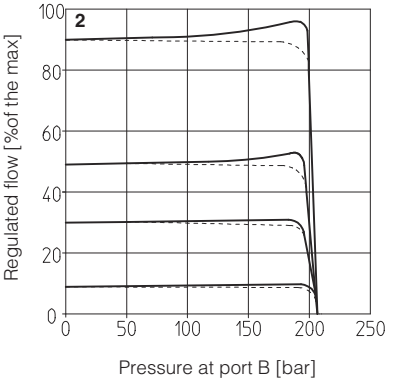
16.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

1 = QVHZA
2 = QVKZA

Dotted line for 3-way versions

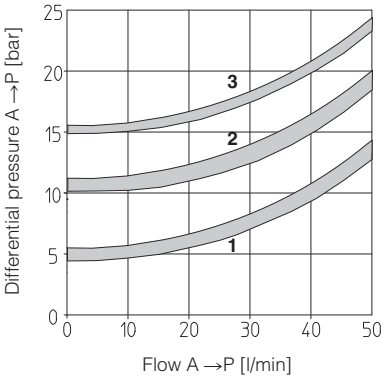


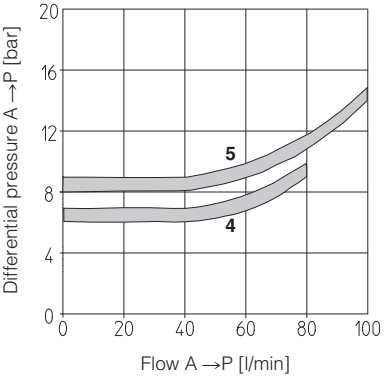


16.3 Flow A → P/Δp diagrams

3-way configuration

1 = QVHZA-*-06**/3**
QVHZA-*-06**/12**
2 = QVHZA-*-06**/18**
QVHZA-*-06**/36**
3 = QVHZA-*-06**/45**
4 = QVKZA-*-10**/65**
5 = QVKZA-*-10**/90**





17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC

17.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

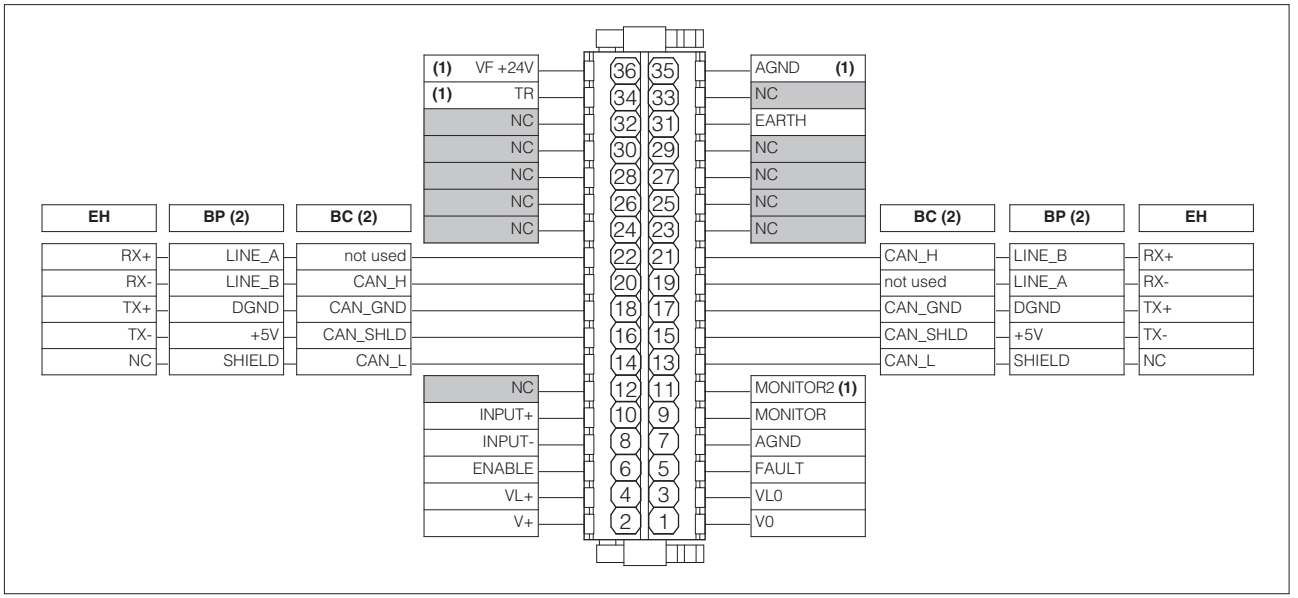
17.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.7 Remote Pressure Transducer Input signal (TR) - only for **/W** option

Analog pressure transducers can be directly connected to the driver.
Analog input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

18 TERMINAL BOARD OVERVIEW



(1) Connections available only for /W option
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

19 ELECTRONIC CONNECTIONS

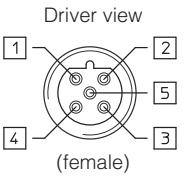
19.1 Main connections signals

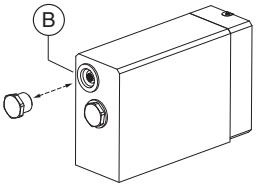
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to AGND Default is: ±5 VDC	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**MONITOR2**	2nd monitor output signal: ±5 VDC maximum range, referred to AGND **(1)** Default is: 0 ÷ 5 VDC	Output - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) 2nd monitor output signal is available only for /W option

19.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





19.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

19.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

19.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

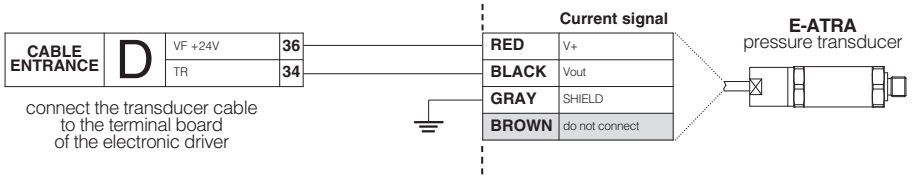
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19.6 Remote pressure transducer connector - only for /W option

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	Voltage	Current
D	34	**TR**	Signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

for **/W** option

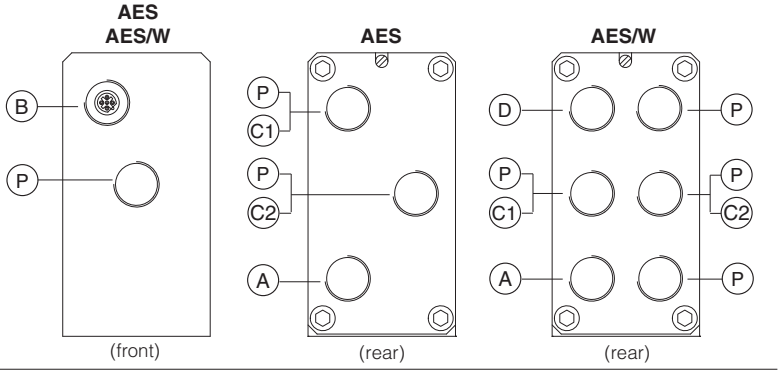


20 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

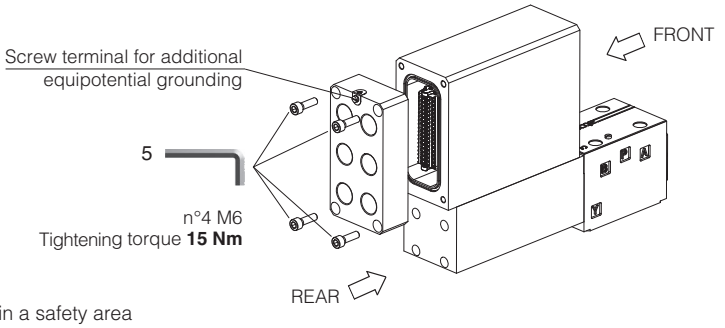
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (D) pressure transducer (only /W option)
- (P) Threaded plug



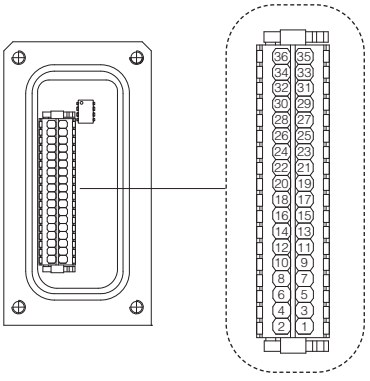
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

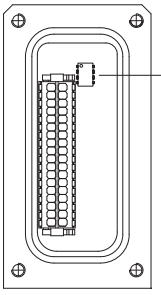


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 18

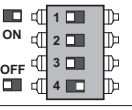


Fieldbus terminator only for BC and BP executions **(1)**



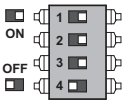
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

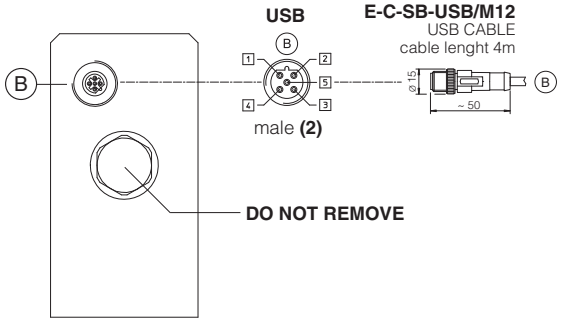


BP - PROFIBUS DP setting:

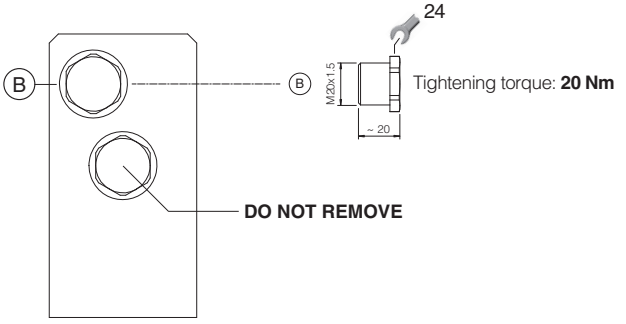
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

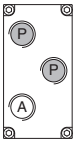
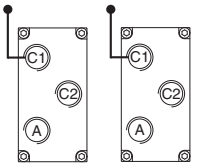
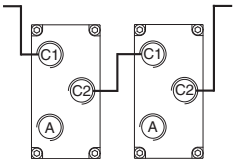


METALLIC PROTECTION CAP - supplied with the valves

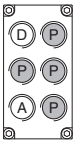
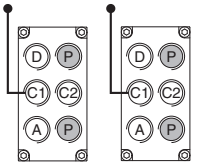
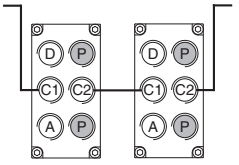


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

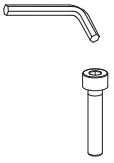
20.1 Cable glands and threaded plug for AES - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

20.2 Cable glands and threaded plug for AES with /W option - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D A	none	none		Cable entrance P are factory plugged Cable entrance A, D are open for costumers
BC, BP, EH "via stub" connection	3	D C1 A	1	C2		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers
BC, BP, EH "daisy chain" connection	4	D C1 - C2 A	none	none		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers

21 FASTENING BOLTS AND SEALS

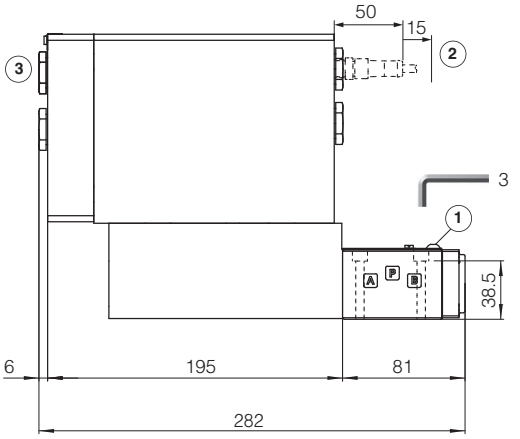
	QVHZA	QVKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

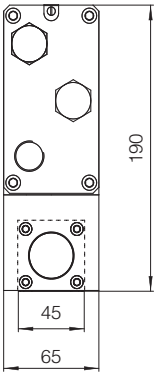
22 INSTALLATION DIMENSIONS [mm]

QVHZA-AES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZA-AES	8,2

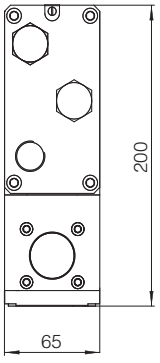


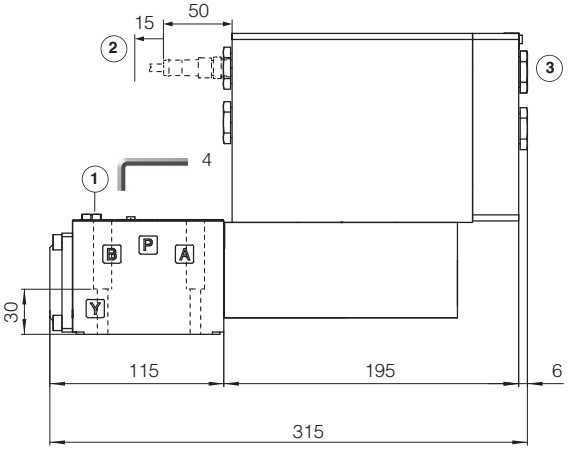


QVKZA-AES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZA-AES	10





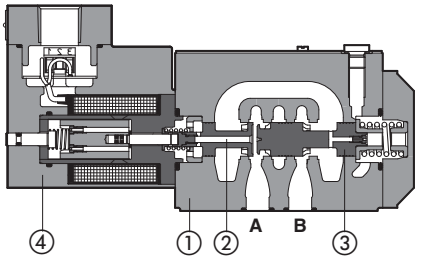
(1) = Air bleed off
(2) = Space to remove the USB connector
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

23 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		

Ex-proof proportional flow valves

pressure compensated, without transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



① valve body
② throttle
③ compensator
④ proportional solenoid

QVKZA-A-10

QVHZA-A, QVKZA-A

Ex-proof proportional flow valves, without position transducer for pressure compensated flow regulations.
They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

QVHZA:
Size: **06** - ISO 4401
Max flow: **45 l/min**
Max pressure: **210 bar**

QVKZA:
Size: **10** - ISO 4401
Max flow: **90 l/min**
Max pressure: **210 bar**

1 MODEL CODE

QVKZA	/	*	-	A	-	10	/	90	/	M	/	*	/	*	*	/	*

QVKZA
Ex-proof pressure compensated proportional flow valves, direct
QVHZA = size 06
QVKZA = size 10

Certification type:
Multicertification
ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

Valve size ISO 4401:
06 = size 06 **10** = size 10

Max regulated flow:

QVHZA	QVKZA
3 = 3,5 l/min	**65** = 65 l/min
12 = 12 l/min	**90** = 90 l/min
18 = 18 l/min	
36 = 35 l/min	
45 = 45 l/min	

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
D = quick venting of port B
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap

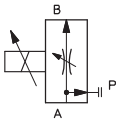
Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Series number

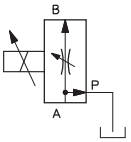
Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /DO, /DWP, /DOWP, /OWP
(4) Approved only for the Italian market

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines

The port T must be always not connected (blocked)

For application examples of 2 and 3 way connections, see section

3 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		QVHZA					QVKZA	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating Δp	[bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A	[l/min]	40			50	55	70	100
Max pressure	[bar]	210						
Response time **(1)**	[ms]	≤ 35					≤ 50	
Hysteresis		≤ 5 [% of the regulated max flow]						
Linearity		≤ 3 [% of the regulated max flow]						
Repeatability		≤ 1 [% of the regulated max flow]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3
(1) 0 ÷100 % step signal

6 ELECTRICAL CHARACTERISTICS

Max. power	35W	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Protection degree with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 180 bar
-max fluid temperature = 50°C

8 CERTIFICATION DATA

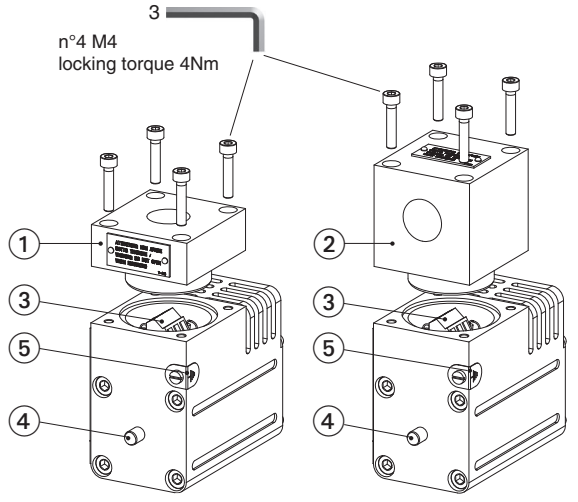
Valve type	QVHZA, QVKZA		QVHZA**/M**, QVHZA**/M**	QVHZA**/UL**, QVHZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

9 EX PROOF SOLENOIDS WIRING

Multicertification



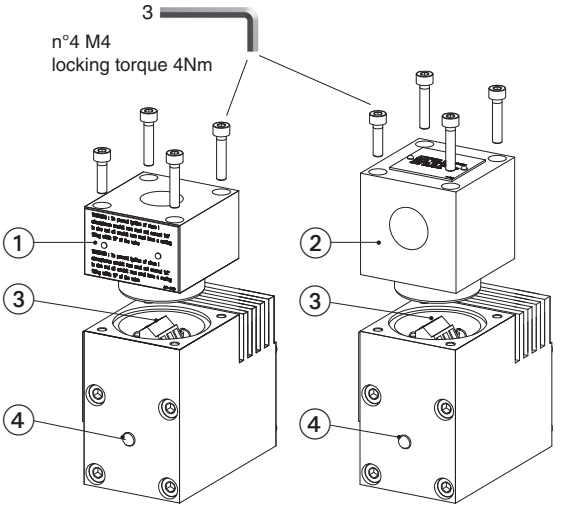
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

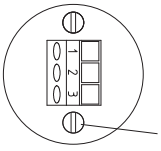
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override



⚠ **Pay attention to respect the polarity**

1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

11 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX600**

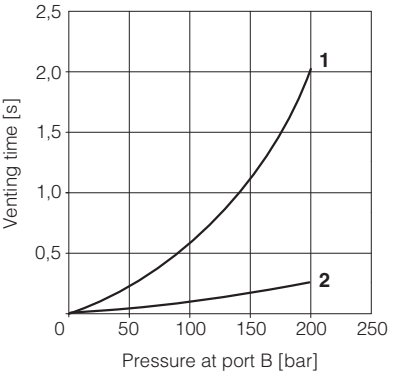
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 OPTIONS

D = This option provides a quick venting of the use port B when the valve is closed or de-energized. The valve must be connected in 3 way, with P port connected to tank. When the proportional throttle is fully closed, the valve's port B is internally connected to port P (tank), permitting a quickly decompression of the pressure in the use line.
In the diagram aside are represented the venting times of **QVHZA** and **QVKZA** option **/D** respect to standard versions:
1 = standard versions
2 = option /D

O = Horizontal cable entrance , to be selected in case of limited verical space.

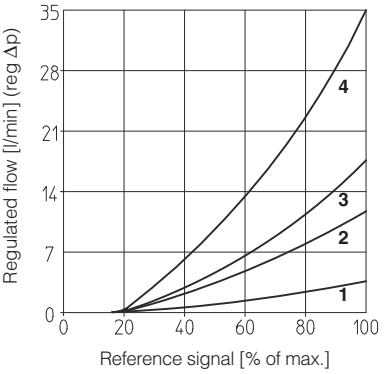
WP = Manual override protected by metallic cap.

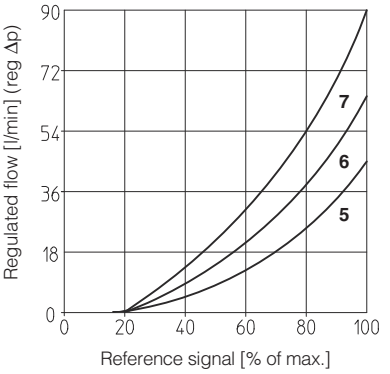


13 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

13.1 Regulation diagrams

1 = QVHZA-*-06**/3**
2 = QVHZA-*-06**/12**
3 = QVHZA-*-06**/18**
4 = QVHZA-*-06**/36**
5 = QVHZA-*-06**/45**
6 = QVKZA-*-10**/65**
7 = QVKZA-*-10**/90**

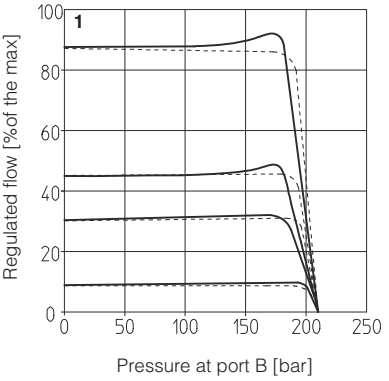


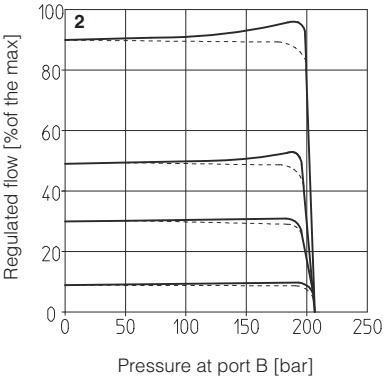


13.2 Regulated flow/outlet pressure diagrams
with inlet pressure = 210 bar

1 = QVHZA
2 = QVKZA

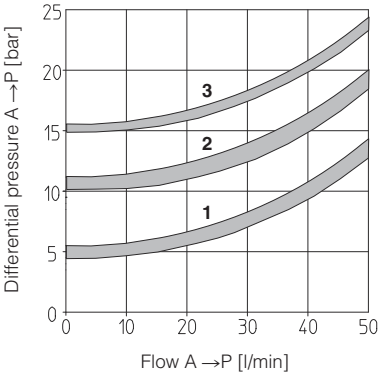
Dotted line for 3-way versions

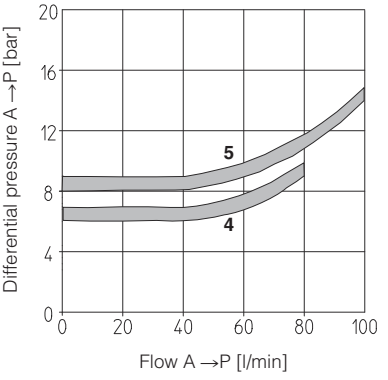




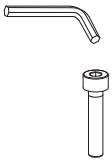
13.3 Flow A → P/Δp diagrams
3-way configuration

1 = QVHZA-*-06**/3**
QVHZA-*-06**/12**
2 = QVHZA-*-06**/18**
QVHZA-*-06**/36**
3 = QVHZA-*-06**/45**
4 = QVKZA-*-10**/65**
5 = QVKZA-*-10**/90**





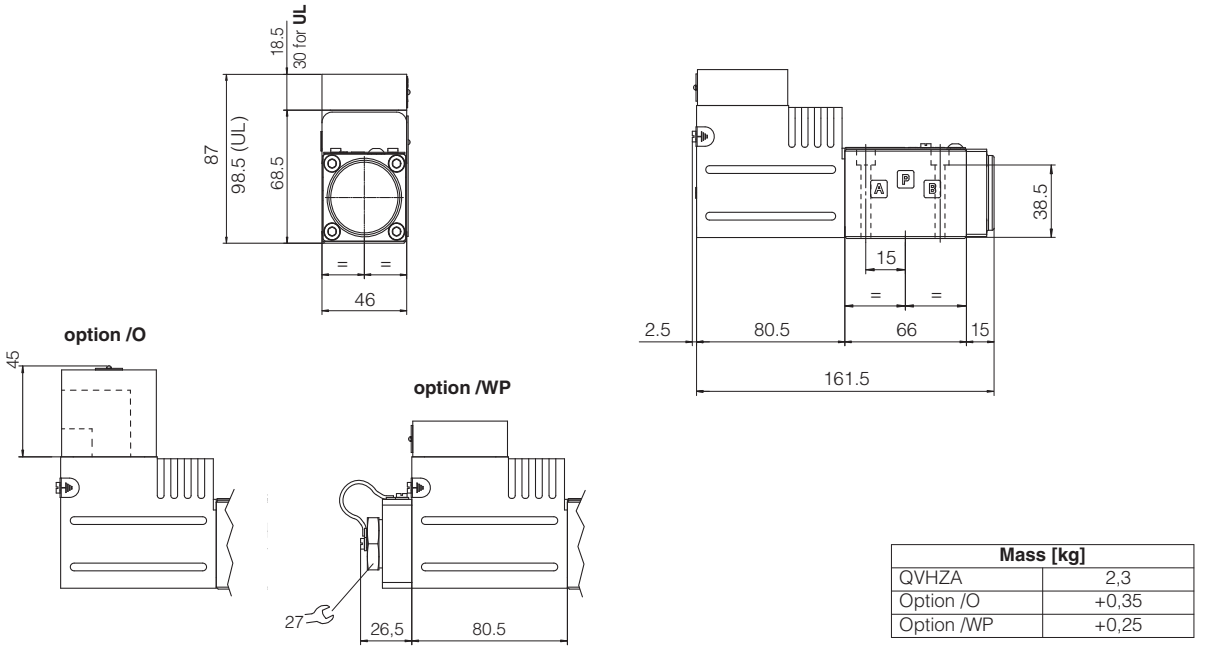
14 FASTENING BOLTS AND SEALS

	QVHZA	QVKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

15 INSTALLATION DIMENSIONS [mm]

QVHZA-A

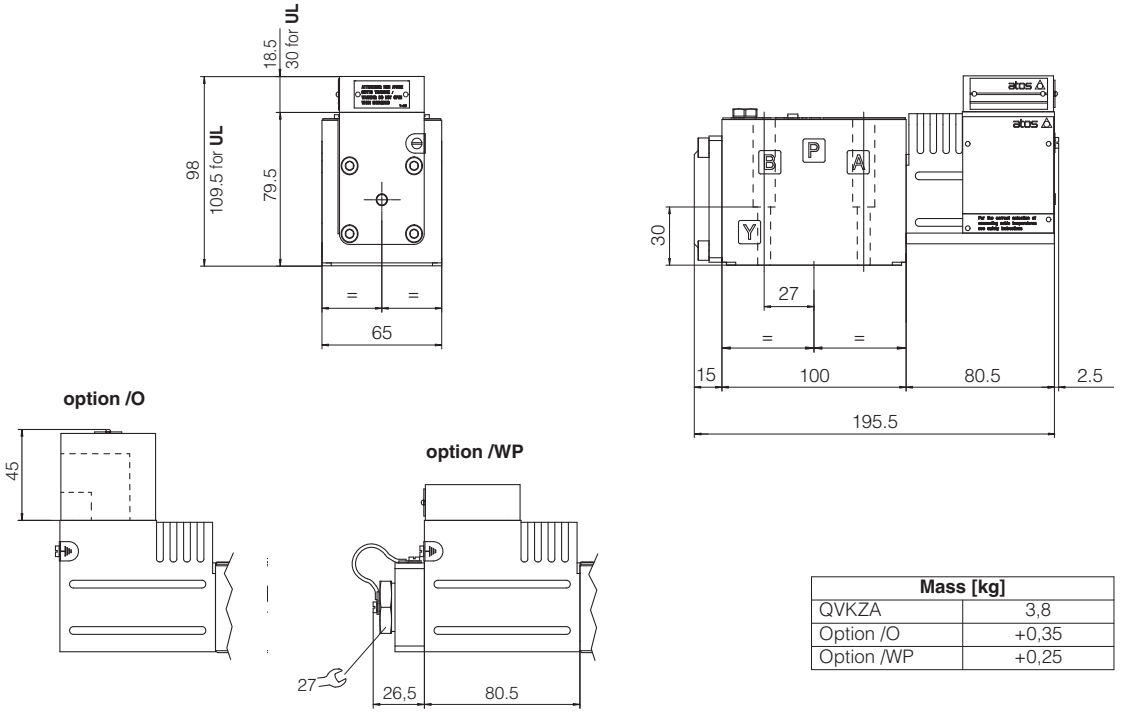
ISO 4401: 2005 (see tab. P005)
Mounting surface: 4401-03-02-0-05



Mass [kg]	
QVHZA	2,3
Option /O	+0,35
Option /WP	+0,25

QVKZA-A

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)



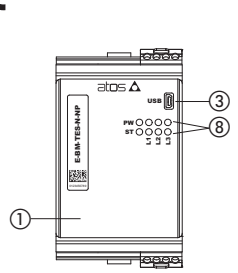
Mass [kg]	
QVKZA	3,8
Option /O	+0,35
Option /WP	+0,25

16 RELATED DOCUMENTATION

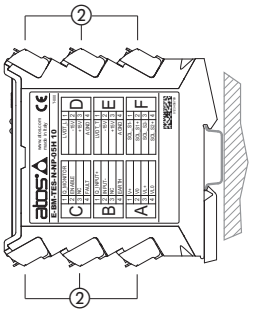
X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

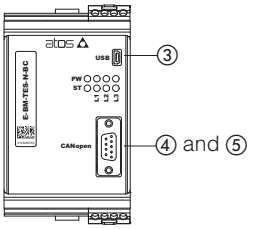
Digital E-BM-TES/LES drivers

DIN-rail format, for proportional valves with one or two LVDT transducers

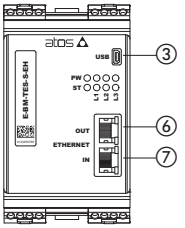


E-BM-TES-N- **NP** Not Present

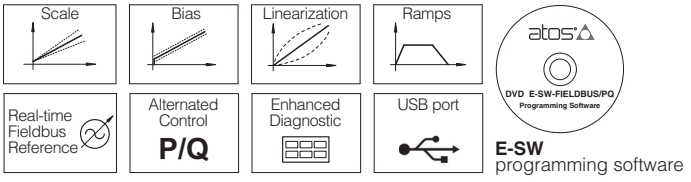




E-BM-TES-N- **BC** CANopen
BP PROFIBUS DP



E-BM-TES-S- **EH** EtherCAT
EW POWERLINK
EI EtherNet/IP
EP PROFINET RT/IRT



E-SW programming software

Connectors ② included

E-BM-TES/LES

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.
TES execution controls direct operated directional/flow valves with one LVDT transducer.
LES execution controls pilot operated directional valves with two LVDT transducers.
Option S adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation (see section 4).
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- up to 9 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 6.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM	- TES -	N	- NP	- 01H	* / *	* / *

E-BM: Off-board electronic driver in DIN rail format

TES = digital full driver, for valves with one LVDT transducer
LES = digital full driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none
S = closed loop pressure/force (see tech table **GS002**)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TES**)

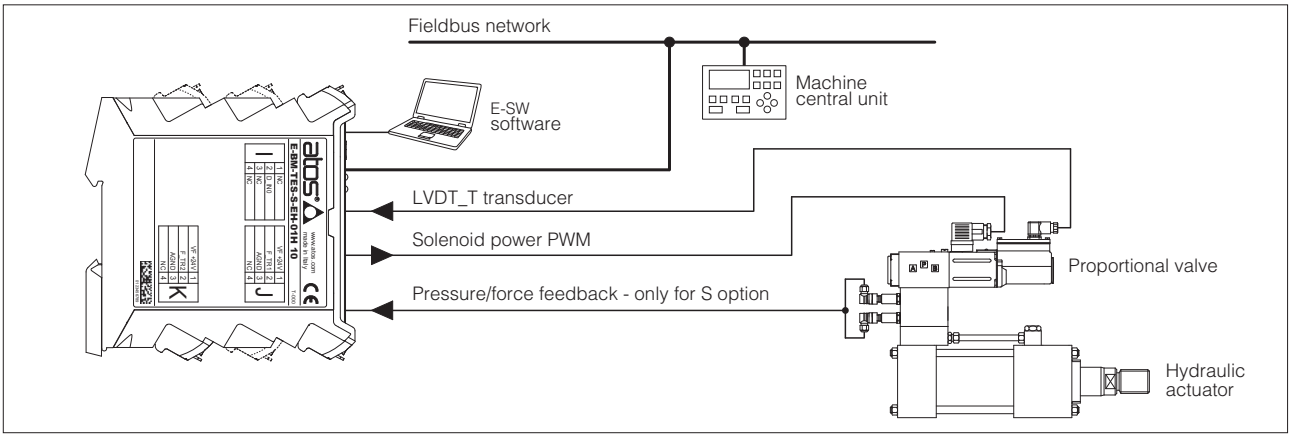
- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TES-N**)

Options, see section 6 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for remote transducers (only for option **S**) and LVDT transducers (only for option **A**)
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 VDC)

Series number

Set code (see section 7)

2 BLOCK DIAGRAM EXAMPLE



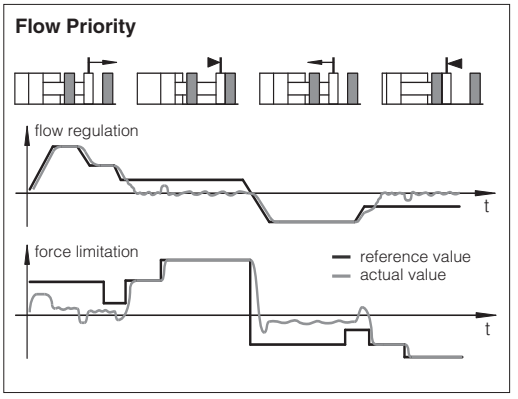
3 VALVES RANGE

Valves	Directional			Flow	Directional	Cartridge
Standard Data sheet	**DHZO-T, DKZOR-T** F165	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F1412	**DPZO-L** F175	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Data sheet	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	-
Driver model	**E-BM-TEB**				**E-BM-LEB**	

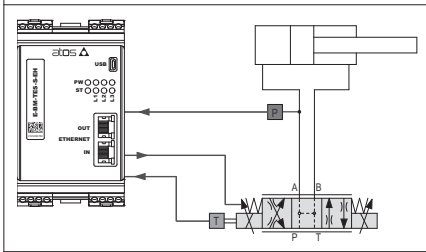
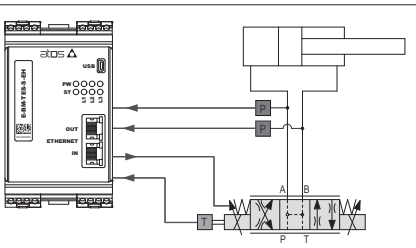
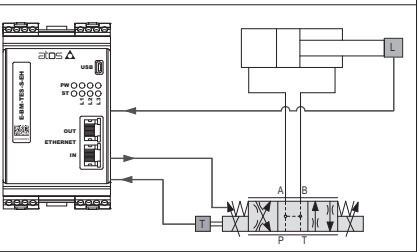
Option S not available

4 ALTERNATED P/Q CONTROL - only for **S** option

S option on digital drivers adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation.
The alternated P/Q control operates according to the two electronic reference signals by a dedicated algorithm that automatically selects which control will be active time by time.
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations.
Flow regulation is active when the actual system pressure/force is lower than the relevant input reference signal - the valve works normally to regulate the flow by controlling in closed-loop the spool/poppet position through the integral LVDT transducer.
Pressure/force control is activated when the actual system pressure/force, measured by remote transducers, grows up to the relevant input reference signal - the driver reduces the valve's flow regulation in order to keep steady the system pressure/force.
If the pressure/force tends to decrease under its input reference signal, the flow control returns active.
The dynamic response of pressure/force control can be adapted to different system's characteristics, by setting the internal PID parameters using Atos PC software.
Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.



Alternated control configurations - software selectable

SP	SF	SL
		
one remote pressure transducer has to be installed on the actuator's port to be controlled	two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve's spool transducer P pressure transducer L load cell

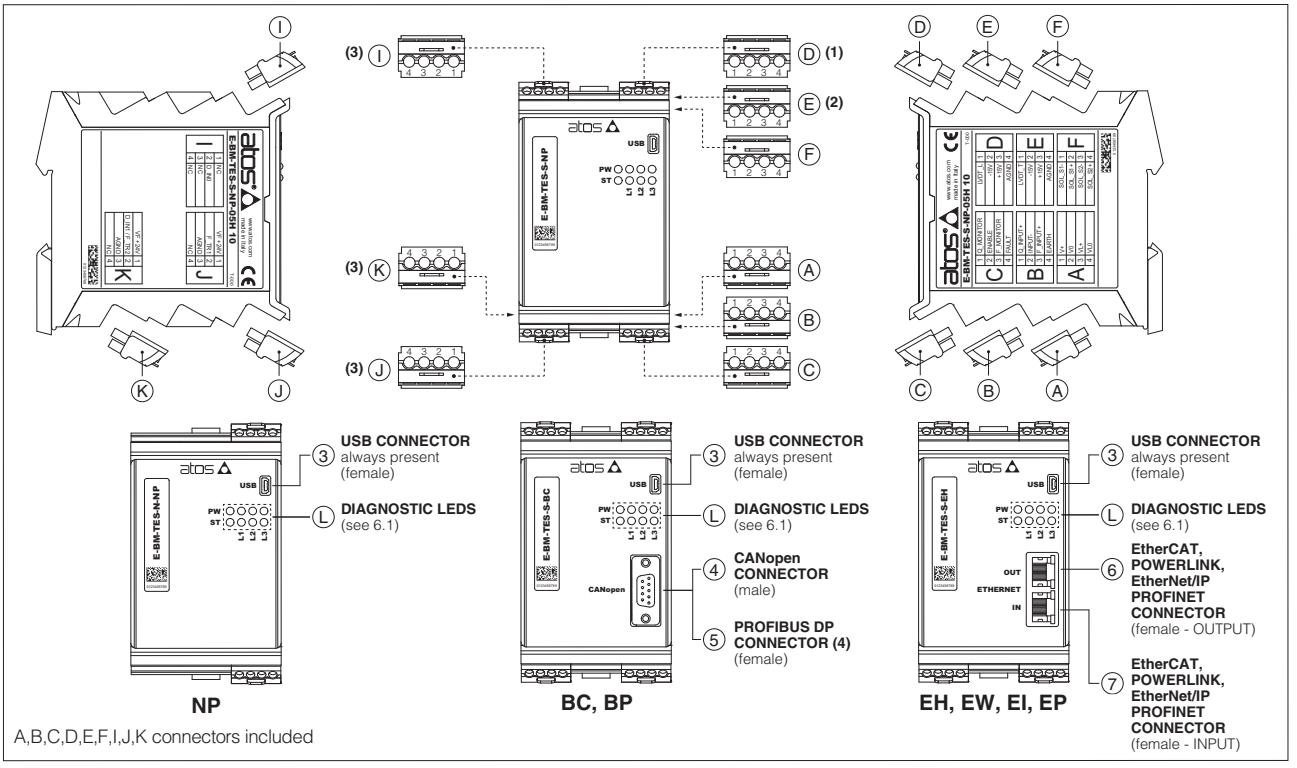
SP – flow/pressure control
Adds pressure control to standard flow control and permits to limit the max force in one direction controlling in closed loop the pressure acting on one side of the hydraulic actuator. A single pressure transducer has to be installed on hydraulic line to be controlled.
SF – flow/force control
Adds force control to standard flow control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.
SL – flow/force control
Adds force control to standard flow control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.
General Notes:
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **GS002**
- Atos technical service is available for additional evaluations related to specific applications usage

5 MAIN CHARACTERISTICS

Power supplies (see 8.1, 8.2)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Current supplied to solenoids	IMAX = 3.0 A for standard driver IMAX = 2.5 A for ex-proof driver (**/A option**)			
Analog input signals (see 8.3, 8.4)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs (see 8.5, 8.6)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input (see 8.7) Digital inputs (see 8.11)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output (see 8.8)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Pressure/Force transducers power supply (only for S option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +50 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 400 g			
Additional characteristics	8 leds for diagnostic; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet			
Max conductor size (see 12)	2,5 mm²			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

6 CONNECTIONS AND LEDS

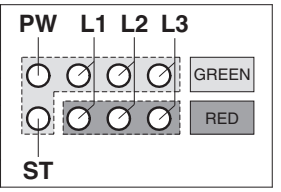


(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I , J and K connectors are available only for TES-S and LES-S
(4) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector:
DG909MF1 - the connector will be oriented upwards
DG909MF3 - the connector will be oriented downwards

6.1 Diagnostic LEDs (L)

Eight leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET
L1	VALVE STATUS			LINK/ACT			
L2	NETWORK STATUS			NETWORK STATUS			
L3	SOLENOID STATUS			LINK/ACT			
PW	OFF = Power supply OFF		ON = Power supply ON				
ST	OFF = Fault present		ON = No fault				

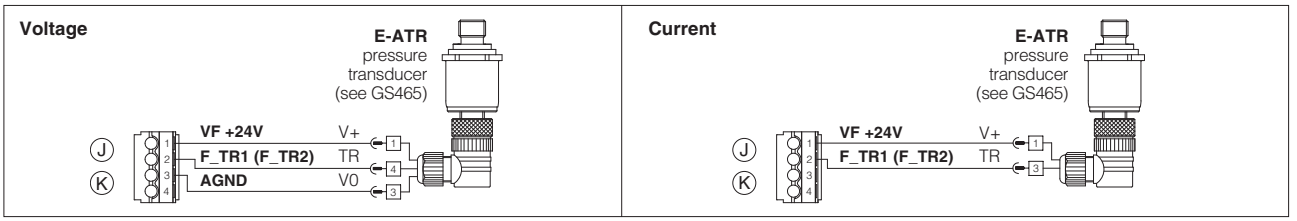


6.2 Connectors - 4 pin

CONNECTOR	PIN	ALTERNATED P/Q CONTROL **N** none / **S** pressure/force		TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**		Power supply 24 VDC (see 8.1)	Input - power supply
	A2	**V0**		Power supply 0 VDC (see 8.1)	Gnd - power supply
	A3	**VL+**		Power supply 24 VDC for driver's logic and communication (see 8.2)	Input - power supply
	A4	**VL0**		Power supply 0 VDC for driver's logic and communication (see 8.2)	Gnd - power supply
B	B1	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.3)	Input - analog signal **Software selectable**
	B2	**INPUT-**		Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	B3	**NC**		Do not connect	
			F_INPUT+	Pressure/Force reference input signal ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.4)	Input - analog signal **Software selectable**
	B4	**EARTH**		Connect to system ground	
C	C1	**Q_MONITOR**		Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND. Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.5)	Output - analog signal **Software selectable**
	C2	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the controller, referred to VL0 (see 8.7)	Input - on/off signal
	C3	**NC**		Do not connect	
			F_MONITOR	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.6)	Output - analog signal **Software selectable**
	C4	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 8.8)	Output - on/off signal
D (1)	D1	**LVDT_L**		Main stage valve position transducer signal (see 8.9)	Input - analog signal
	D2	**-15V**		Main stage valve position transducer power supply -15V	Output power supply
	D3	**+15V**		Main stage valve position transducer power supply +15V	Output power supply
	D4	**AGND**		Common gnd for transducer power and monitor outputs	Common gnd
E (2)	E1	**LVDT_T**		Direct valve or pilot valve position transducer signal (see 8.9)	Input - analog signal
	E2	**-15V**		Direct valve or pilot valve position transducer power supply -15V	Output power supply
	E3	**+15V**		Direct valve or pilot valve position transducer power supply +15V	Output power supply
	E4	**AGND**		Common gnd for transducer power and monitor outputs	Common gnd
F	F1	**SOL_S1-**		Negative current to solenoid S1	Output - power PWM
	F2	**SOL_S1+**		Positive current to solenoid S1	Output - power PWM
	F3	**SOL_S2-**		Negative current to solenoid S2	Output - power PWM
	F4	**SOL_S2+**		Positive current to solenoid S2	Output - power PWM
I	I1		**NC**	Do not connect	
	I2		**D_IN0**	NP execution: multiple pressure/force PID selection, referred to VL0 (see 8.11) Fieldbus execution: general purpose digital input 0 ÷ 24VDC, referred to VL0 (see 8.11)	Input - on/off signal
	I3		**NC**	Do not connect	
	I4		**NC**	Do not connect	
J	J1		**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	J2		**F_TR1**	1st signal pressure/force transducer: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /C option (see 8.10)	Input - analog signal **Software selectable**
	J3		**AGND**	Common gnd for transducer power and signals	Common gnd
	J4		**NC**	Do not connect	
K	K1		**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	K2		**F_TR2**	2nd signal pressure transducer (only for SF): ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /C option (see 8.10)	Input - analog signal **Software selectable**
			D_IN1	NP execution: multiple pressure/force PID selection (only for SP and SL), referred to VL0 (see 8.11) Fieldbus execution: general purpose digital input 0 ÷ 24VDC, referred to VL0 (see 8.11)	Input - on/off signal
	K3		**AGND**	Common gnd for transducer power and signals	Common gnd
	K4		**NC**	Do not connect	

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*

6.3 Pressure/force transducers connection - example - only for **S** option



6.4 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥ ⑦ **EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

(1) shield connection on connector's housing is recommended

7 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

8 SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **F003** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

8.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

8.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

8.3 Flow reference input signals (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve's spool position.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

8.4 Pressure or force reference input signal (F_INPUT+) - only for **S** option

Functionality of pressure or force input reference signal (pin B3), is used as reference for the driver pressure/force closed loop, see section 4 .
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

8.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

8.6 Pressure or force monitor output signal (F_MONITOR) - only for **S** option

The driver generates an analog output signal (C3) proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA

8.7 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as digital input by software selection.

8.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the status of the Enable input signal.
Fault output signal can be used as digital output by software selection.

8.9 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 VDC supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

8.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - only for **S** option

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **GS002**).

8.11 Multiple PID selection or digital input signals (D_IN0 and D_IN1) - only for **S** option

Two on-off input signals are available on the connectors I and K.
For NP executions pin I2 and/or pin K2 are used to select one of the four pressure (force) PID parameters setting, stored into the driver. Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.). Supply a 24 VDC or a 0 VDC on pin I2 and/or pin K2, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.
For fieldbus executions pin I2 and/or K2 can be used as generic purpose on-off input signals.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
I2	0	24 VDC	0	24 VDC
K2	0	0	24 VDC	24 VDC

8.12 Possible combined options: /AC, **/AI**, **/ACI**, **/CI** - combined options **/CI** is available only for E-BM-TES/LES-S.

9 VALVE SETTINGS AND PROGRAMMING TOOLS

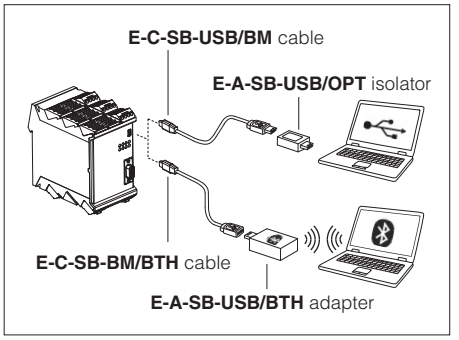
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

10 MAIN SOFTWARE PARAMETER SETTINGS

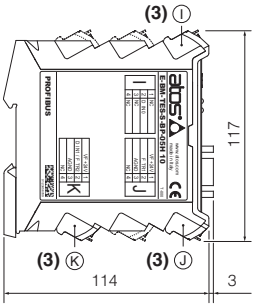
For basic information about main setting parameters by E-SW programming software, see tech table **GS003**

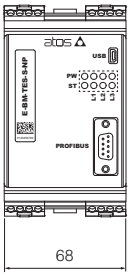
For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

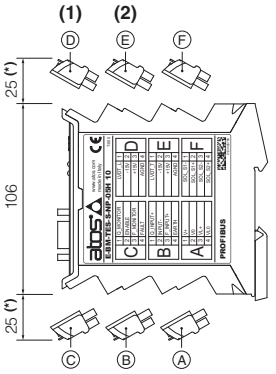
E-MAN-BM-LES - user manual for **E-BM-TES-N** and **E-BM-LES-N** digital drivers
E-MAN-BM-LES-S - user manual for **E-BM-TES-S** and **E-BM-LES-S** digital drivers

11 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors







DIN rail dimensions

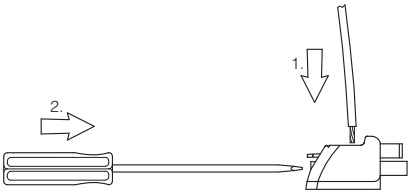
A,B,C,D,E,F,I,J,K connectors included

(*) Space to remove the connectors

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I , J and K connectors are available only for TES-S and LES-S

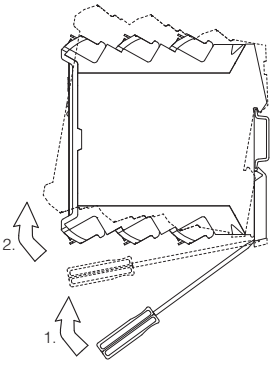
12 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



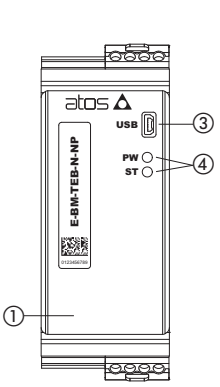
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

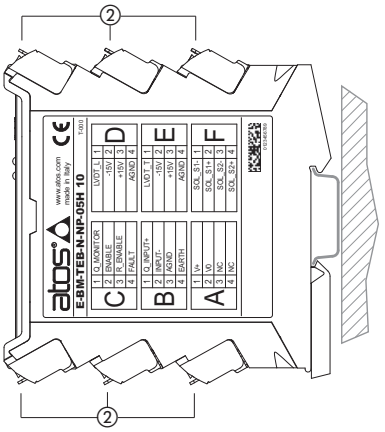
Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(e.g. connector A can not be inserted into connector slot of B,C,D,E,F,I,J,K)

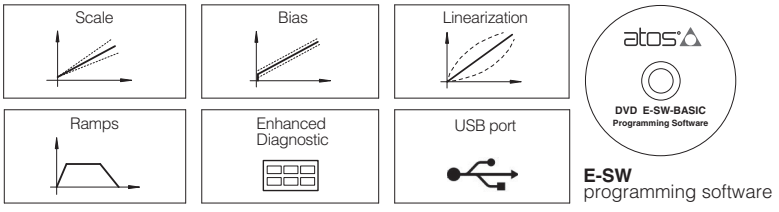
Digital E-BM-TEB/LEB drivers

DIN-rail format, for proportional valves with one or two LVDT transducers



E-BM- **TEB** -N-NP





E-SW
programming software

Connectors ② included

E-BM-TEB/LEB

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.
TEB execution controls direct operated directional/flow valves with one LVDT transducer.
LEB execution controls pilot operated directional valves with two LVDT transducers.
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 6 fast plug-in connectors ②
- Mini USB port ③ always present
- 2 leds for diagnostics ④ (see 5.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM	-	**TEB**	-	**N**	-	**NP**	-	**01H**	*	/	*	*	/	*

E-BM — Off-board electronic driver in DIN rail format

TEB = digital basic driver, for valves with one LVDT transducer
LEB = digital basic driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none

Fieldbus interface, USB port always present:
NP = Not Present

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TEB**)

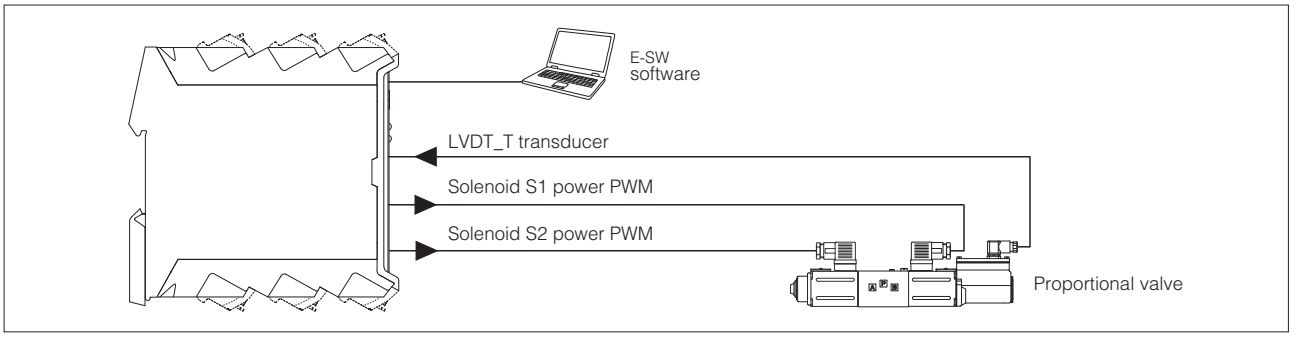
- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TEB**)

Options, see section 5 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for LVDT transducers only in combination with option A
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 VDC)

Series number

Set code (see section 6)

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

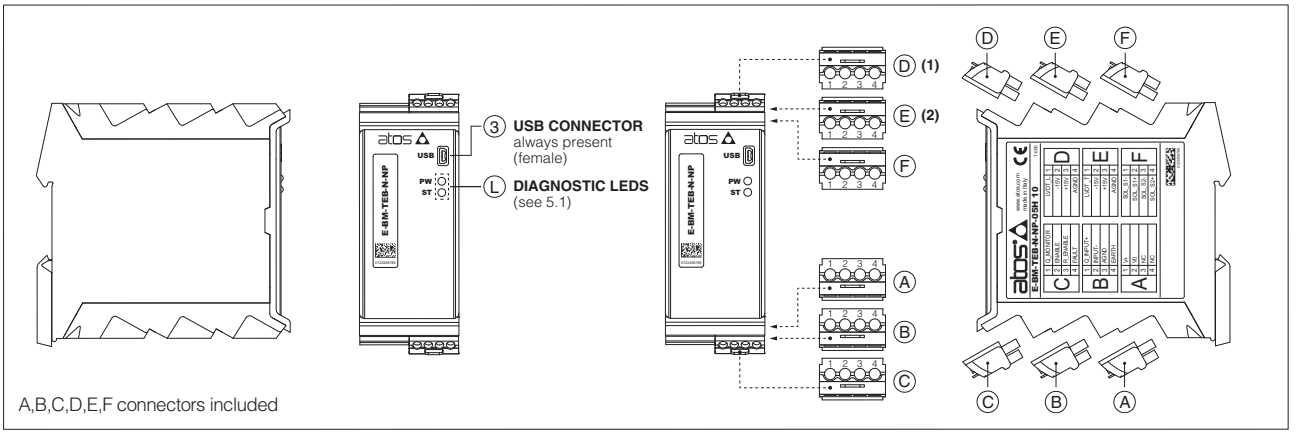
Valves	Directional			Flow	Directional	Cartridge
Standard Data sheet	**DHZO-T, DKZOR-T** F165	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F412	**DPZO-L** F175	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Data sheet	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	-
Driver model	**E-BM-TEB**				**E-BM-LEB**	

4 MAIN CHARACTERISTICS

Power supply (see 7.1)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	50 W
Current supplied to solenoids	IMAX = 3.0 A for standard driver IMAX = 2.5 A for ex-proof driver (**/A option**)
Analog input signal (see 7.2)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Monitor output (see 7.3)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance
Enable input (see 7.4)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ
Repeat enable output (see 7.5) Fault output (see 7.6)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)
Mass	Approx. 400 g
Additional characteristics	2 leds for diagnostic; protection against reverse polarity of power supply
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	USB Atos ASCII coding
Communication physical layer	USB 2.0 + USB OTG not insulated
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet
Max conductor size (see 11)	2,5 mm²

Note: a maximum time of 400 ms have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

5 CONNECTIONS AND LEDS

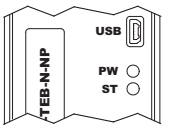


(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

5.1 Diagnostic LEDs (L)

Two leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LEDS	DESCRIPTION	
PW	OFF = Power supply OFF	ON = Power supply ON
ST	OFF = Fault present	ON = No fault



5.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNALS	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 7.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 7.1)	Gnd - power supply
	A3	**NC**	Do not connect	
	A4	**NC**	Do not connect	
B	B1	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 7.2)	Input - analog signal **Software selectable**
	B2	**INPUT-**	Negative reference input signal for Q_INPUT+	Input - analog signal
	B3	**AGND**	Common gnd for monitor output	Common gnd
	B4	**EARTH**	Connect to system ground	
C	C1	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 7.3)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the controller, referred to V0 (see 7.4)	Input - on/off signal
	C3	**R_ENABLE**	Repeat enable, output repeater signal of enable input, referred to V0 (see 7.5)	Output - on/off signal
	C4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to V0 (see 7.6)	Output - on/off signal
D (1)	D1	**LVDT_L**	Main stage valve position transducer signal (see 7.7)	Input - analog signal
	D2	**-15V**	Main stage valve position transducer power supply -15V	Output power supply
	D3	**+15V**	Main stage valve position transducer power supply +15V	Output power supply
	D4	**AGND**	Common gnd for transducer power	Common gnd
E (2)	E1	**LVDT_T**	Direct valve or pilot valve position transducer signal (see 7.7)	Input - analog signal
	E2	**-15V**	Direct valve or pilot valve stage position transducer power supply -15V	Output power supply
	E3	**+15V**	Direct valve or pilot valve tage position transducer power supply +15V	Output power supply
	E4	**AGND**	Common gnd for transducer power	Common gnd
F	F1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	F2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	F3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	F4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM

(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

6 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

7 SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **F003** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

7.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

7.2 Flow reference input signal (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve's spool position.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

7.3 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

7.4 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

7.5 Repeat enable output signal (R_ENABLE)

Repeat enable (pin C3) is used as output repeater signal of enable input signal (see 7.4).

7.6 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the status of the Enable input signal.

7.7 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 VDC supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

7.8 Possible combined options: /AC, /AI, /ACI

8 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
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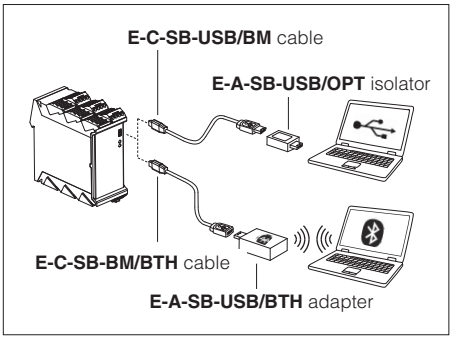
E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

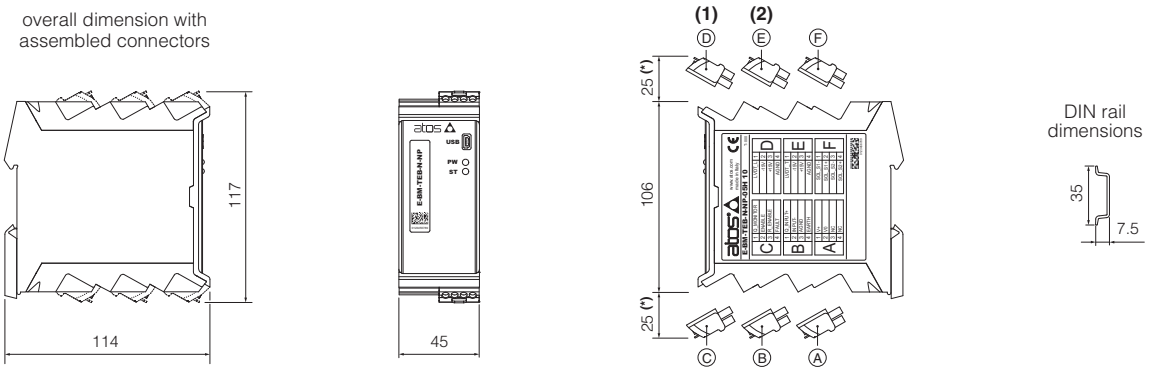
9 MAIN SOFTWARE PARAMETER SETTINGS

For basic information about main setting parameters by E-SW programming software, see tech table **GS003**

For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-LEB - user manual for **E-BM-TEB** and **E-BM-LEB** digital drivers

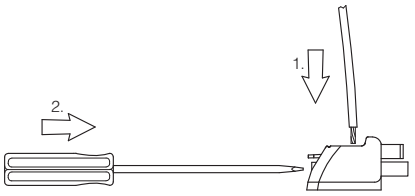
10 OVERALL DIMENSIONS [mm]



(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

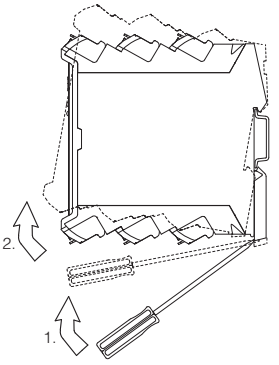
11 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



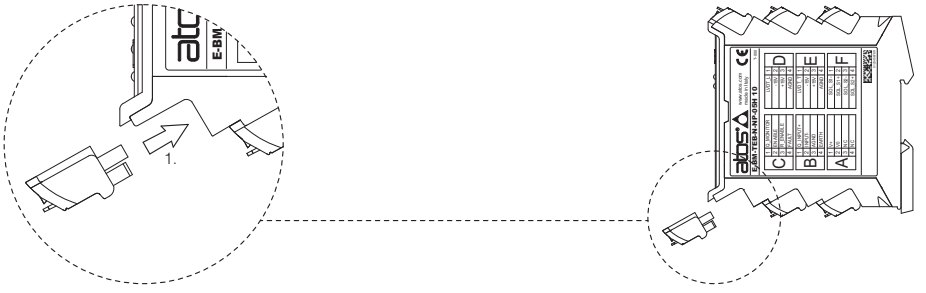
Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



To extract the connectors:
1. push lever
2. pull connector

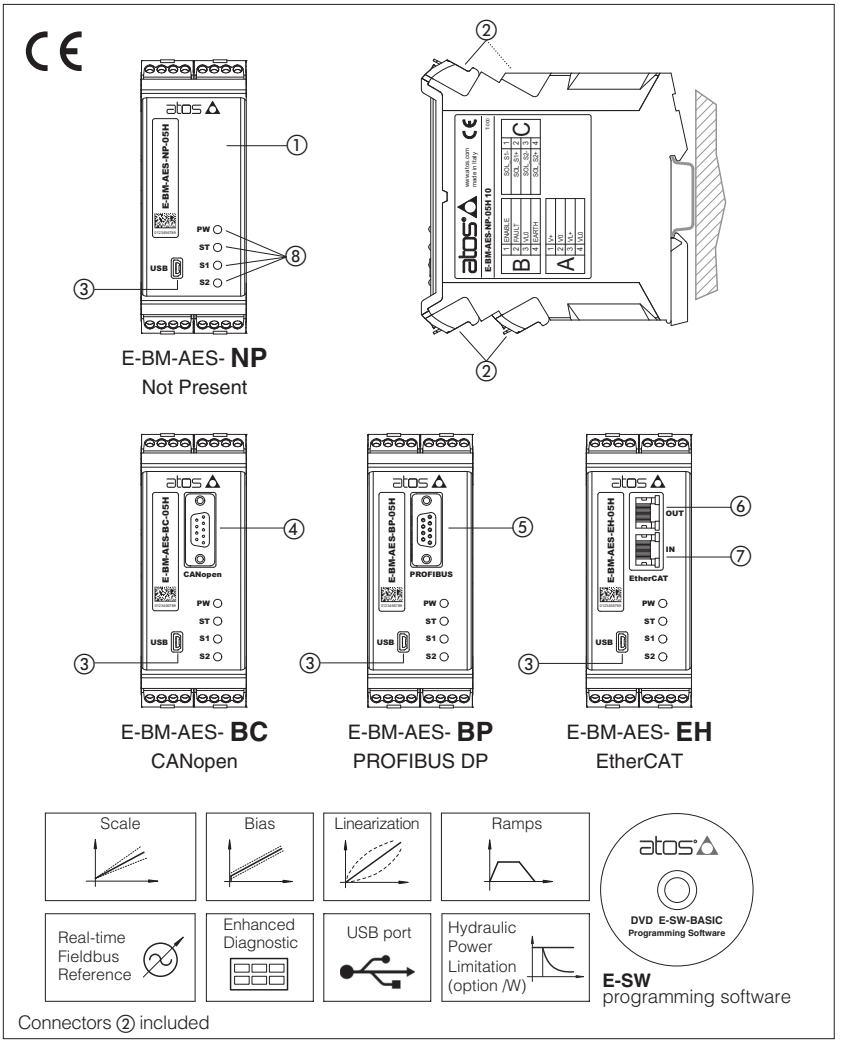
To insert the connectors:
1. push the connector in its slot



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(e.g. connector A can not be inserted into connector slot of B,C,D,E,F)

Digital electronic E-BM-AES drivers

DIN-rail format, for proportional valves without transducer



E-BM-AES

Digital drivers ① control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.
E-BM-AES operate direct and pilot operated proportional valves ZO-A without transducer.
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 7 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 CANopen ④ and PROFIBUS DP ⑤ communication connector
- RJ45 EtherCAT communication connectors ⑥ output and ⑦ input
- 4 leds for diagnostics ⑧ (see 4.1)
- ±5 VDC output supply for external reference potentiometer
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither, PID gains
- Linearization function for hydraulic regulation
- /W option max power limitation function
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

Fieldbus Features:

- Valve direct communication with machine control unit for digital reference, diagnostics and settings
- Fieldbus execution allow to operate the valves via fieldbus or via analog signals available on the connectors (see 4.2)

1 MODEL CODE

E-BM	-	**AES**	-	**NP**	-	**01H**	/	*	*	/	*

E-BM — Off-board electronic driver in DIN rail format

AES = digital full driver, for valves without transducer

Fieldbus interface - USB port always present**:**
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves

Options:
A= max current limitation for Ex-proof valves
C= current feedback 4 ÷ 20 mA for remote transducer, only in combination with option **W**
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input ±10 VDC)
W= power limitation function

Series number

Set code **(1)**

(1) set code identifies the corrispondence between the driver and the relevant valve

2 VALVES RANGE

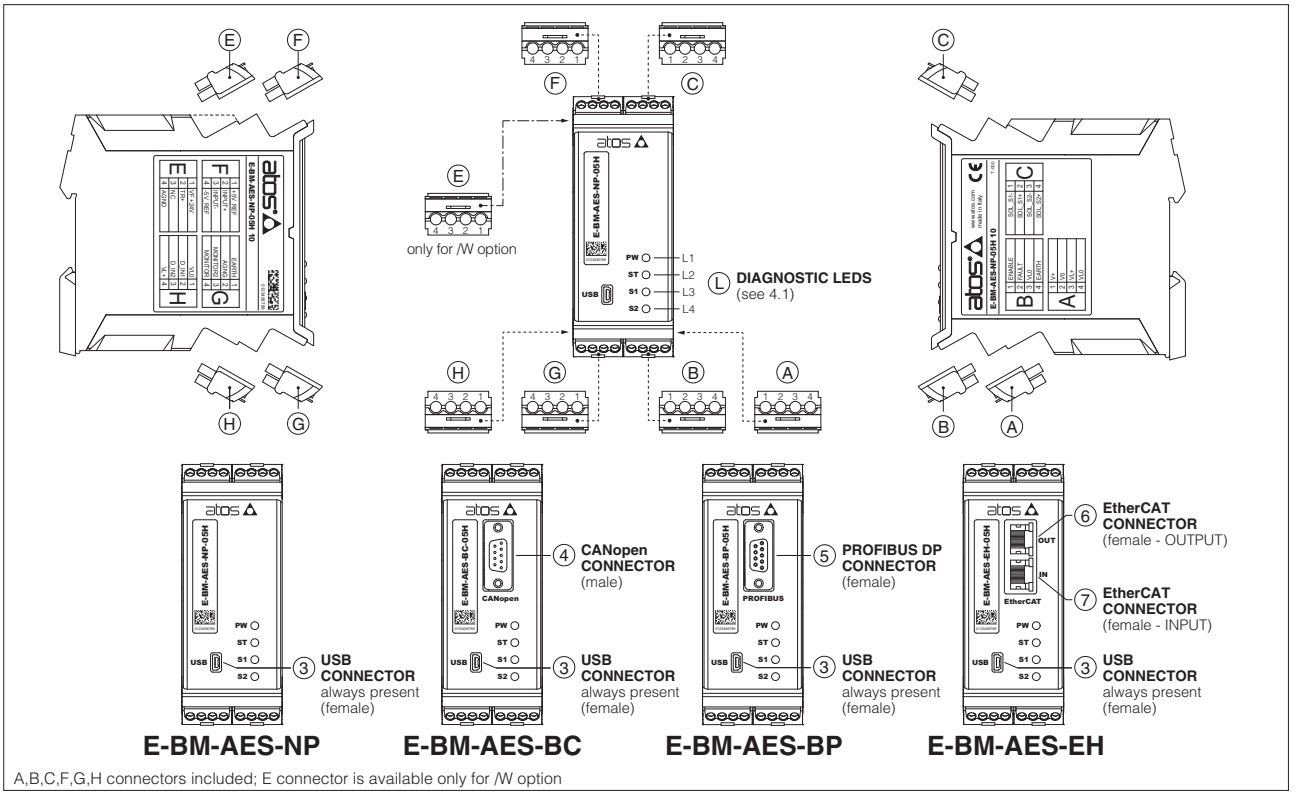
Valves	Pressure					Directional		Cartridge	Flow
Standard Data sheet	**RZMO** FS007, FS065	**RZGO** FS015, FS070	**AGMZO** FS035	**AGRCZO** FS050	**DHRZO** TF040	**DHZO, DKZOR** FS160	**DPZO** FS170	**LICZO, LIMZO, LIRZO** FS300	**QVHZO, QVKZOR** FS410
Ex-proof Data sheet	**RZMA** FX010	**RZGA** FX040	**AGMZA** FX010	**AGRCZA** FX040	**DHRZA** FX070	**DHZA, DKZA** FX100	**DPZA** FX200	**LICZA, LIMZA, LIRZA** FX300	**QVHZA, QVKZA** FX400
Driver model	**E-BM-AES**								

3 MAIN CHARACTERISTICS

Power supply (see 5.1, 5.2)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Current supplied to solenoids	IMAX = 2.7 A with +24 VDC power supply to drive standard proportional valves (3,2 Ω solenoid) IMAX = 2.5 A with +24 VDC power supply to drive ex-proof proportional valves (3,2 Ω solenoid) for **/A option**			
Analog input signals (see 5.3)	Voltage: maximum range ±10 VDC Input impedance: Ri > 50 kΩ Current: maximum range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output (see 5.4)	Voltage: maximum range ±5 VDC @ max 5 mA			
Enable input (see 5.5)	Range : 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Output supply (see 5.8)	±5 VDC @ max 10 mA : output supply for external potentiometer			
Fault output (see 5.6)	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 330 g			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply and solenoids			
Max conductor size (see 9)	2,5 mm²			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

4 CONNECTIONS AND LEDS

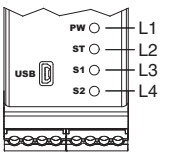


A,B,C,F,G,H connectors included; E connector is available only for /W option

4.1 Diagnostic LEDs (L)

Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

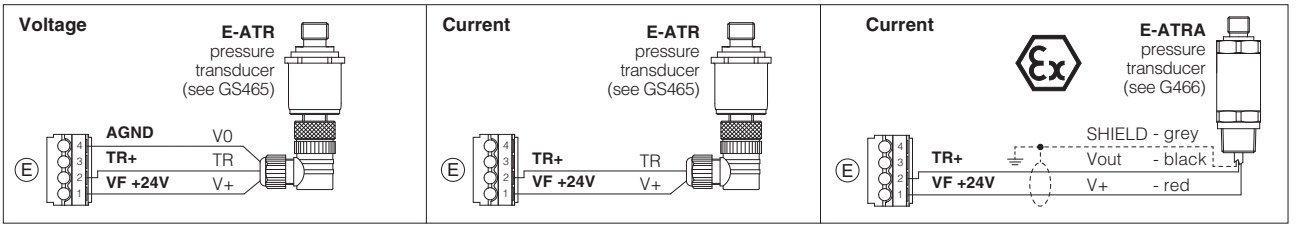
LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	PW	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	ST	OFF	Fault present
			ON	No fault
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF
			ON	PWM command ON



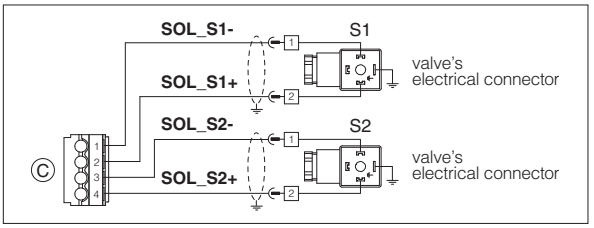
4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 5.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 5.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 VDC for driver's logic and communication (see 5.2)	Input - power supply
	A4	**VL0**	Power supply 0 VDC for driver's logic and communication (see 5.2)	Gnd - power supply
B	B1	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0 (see 5.5)	Input - on/off signal
	B2	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 5.6)	Output - on/off signal
	B3	**VL0**	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	**EARTH**	Connect to system ground	
C	C1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	C2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	C3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	C4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM
E available only for **/W** option	E1	**VF +24V**	Power supply +24 VDC	Output - power supply
	E2	**TR+**	Positive pressure transducer input signal: ±10 VDC / ±20 mA maximum range (see 5.7) Default are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Input - analog signal **Software selectable**
	E3	**NC**	Do not connect	
	E4	**AGND**	Common GND for transducer power, signals and external potentiometer	
F	F1	**+5V_REF**	External potentiometer power supply +5 VDC @ 10mA (see 5.8)	Output - power supply
	F2	**INPUT+**	Positive reference input signal: ±10 VDC / ±20 mA maximum range (see 5.3) Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	F3	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	F4	**-5V_REF**	External potentiometer power supply -5 VDC @ 10mA (see 5.8)	Output - power supply
G	G1	**EARTH**	Connect to system ground	
	G2	**AGND**	Analog ground for MONITOR and external potentiometer	Gnd - analog signal
	G3	**MONITOR2**	Only for /W option, 2nd monitor output signal: ±5 VDC maximum range (see 5.4) Default is 0 ÷ 5 VDC	Output - analog signal **Software selectable**
	G4	**MONITOR**	Monitor output signal: ±5 VDC maximum range (see 5.4) Default is ±5 VDC (1V = 1A)	Output - analog signal **Software selectable**
H	H1	**VL0**	Power supply 0 VDC for digital input (see 5.2)	Gnd - power supply
	H2	**D_IN1**	Digital input 0 ÷ 24VDC, referred to VL0	Input - on/off signal
	H3	**D_IN0**	Digital input 0 ÷ 24VDC, referred to VL0	Input - on/off signal
	H4	**VL+**	Power supply 24 VDC for digital input (see 5.2)	Output - power supply

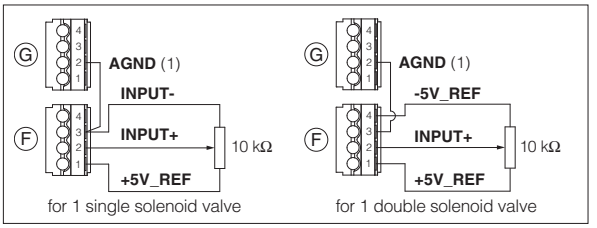
Pressure transducer connections - only for **/W** option



Coils connection



Potentiometer connection



(1) As alternative the AGND on pin E4 can be used (only /W option)

4.3 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥ ⑦ **EH fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

(1) shield connection on connector's housing is recommended

5 SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **F003** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

5.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
In case of double power supply see 5.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

5.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin A3 and A4, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

5.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

5.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC.

5.5 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin B1: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

5.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

5.7 Remote pressure transducer input signal (TR+) - only for **/W** option

Analog pressure transducers can be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

5.8 Output supply for external potentiometer (±5V_REF) - not available for **EH** version

The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the ±5 VDC supply output available at pin F1 and F4.

Note: using an external potentiometer, the reference input signal must be set via software at ±5 VDC (default ±10 VDC, see 5.3)

5.9 Possible combined options: /AI, /AW, /IW, /AIW, /ACW, /CIW, /ACIW, /CW

6 VALVE SETTINGS AND PROGRAMMING TOOLS

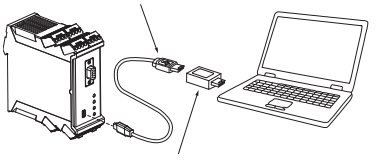
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB connection



Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers.
For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:
E-MAN-BM-AES - user manual for **E-BM-AES**

7.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.
Two different Scale regulations are available for double solenoid valves: ScaleA for positive reference signal and ScaleB for negative reference signal.

7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input).
The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current to the specific proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If fieldbus reference signal is active (see 5.3), threshold should be set to zero.
Two different Bias regulations are available for double solenoid valves: positive reference signals activate BiasA and negative reference signals activate BiasB.
Refer to the programming manuals for a detailed description of other software selectable Bias functions.

7.3 Offset

Proportional valves may be provided with zero overlapping in the hydraulic regulation corresponding to zero reference input signal (valve's central spool position).
The Offset function allows to calibrate the Offset current, required to obtain valve's spool central position, to the specific hydraulic system setup (e.g. valve applied to cylinder with differential areas).

7.4 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.
Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations
- four ramps for positive/negative signal values and increasing/decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

7.5 Linearization - E-SW level 2 functionality

Linearization function allows to set the relation between the reference input signal and the controlled valve's regulation.
Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition.

7.6 Variable Dither

The dither is the frequency modulation of the current supplied to the solenoid. To reduce the hysteresis should be selected a lower value of frequency, despite a lower regulation stability, because a small vibration in the valve regulating parts considerably reduces static friction effects.
To improve the regulation stability, should be selected a high value of frequency, despite a higher hysteresis. This solution in some application can lead to vibration and noise. Normally, the right setting is a compromise and depends on system setup.
E-BM-AES drivers allow to realize a variable dither frequency that linearly depends on the demanded current: variable dither frequency allows an higher degree to optimize the valve hysteresis.

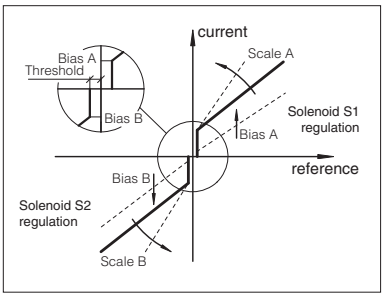
7.7 Hydraulic Power Limitation - only for **/W** option

Digital E-BM-AES drivers with /W option electronically perform hydraulic power limitation on:
- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tech table **A170**)

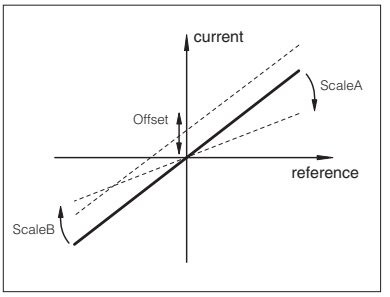
The driver receives the flow reference signal by the analog external input INPUT+ (see 5.3) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR (see 5.7).
When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\ \left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}}\ ;\ \text{Flow Reference [INPUT+]}\right)$$

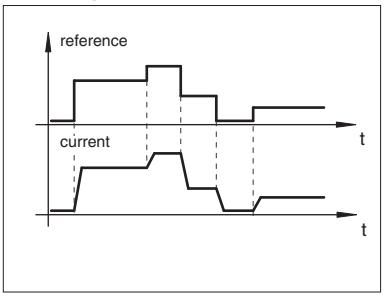
7.1, 7.2 - Scale, Bias & Threshold



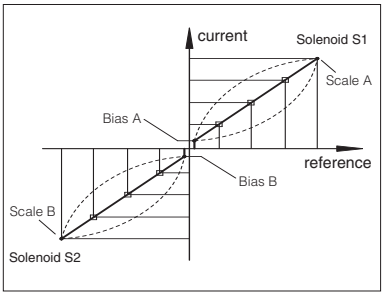
7.3 - Offset



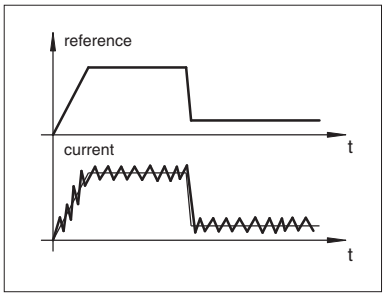
7.4 - Ramps



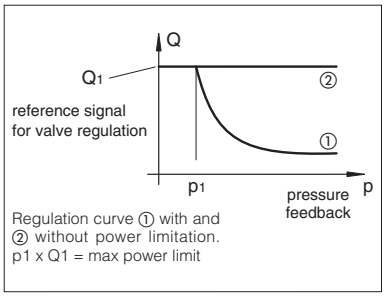
7.5 - Linearization



7.6 - Variable Dither

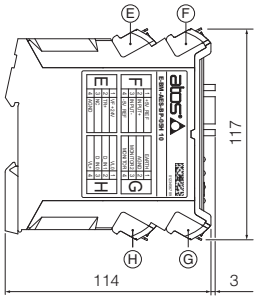


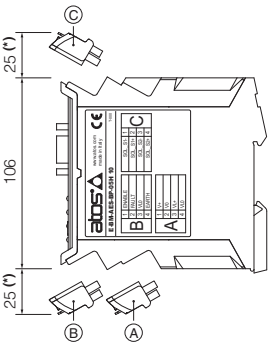
7.7 - Hydraulic Power Limitation



8 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors





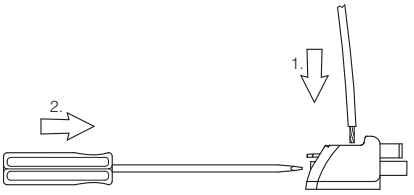
DIN rail dimensions

A,B,C,F,G,H connectors included; E connector is available only for /W option

(*) Space to remove the connectors

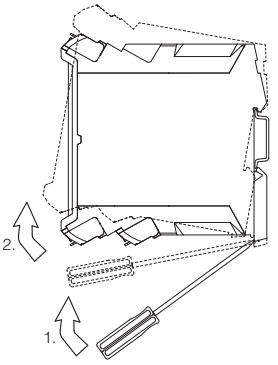
9 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



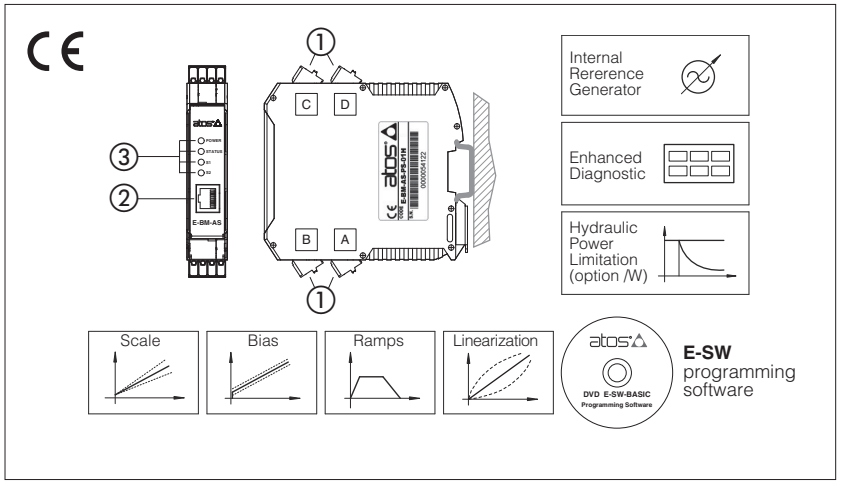
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)

Digital electronic E-BM-AS drivers

DIN-rail format, for proportional valves without transducer



E-BM-AS

Digital drivers control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.
The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the hydraulic regulation.
E-BM-AS can drive up to two single or one double solenoid proportional valves.

Electrical Features:

- 4 fast plug-in connectors ①
- RJ45 connector ② for RS232 Serial communication to program the driver with the Atos PC software
- 4 leds for diagnostics ③ (see section 10)
- ±5 VDC output supply for external reference potentiometers (/P option)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- /W option max power limitation function
- Complete diagnostics of driver status

1 MODEL CODE

E-BM	- AS - PS - 01H /	*	*

E-BM — Off-board electronic driver in DIN rail format

AS = digital basic driver, for valves without transducer

PS = Serial communication interface

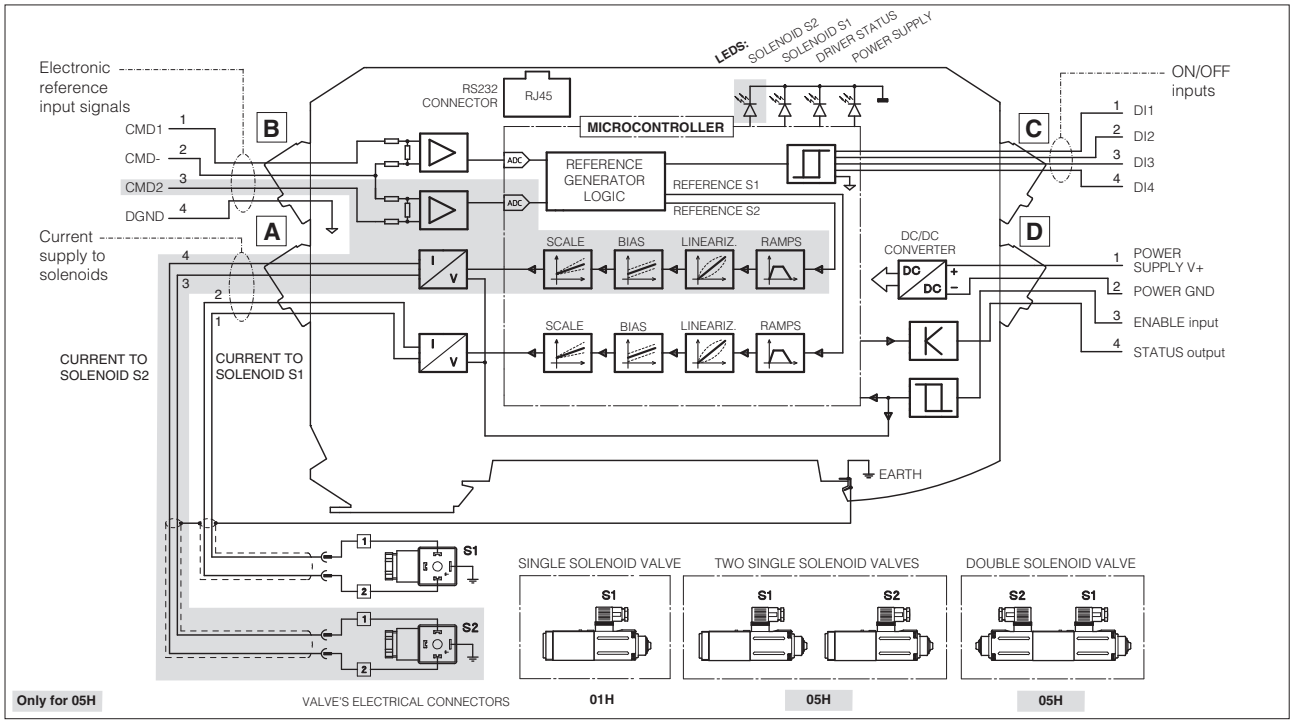
01H = for single solenoid proportional valves
05H = for double solenoid or two single solenoid proportional valves

***** — Series number

Options:

- = standard 24 VDC power supply
12 = 12 VDC power supply
A = max current limitation for ex-proof valves
C = current feedback 4 ÷ 20 mA for remote transducer, only for **IW**
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input ±10 VDC)
P = electrical supply for external potentiometers to generate reference signal, not available with **I** option (see 4.4)
W = power limitation function, only for **05H** (see 7.7)

2 BLOCK DIAGRAM



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	**Standard** Nominal: +24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP) **option /12** Nominal: +12 VDC Rectified and filtered: VRMS = 10 ÷ 14 VMAX (ripple max 10 % VPP)
Max power consumption	50 W 01H single solenoid valve and 05H double solenoid valve 100 W 05H two single solenoid valves
Current supplied to solenoids	IMAX = 2.7 A with +24 VDC power supply for standard proportional valves (3,2 Ω solenoid) IMAX = 3.3 A with +12 VDC power supply for proportional valves with /6 option (2,1 Ω solenoid) IMAX = 2.5 A with +24 VDC power supply for ex-proof proportional valves (3,2 Ω solenoid) for **/A option**
Analog input signal (see 4.2)	Voltage: range ±10 VDC Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Enable and optical insulated ON/OFF inputs (see 4.5, 4.7)	Range : 0 ÷ 24 VDC (OFF state: 0 ÷ 5 VDC ; ON state: 9 ÷ 24 VDC) Input impedance: Ri > 10 kΩ
Output supply (see 4.4)	±5 VDC @ max 10 mA : output supply for external potentiometers (only for **/P option**)
Status output (see 4.6)	Output range : 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 1,4 A
Alarms	Solenoid not connected, short circuit and cable break with current reference signal
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (-20 ÷ +40 °C for 05H version if drive two single solenoid proportional valves; storage -25 ÷ +85 °C)
Mass	130 g
Additional characteristics	Short circuit protection of current output to solenoids; protection against reverse polarity of power supply
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE - Immunity: EN 61000-6-2 (2005); Emission: EN 61000-6-4 (2001)
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	RS232 serial connection (not insulated), Atos protocol with ASCII coding (see section 9)
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² for length up to 40 m [1,5 mm² for power supply and solenoids]
Max conductor size (see section 12)	2,5 mm²

4 SIGNALS SPECIFICATIONS

4.1 Power supply

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve
5 A time lag fuse for 05H two single solenoid valves

Option /12

This driver execution is designed to receive a 12 VDC power supply and it is commonly used in mobile application.
A safety fuse is required in series to each driver power supply:

⚠ A safety fuse is required in series to each power supply: 4 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve
6,3 A time lag fuse for 05H two single solenoid valves

4.2 Reference Input Signals (pin B1 and B3, both referred to pin B2)

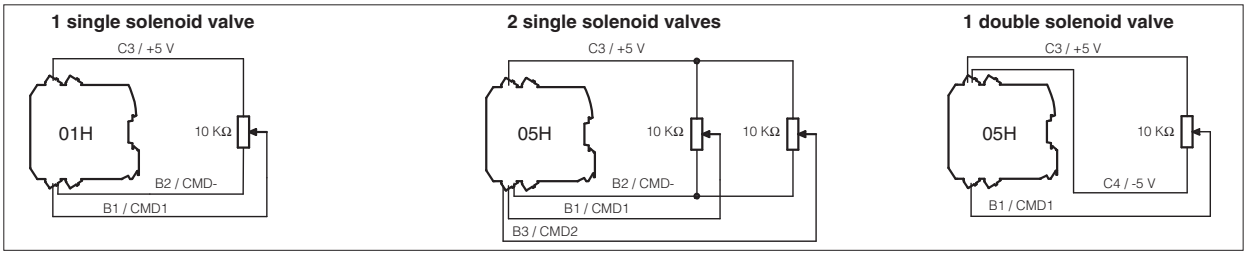
The driver proportionally transforms the external reference input signal into the current supplied to the solenoid.
The driver is designed to receive one (01H) or two (05H) analog reference inputs (CMD1 on pin B1, CMD2 on pin B3); both signals are referred to a common electric ground (CMD- on pin B2). CMD1 has to be used in case of 05H version that drives one double solenoid valve. CMD2 has to be used in case of 05H version that drives two single solenoid valves or transducer input for /W option (see 4.3).
The input range is software selectable among voltage (0 ÷ ±10 VDC) or current (4 ÷ 20 mA with cable break detection or 0 ÷ ±20 mA).
Defaults for standard: 0 ÷ 10 VDC for two position valves; 0 ÷ ±10 VDC for three position valves (see valve's tech. table).
Default for /I option: 4 ÷ 20 mA (see valve's tech. table)
Other ranges can be set by software. Internal reference generation is software selectable (see 7.6).
Note: software selection of analog input range (voltage or current) is applied to both signals CMD1 and CMD2.

4.3 Pressure Input Signal (pin B3 referred to pin B2) only for, /W option)

When hydraulic power limitation is active (see 7.7), input signal CMD2 must be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 ÷ 10 VDC.

4.4 Output supply Signal for external reference potentiometers (/P option)

The reference analog signals can be generated by one (01H) or two (05H) external potentiometers directly connected to the driver, using the ±5 VDC supply output available at pin C3 and C4. Reference input signal can be set up via software to ±5 VDC, in order to match potentiometer output signal.



4.5 Enable Input Signal (pin D3 referred to pin D2)

Enable input signal allows to enable/disable the current supply to the solenoids, without removing the electrical power supply to the driver; it is used to maintain active the serial connection and the other driver functions when the valve must be disabled for safety reasons.
To enable the driver, supply a 24VDC on pin D3 referred to pin D2.

4.6 Status Output Signal (pin D4 referred to pin D2)

Status output signal indicates fault conditions of the driver (short circuits, solenoids not connected, cable broken for 4 ÷ 20mA input) and is not affected by Enable input signal status: fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
When hydraulic power limitation function is active (see 7.7), status output signal can be software configured to indicate power limitation status: not active (0 VDC) or active (24 VDC).

4.7 ON/OFF Input Signals (pin C1...C4 referred to DGND pin B4)

Analog Drivers Compatibility - **default** for series 12 or higher

The four ON/OFF digital input signals (DI) can be used to activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers (see section 5). If digital inputs are not connected, the driver behavior corresponds to an E-BM-AS series 11 or lower

or

Internal Reference Generation - software selectable

When the driver is configured in internal reference generation mode (see 7.6), the 4 ON/OFF input signals (DI) are used to select the active reference signal, among the available stored values. If the 4 ON/OFF input signals (DI) are not active, the driver can be commanded by external analog reference. The polarity of the digital inputs can be customized: active status = 24 VDC is the default setting.

Note: for /P option DI3 and DI4 are not available

4.8 Possible combined options:

/12W, **/12PW**, **/12CIW**, **/AW**, **/ACIW**, **/APW**, **/CIW**, **/PW** only for 05H
/12I, **/12P**, **/AI**, **/AP** for 01H and 05H

5 ANALOG DRIVERS COMPATIBILITY - only for E-BM-AS series 12 or higher

E-BM-AS digital inputs (DI1..DI4) activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers:

REFERENCE COMPATIBILITY

Digital Inputs Signals		Digital driver	Analog driver	24 VDC to DI1:	0 VDC to DI1:
DI1	24 VDC	E-BM-AS 01H E-BM-AS 05H	E-BM-AC 01F E-BM-AC 05F E-BM-AC 011F E-ME-AC 01F E-ME-AC 05F	01H Voltage 0 ÷ 5 VDC / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100% 05H Voltage ± 5 VDC / ± 100% Current 4 ÷ 20 mA / 0 ÷ 100%	See section 4.2
DI2	0 VDC				
DI3	0 VDC				
DI4	0 VDC				

Note: set 0 VDC to DI1 and power-off/on the driver to restore latest settings

REFERENCE INVERSION

Digital Inputs Signals		Digital driver	Analog driver	24 VDC to DI2:	0 VDC to DI2:
DI1	24 VDC	E-BM-AS 05H	E-BM-AC 05F	Voltage 0 ÷ 5 VDC / 0 ÷ -100% Current 4 ÷ 20 mA / 0 ÷ -100%	Voltage 0 ÷ 5 VDC / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100%
DI2	24 VDC				
DI3	0 VDC				
DI4	0 VDC				

Note: to enable reference inversion, set 24 VDC to DI1 before driver power-on

RAMP SWITCH OFF

Digital Inputs Signals		Digital driver	Analog driver	24 VDC to DI3:	0 VDC to DI3:
DI1	24 VDC	E-BM-AS 01H E-BM-AS 05H	E-ME-AC 01F E-ME-AC 05F	Ramp excluded	Ramp activated
DI2	0 VDC				
DI3	24 VDC				
DI4	0 VDC				

Notes: to enable ramp switch off, set 24 VDC to DI1 before driver power-on; DI3 not available for /P option

011F CONFIGURATION

Digital inputs dignals		Digital driver	Analog driver	24 VDC to DI4:	0 VDC to DI4:
DI1	(*)	E-BM-AS 05H	E-BM-AC 011F	Driver configuration 011F (*) = don't care	Driver configuration 05H (*) = don't care
DI2	(*)				
DI3	(*)				
DI4	24 VDC				

Notes: set 0 VDC to DI4 and power-off/on the driver to restore latest settings; DI4 not available for /P option

6 VALVE SETTINGS AND PROGRAMMING TOOLS

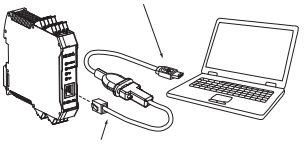
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via RS232 serial port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

Connection

E-A-PS-USB/DB9 USB to serial adapter



E-C-PS-DB9/RJ45 serial cable

WARNING: drivers RS232 port is not isolated!

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-AS - user manual for **E-BM-AS**

7.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.
For double solenoid valves two different Scale regulations are available:
ScaleA for positive reference signal and ScaleB for negative reference signal

7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).
The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If internal reference generation is active (see 7.6), threshold should be set to 0.
For double solenoid valves two different Bias regulations are available: positive reference signal activates BiasA for solenoid S1 and negative reference signal activates BiasB for solenoid S2

7.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.
Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations
- four ramps for positive/negative signal values and increasing/decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting)

7.4 Dither

The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve's regulation: a small vibration in the valve's regulating parts considerably reduces static friction effects.
Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).
Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup.
Default dither is a valid setting for a wide range of hydraulic applications

7.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.
Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition (e.g. maximum pressure control at defined working flow)

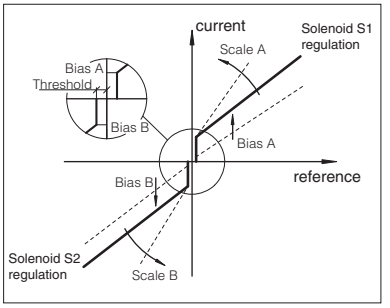
7.6 Internal Reference Generation

Internal generation of reference values is software selectable.
In this mode the 4 digital inputs of the driver (DI1..DI4) allow to activate the desired internal reference signal, among the different driver's stored values: external control unit can thus manage complex machine profile by simple switching the reference signal, by 4 digital inputs (see 4.7).
The digital inputs are software configurable into 2 different reference selection mode:

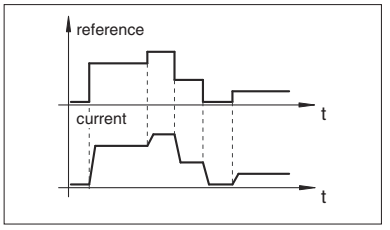
- *Standard mode*
  each digital input corresponds to a different value; up to 4 different internal values are available (2+2 with E-BM-AS-PS-05H driving two single solenoid valves)
- *Binary mode*
  each digital input combination corresponds to a different value; up to 15 different internal values are available (3+3 with E-BM-AS-PS-05H when driving two single solenoid valves)

A dedicated ramp time value can be set by software for each available stored reference value.
Note: with all input signals (DI) set to zero, the driver can be commanded by external analog reference also if internal reference generation is selected (for more information please refer to the programming manual E-MAN-BM-AS).

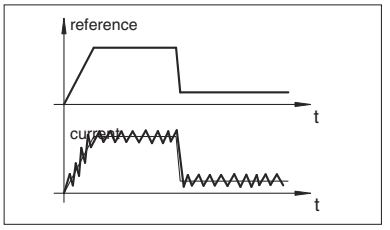
7.1, 7.2 - Scale, Bias & Threshold



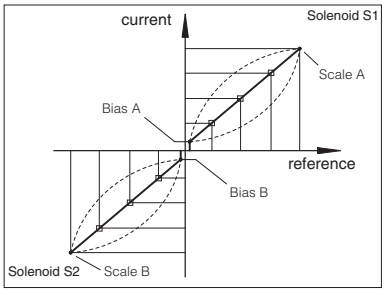
7.3 - Ramps



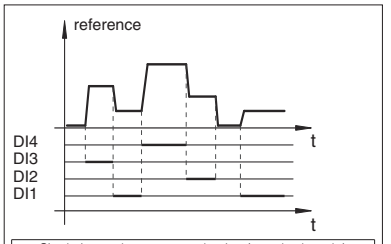
7.4 - Dither



7.5 - Linearization



7.6 - Internal Reference Generation



Single internal generator selection (standard mode)				
DI1	**DI2**	**DI3**	**DI4**	**Reference**
OFF	OFF	OFF	OFF	External
ON	OFF	OFF	OFF	Generation 1
(*)	ON	OFF	OFF	Generation 2
(*)	(*)	ON	OFF	Generation 3
(*)	(*)	(*)	ON	Generation 4

Double internal generator selection (standard mode)					
DI1	**DI2**	**S1**	**DI3**	**DI4**	**S2**
OFF	OFF	External	OFF	OFF	External
ON	OFF	Generation 1	ON	OFF	Generation 1
(*)	ON	Generation 2	(*)	ON	Generation 2

(*) don't care

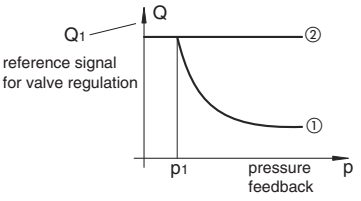
7.7 Hydraulic Power Limitation (**/W option**, only for drivers E-BM-AS-PS-05H)

E-BM-AS drivers with /W option electronically perform hydraulic power limitation on:
- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator
  (e.g. PVPC-*-LQZ, tech. table A170)

The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) or by the internal generator (see 7.6) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input CMD2.
When the actual requested hydraulic power **p**x**Q** (CMD2xCMD1) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [CMD2]}} ; \text{Flow Reference [CMD1]} \right)$$

7.7 - Hydraulic Power Limitation



Regulation curve ① with and
② without power limitation.
p1 x Q1 = max power limit

8 CONNECTIONS

The 4 fast plug-in connectors (A,B,C,D), included in the supply, provide simple wirings, easy driver's replacement and the possibility to test the signals directly on the connectors.

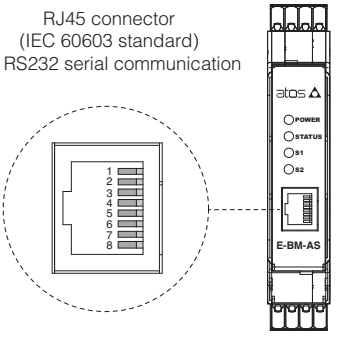
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS		NOTES	
A	A1	SOL S1	Current to solenoid S1		Output - power PWM	
	A2					
	A3	SOL S2	Current to solenoid S2 (only for 05H version)			
	A4					
B	B1	CMD1	Reference analog input: ±10 VDC / ± 20 mA maximum range software selectable (see 4.2)		Input - analog signal	
	B2	CMD-	Standard	/P option (see 4.4)		
			Zero signal, ground for reference signals	Reference for ±5 VDC output (AGND)		
	B3	CMD2 **(1)**	Reference analog input: ±10 VDC / ± 20 mA maximum range software selectable (see 4.2)			
	B4	DGND	Optical insulated ground for on/off inputs (DI1 ÷ DI4)			
C			Standard	/P option (see 4.4)	Standard	Option /P
	C1	DI1	Optical insulated on/off input 0 ÷ 24 VDC referred to pin B4 DGND (see 4.7) For analog driver compatibility see section 5	Optical insulated on/off input 0 ÷ 24 VDC referred to pin B4 DGND (see 4.7) For analog driver compatibility see section 5	Input - on/off signal	
	C2	DI2				
	C3	DI3		+5 VDC @ 10 mA output supply to pin B2 (AGND)	Input - on/off	Output - reference analog
	C4	DI4		-5 VDC @ 10 mA output supply to pin B2 (AGND)		
D	D1	V+	Power supply 24 VDC (see 4.1)		Input - power supply	
	D2	V0	Power supply 0 VDC			
	D3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (see 4.5)		Input - on/off signal	
	D4	STATUS	Fault (default) or software selected output (see 4.6)		Output - on/off signal	

(1) Only for 05H version, when used to drive two single solenoid valves or transducer input for /W option
WARNING: if CMD2 is not used has to be connect to CMD- (ground)

9 RJ45 CONNECTOR

RJ45 CONNECTOR		
PIN	SIGNAL	DESCRIPTION
1	/	Not connected
2	/	Not connected
3	/	Not connected
4	GND	Signal zero data line
5	RX	Driver receiving data line
6	TX	Driver transmitting data line
7	/	Not connected
8	/	Not connected

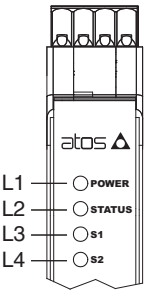
RJ45 connector
(IEC 60603 standard)
for RS232 serial communication



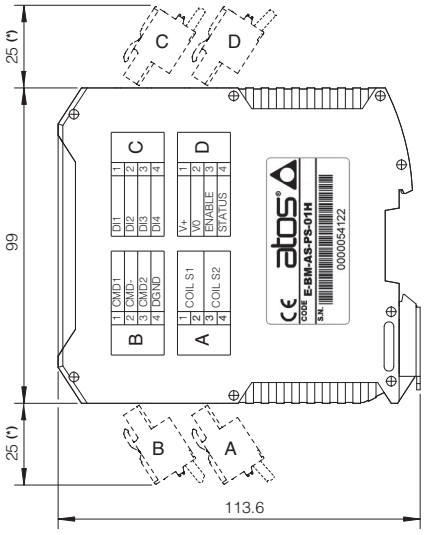
10 DIAGNOSTIC LEDS

Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

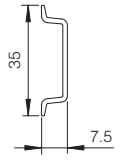
LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	POWER	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	STATUS	OFF or ON	Fault conditions
			Slow blinking	Driver disabled
			Fast blinking	Driver enabled
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF
			ON	PWM command ON
			Slow blinking	Coil not connected
			Fast blinking	Short circuit on the solenoid



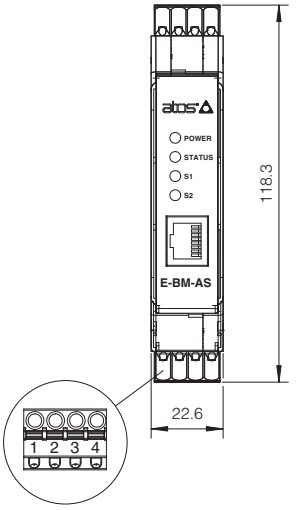
11 OVERALL DIMENSIONS [mm]



DIN rail dimensions



overall dimension with assembled connectors

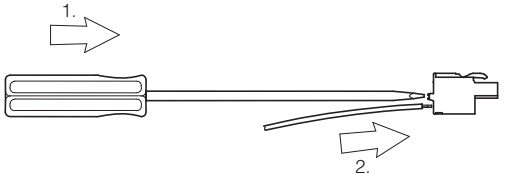


A, B, C, D connectors included

(*) Space to remove the connectors

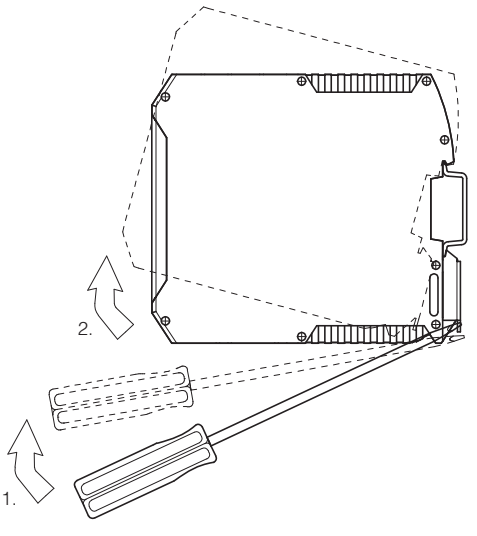
12 INSTALLATION

To wire cables in the connectors:
1. press the button with a screwdriver
2. insert the cable termination



Note: max conductor size: 2,5 mm²

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



2 AXIS & P/Q CONTROLS

INDEX

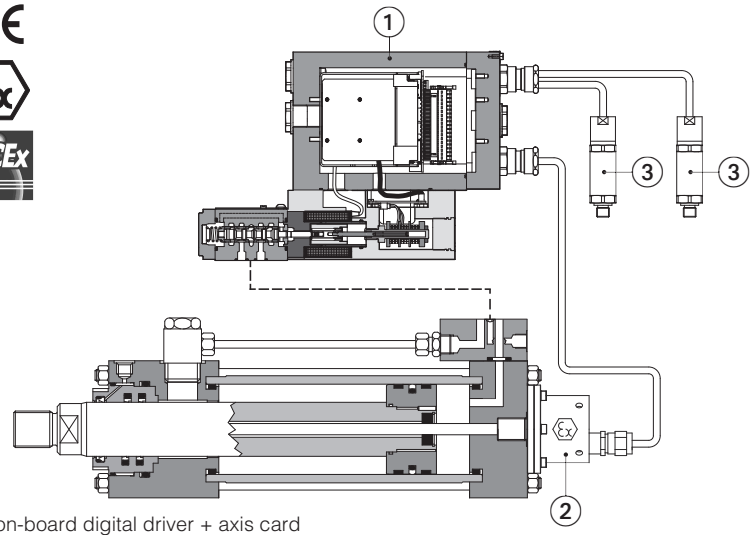
AXIS & P/Q CONTROLS

Ex-d

Supplementary components range available on **www.atos.com**

Ex-proof digital servoproportionals with on-board axis card

direct, sleeve execution, with LVDT transducer and zero spool overlap - **ATEX and IECEx**



① on-board digital driver + axis card
② transducer to feedback the axis position
③ pressure/force transducers

DLHZA-TEZ-D-SF-EP-040

DLHZA-TEZ, DLKZA-TEZ

Ex-proof digital servoproportional valves equipped with on-board driver plus axis card, LVDT position transducer and zero spool overlap to perform the position control of any linear or rotative hydraulic actuator.

They are certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The controlled actuator has to be equipped with integral or external ex-proof transducer (analog, potentiometer, SSI or Encoder) to feedback the axis position.

The valve can be operated by an external or internally generated reference position signal, see section 2.

Options SF, SL add the alternated pressure/force control to the basic position one, see section 3.

DLHZA:
Size: **06** -ISO 4401
Max flow: **50 l/min**
Max pressure: **350 bar**

DLKZA:
Size: **10** -ISO 4401
Max flow: **100 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DLHZA	- TEZ	- D	- SN	- NP	- 0	40	- L	7	3	/ M	/ *	*	/ *

DLHZA = Ex-proof servoproportional directional valves, direct
DLKZA = size 10

TEZ = on-board digital driver + axis card, one LVDT transducer

Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

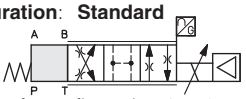
Alternated P/Q controls:
SN = none
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

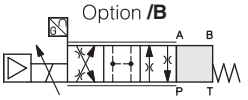
Valve size ISO 4401: **0** = 06 **1** = 10

Configuration: **Standard**

40 =

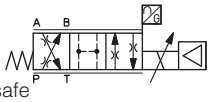


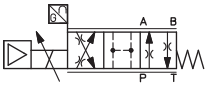
Option **/B**



with fail safe configuration 1 or 3

60 =





without fail safe

Spool type, regulating characteristics:

L = linear

V = progressive

T = not linear **(1)**

D = differential-linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

DT = differential-not linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (2):
B = solenoid with integral electronics and position transducer at side of port A **(3)**
Y = external drain

Electronic options (2):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)

Fail safe configuration, see section 18:

1 =

3 =

Note: select **1** for configuration **60** even without fail safe

Seals material, see section 10:
- = NBR
PE = FKM
BT = HNBR

Series number

Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZA =	4	7	8	14	-	20	28	40
DLKZA =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) Only for configuration **40** **(2)** For possible combined options, see section 16
(3) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

2 POSITION REFERENCE MODE

2.1 External reference generation

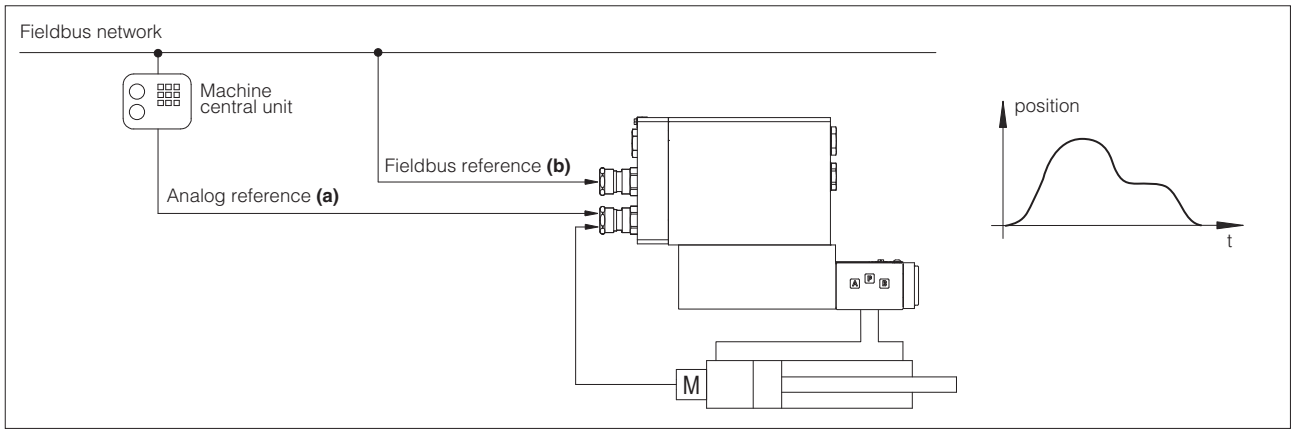
Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer.

The external reference signal can be software selected among:

Analog reference (a) - the controller receives in real time the reference signal from the machine electronic central unit by means analog input on the terminal board.

Fieldbus reference (b) - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication.

For fieldbus communication details, please refer to the controller user manual.



2.2 Internal reference generation

Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.

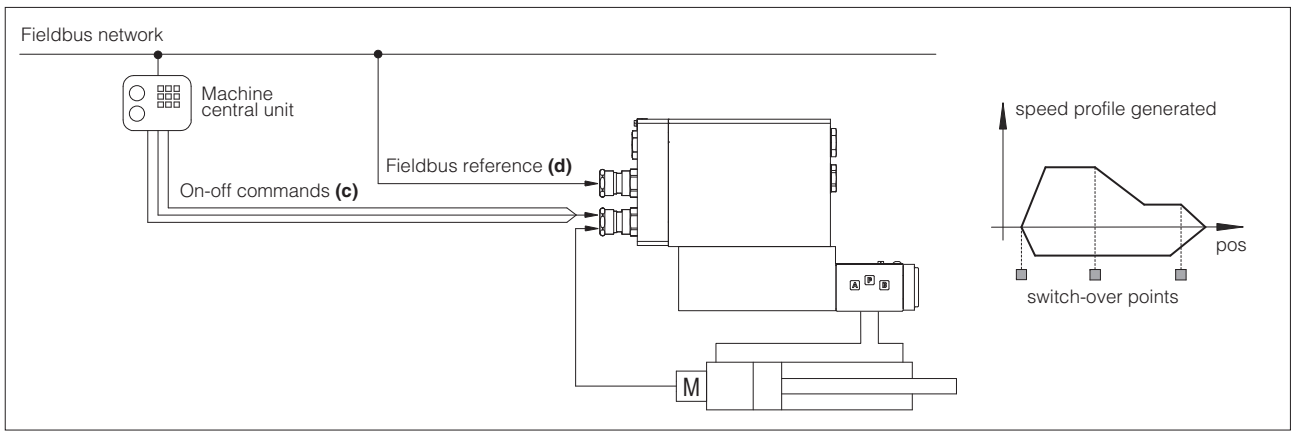
The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means :

- on-off commands ***(c)***

- fieldbus commands ***(d)***

Atos PC software allows to design a customized sequence of motion phases adapted to the specific application requirements: a range of predefined standard sequences are available in the Z-SW software.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.



Start / stop / switch-over commands examples

External digital input	on-off commands, on terminal board, are used to start/stop the cycle generation or to change the motion phase
External fieldbus input	on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase
Switch by position	switch-over from actual to following motion phase occurs when the actual position reaches a programmed value
Switch by time	switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation

Reference generation types examples

Absolute	a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control
Relative	as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software
Time	as 'Absolute' type but the controller automatically determines the speed and acceleration in order to reach the target absolute position in the fixed time internally set by software

3 ALTERNATED POSITION / FORCE CONTROL

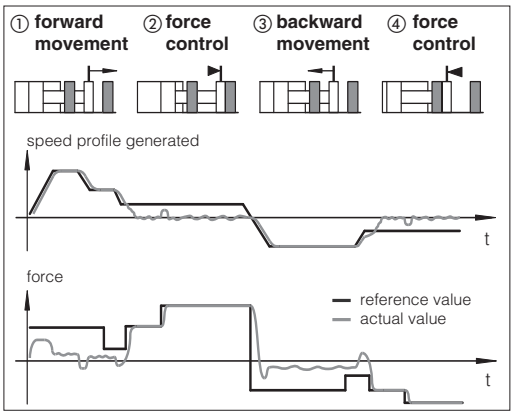
SF and **SL** options add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve driver, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

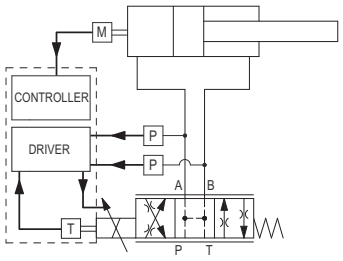
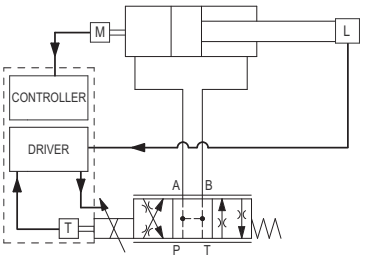
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the controller reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations

SF	SL
	
two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve spool transducer | M actuator position transducer | P pressure transducer | L load cell

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

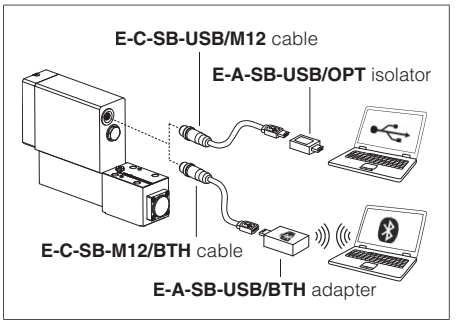
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

Z-SW-FULL support: NP (USB)
BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

Note: Z-SW programming software supports valves with option SF, SL for alternated control

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DLHZA**											**DLKZA**						
Pressure limits [bar]		ports **P, A, B** = 350; **T** = 210 (250 with external drain /Y)											ports **P, A, B** = 315; **T** = 210 (250 with external drain /Y)						
Spool type		**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Max flow [l/min]																				
Δp P-T	at Δp = 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
	at Δp = 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
	max permissible flow	5	9	16	18	26	32		50			50÷28		70		100			100÷50	
Δp max P-T [bar]		120	120	120	120	120	100		100			100		90		70			70	
Leakage [cm³/min] at P = 100 bar **(1)**		<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time **(2)** [ms]		≤ 13												≤ 20						
Hysteresis [% of max regulation]		≤ 0,1												≤ 0,1						
Repeatibility [% of max regulation]		± 0,1												± 0,1						
Thermal drift		zero point displacement < 1% at ΔT = 40°C																		

(1) referred to spool in neutral position and 50°C oil temperature
(2) 0-100% step signal

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Position transducers power supply	+24 VDC @ max 100 mA and +5 VDC @ max 100 mA are software selectable; ±10 VDC @ max 14 mA minimum load resistance 700 Ω			
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the controller energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type	DLHZA, DLKZA				
Certifications	Multicertification Group II **ATEX IECEx**				
Solenoid certified code	**OZA-TEZ**				
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X		
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db		
Temperature class	**T6**		**T5**		**T4**
Surface temperature	≤ 85 °C		≤ 100 °C		≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C		-40 ÷ +55 °C		-40 ÷ +70 °C
Applicable Standards	EN 60079-0	EN 60079-1	EN 60079-31	IEC 60079-0	IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com

(2) The controller and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only for **SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

16 POSSIBLE COMBINED OPTIONS

For SN: /BI, /BY, /IY

For SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

17 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

17.1 Regulation diagrams

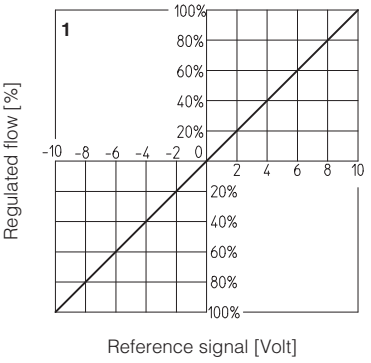
1 = Linear spools L
2 = Differential - linear spool D7

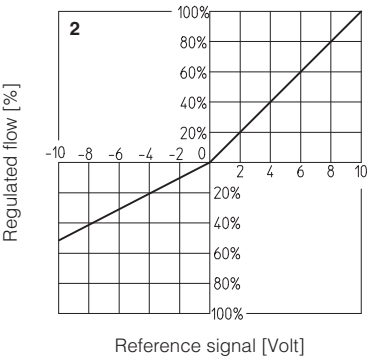
3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZA)

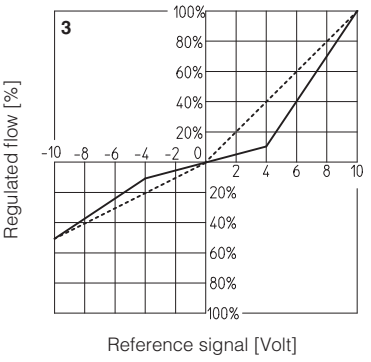
5 = Non linear spool, T3 (only for DLKZA) and T7
6 = Progressive spool V

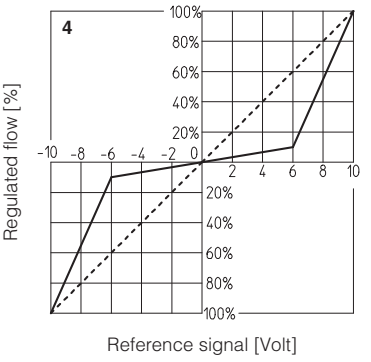
T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2









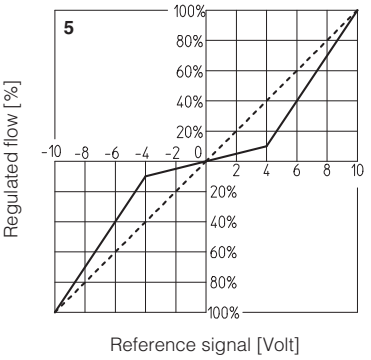
Note:
Hydraulic configuration vs. reference signal:

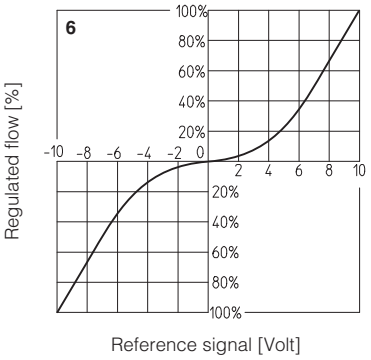
Standard:
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

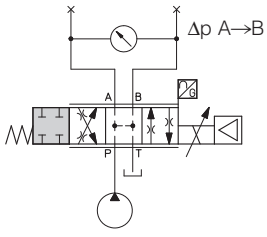
option /B:
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → B / A → T

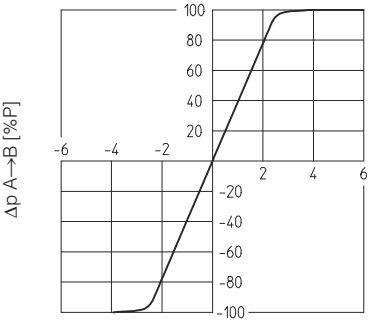
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → A / B → T





17.2 Pressure gain



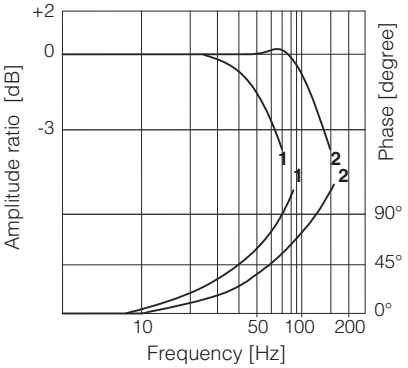


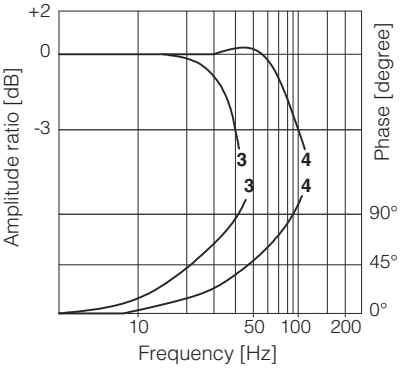
17.3 Bode diagrams

Stated at nominal hydraulic conditions

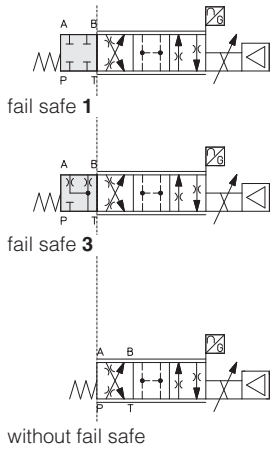
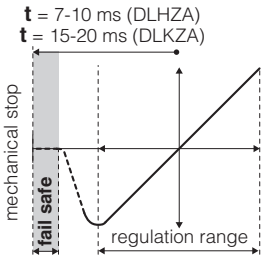
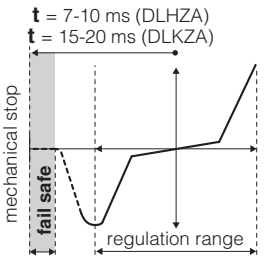
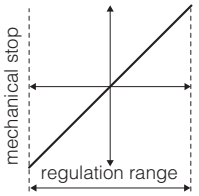
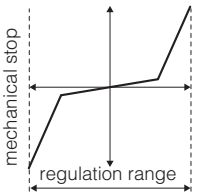
DLHZA:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZA:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke





18 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
		
	t = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar	
		

Fail safe connections		**P → A**	**P → B**	**A → T**	**B → T**
Leakage [cm³/min] at P = 100 bar **(1)**	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] **(2)** DLHZA	Fail safe 3	-	-	15÷30	10÷20
Flow [l/min] **(2)** DLKZA	Fail safe 3	-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature **(2)** Referred to spool in fail safe position at Δp = 35 bar per edge

19 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for controller's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for controller's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 10), depends on controller's reference mode, see section 2 :

External analog reference generation (see 2.1): input is used as reference for the controller axis position closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Fieldbus/internal reference generation (see 2.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.4 Pressure or force reference input signal (F_INPUT+) - only for **SF**, **SL**

Functionality of F_INPUT+ signal (pin 12), depends on selected controllers' reference mode and alternated control options, see section 3 :

SF, SL controls and external analog reference selected : input is used as reference for the controller pressure/force closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

SN control or fieldbus/internal reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.5 Position monitor output signal (P_MONITOR)

The controller generates an analog output signal (pin 9) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the controller (e.g. analog reference, fieldbus reference, position error, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

19.6 Pressure or force monitor output signal (F_MONITOR) - only for **SF**, **SL**

The controller generates an analog output signal (pin 11) according to alternated pressure/force control option:

SN control: output signal is proportional to the actual valve spool position

SF, SL controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the controller (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA.
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

19.7 Enable input signal (ENABLE)

To enable the controller, a 24VDC voltage has to be applied on pin 6.
When the Enable signal is set to zero the controller can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

19.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the controller (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.
Fault output signal can be used as digital output by software selection.

19.9 Position transducer input signal

A position transducer must be always directly connected to the controller. Select the correct controller execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).
Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.
Position analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 20.1).

19.10 Remote pressure/force transducer input signals - only for **SF**, **SL**

Analog remote pressure transducers or load cell can be directly connected to the controller.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 20.2).

20 ACTUATOR'S TRANSDUCER CHARACTERISTICS

20.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controllers, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.
Transducers with analog interface grant simple and cost effective solutions.

20.2 Pressure/force transducers

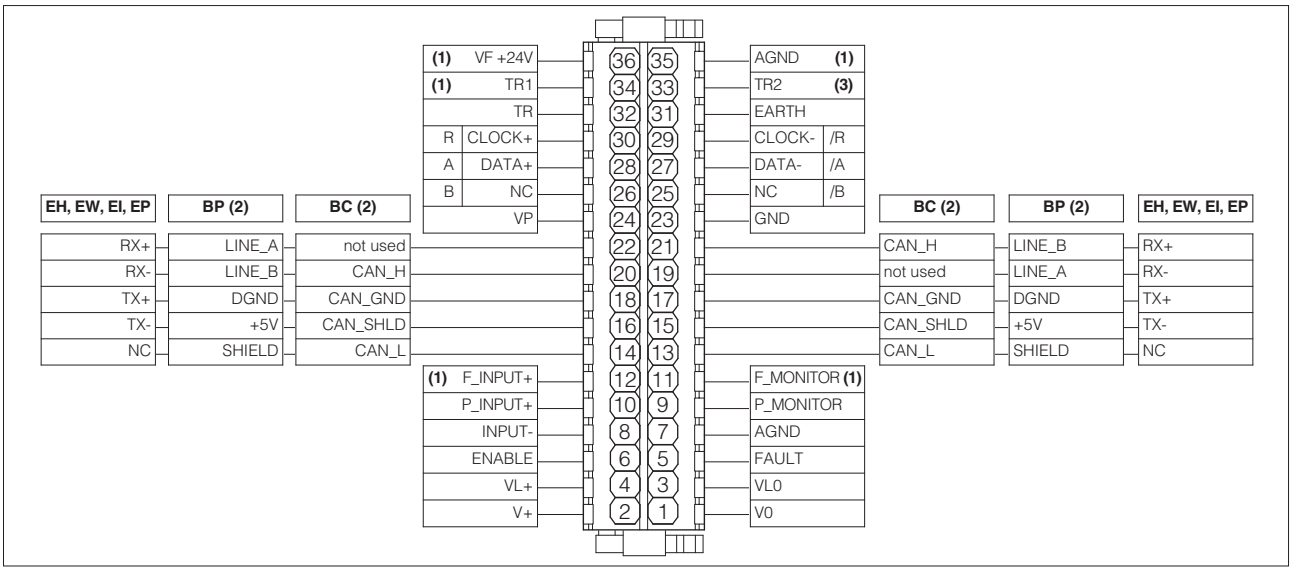
The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section 3 .
Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GX800** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

20.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				**Pressure/Force**
Execution	**A**		**D**		**SF, SL**
Input type	Potentiometer	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	±10 VDC	+24 VDC	+5 VDC / +24 VDC	+5 VDC / +24 VDC	+24 VDC
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos controller **(2)** Percentage of total stroke **(3)** For Balluff BTL7 with SSI interface only special code SA433 is supported

21 TERMINAL BOARD OVERVIEW



(1) Connections available only for **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) Connection available only for **SF**

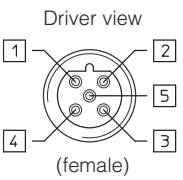
22 ELECTRONIC CONNECTIONS

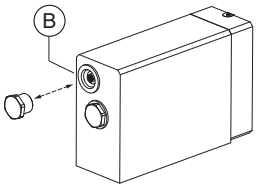
22.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	9	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal (SF, SL controls): ±10 VDC / ±20 mA max. range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

22.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





22.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

22.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

22.5 EH, EW, EI, EP fieldbus execution connections

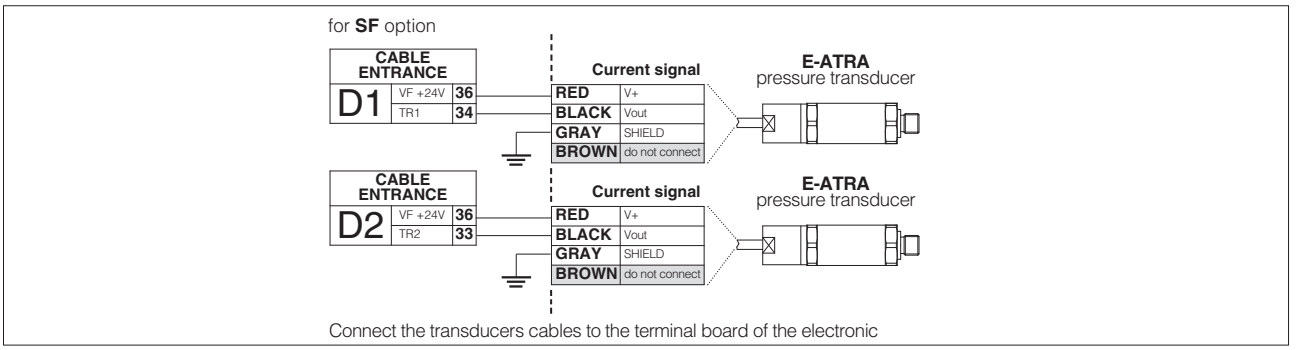
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

22.6 Remote pressure transducer connections - only for **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SL - Single transducer (1) Voltage	SL - Single transducer (1) Current	SF - Double transducers (1) Voltage	SF - Double transducers (1) Current
D1	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
D2	34	**TR1**	1st signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

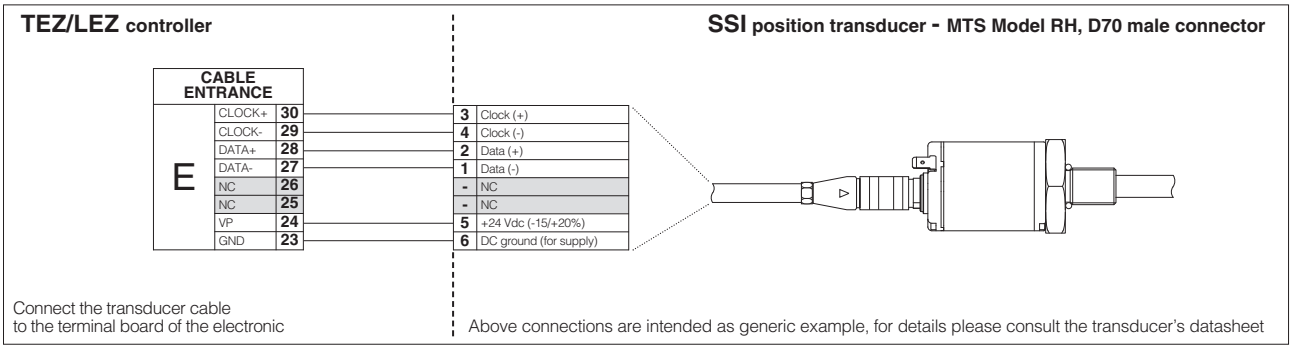


22.7 D execution - Digital position transducers connections

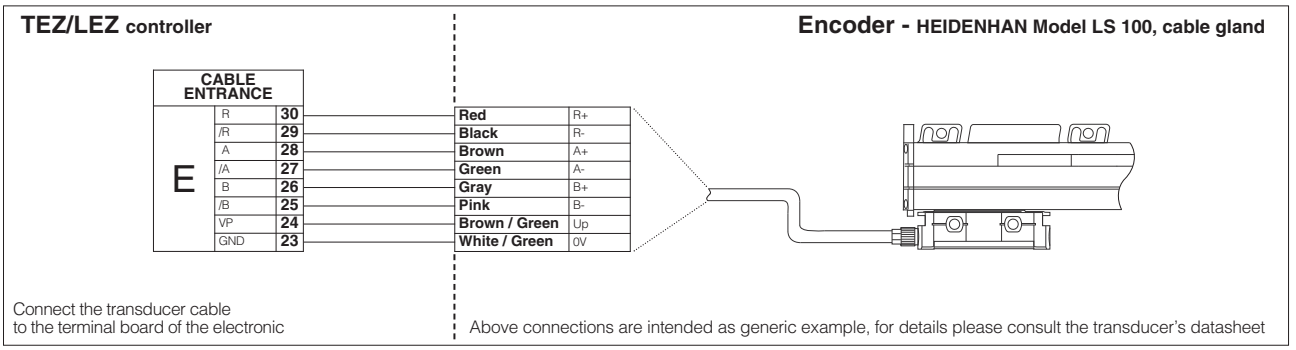
CABLE ENTRANCE	PIN	SSI - default transducer (1)			Encoder (1)		
		SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
E	30	**CLOCK+**	Serial syncronous clock (+)	Input - digital signal	**R**	Input channel R	Input - digital signal
	29	**CLOCK-**	Serial syncronous clock (-)		**/R**	Input channel /R	
	28	**DATA+**	Serial position data (+)		**A**	Input channel A	
	27	**DATA-**	Serial position data (-)		**/A**	Input channel /A	
	26	**NC**	Not connect	Do not connect	**B**	Input channel B	
	25	**NC**			**/B**	Input channel /B	
	24	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	23	**GND**	Common gnd for transducer powerand signals	Common gnd	**GND**	Common gnd for transducer power and signals	Common gnd

(1) Digital position transducer type is software selectable: Encoder or SSI, see 19.9

SSI connection - example



Encoder connection - example



22.8 A execution - Analog position transducers connector

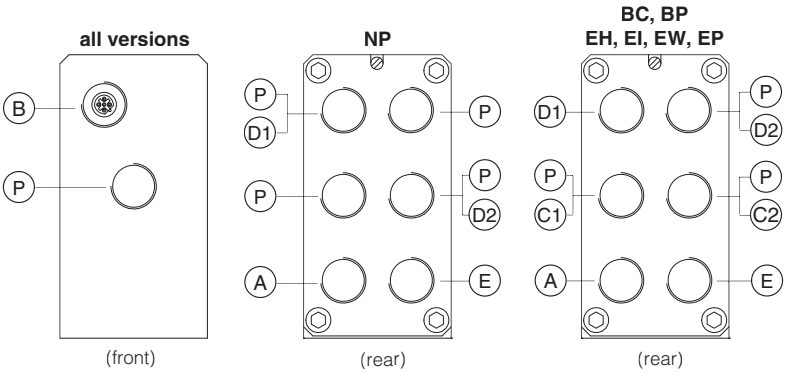
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES
E	32	**TR**	Signal transducer	Input - analog signal
	24	**VP**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	23	**GND**	Common gnd for transducer power and signals	Common gnd

23 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

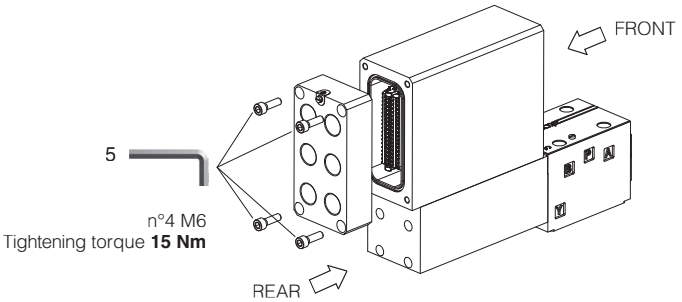
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (E) position transducer
- (P) threaded plug



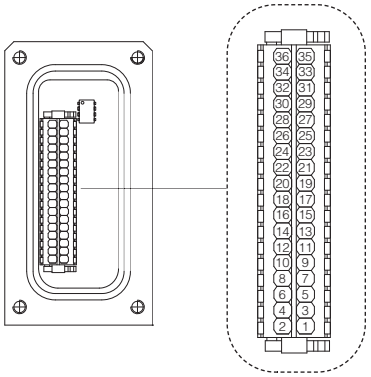
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

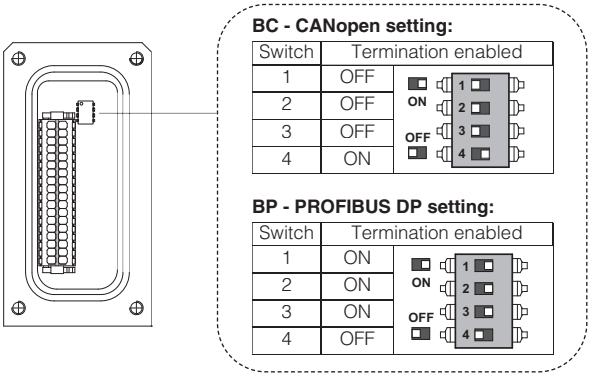


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 21



Fieldbus terminator only for BC and BP executions **(1)**



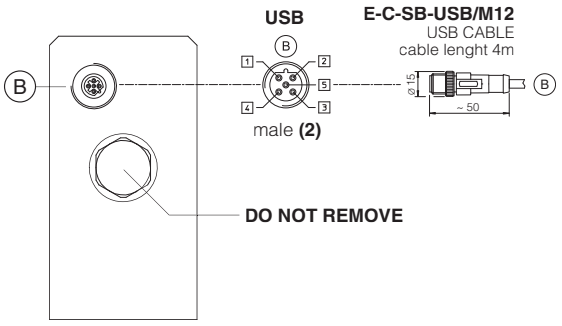
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

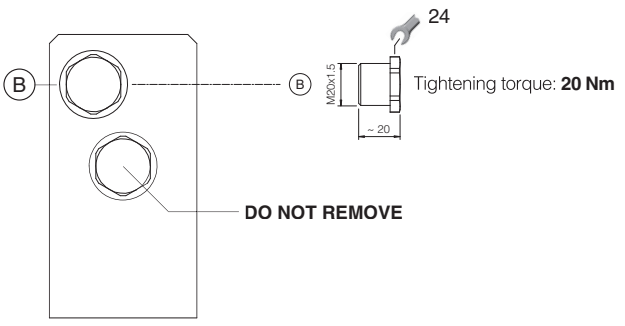
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

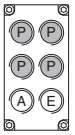
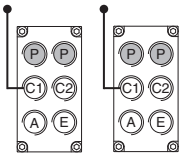
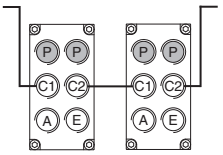


METALLIC PROTECTION CAP - supplied with the valves

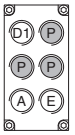
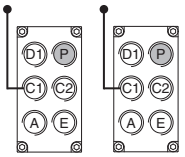
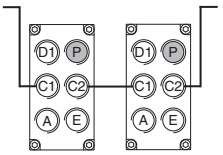


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

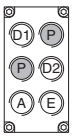
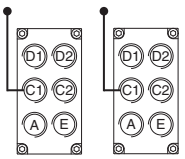
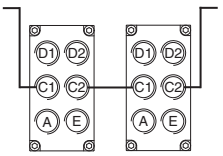
23.1 Cable glands and threaded plug for SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance		
NP	2	A - E	none	none		Cable entrance A, E are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	C1 A - E	1	C2		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged

23.2 Cable glands and threaded plug for SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance		
NP	3	D1 A - E	none	none		Cable entrance A, E, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

23.3 Cable glands and threaded plug for SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance		
NP	4	D1 D2 A - E	none	none		Cable entrance A, E, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	5	D1 - D2 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1, D2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	6	D1 - D2 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1, D2 are open for costumers

24 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:

Z-MAN-RA-LEZ - user manual for **TEZ** and **LEZ** with **SN**
Z-MAN-RA-LEZ-S - user manual for **TEZ** and **LEZ** with **SF**, **SL**

24.1 External reference and transducer parameters

Allow to configure the controller reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

24.2 PID control dynamics parameters

Allow to optimize and adapt the controller closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

24.3 Monitoring parameters

Allow to configure the controller monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 24.4)

24.4 Fault parameters

Allow to configure how the controller detects and reacts to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, controller disabling, etc.)

24.5 Valve characteristics compensation

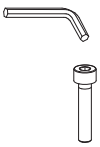
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

24.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

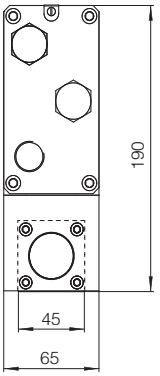
25 FASTENING BOLTS AND SEALS

	DLHZA	DLKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

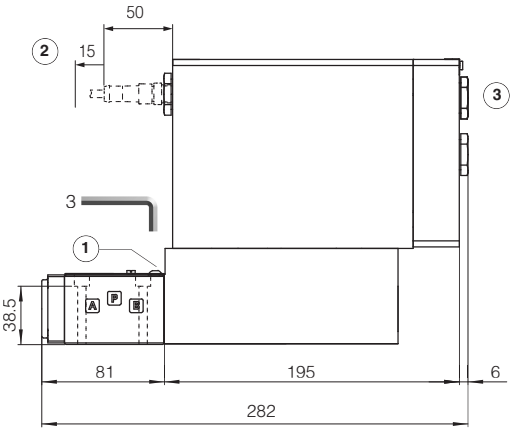
DLHZA-TEZ

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface: 4401-03-03-0-05 without port X)

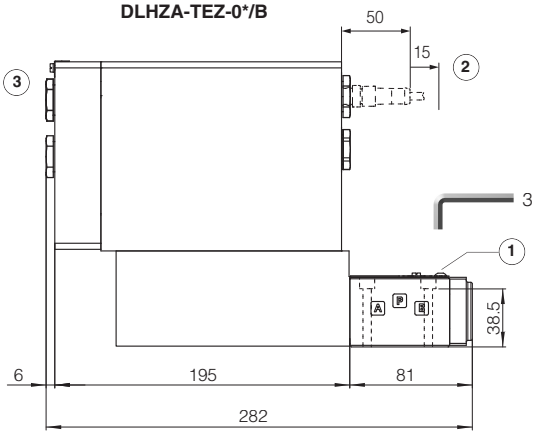
Mass [kg]	
DLHZA-TEZ	7,2



DLHZA-TEZ-0*



DLHZA-TEZ-0*/B



(1) = Air bleed off

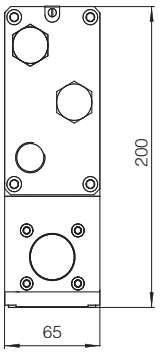
(2) = Space to remove the USB connector

(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

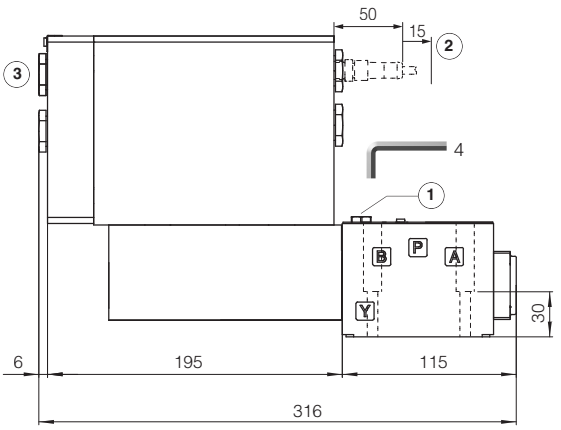
DLKZA-TEZ

ISO 4401: 2000
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

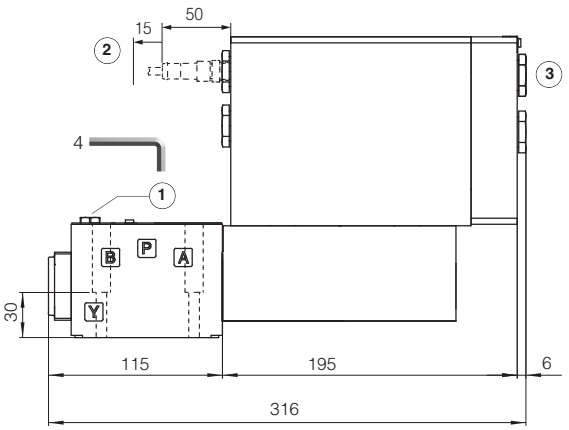
Mass [kg]	
DLKZA-TEZ	9



DLKZA-TEZ-1*



DLKZA-TEZ-1*/B



(1) = Air bleed off

(2) = Space to remove the USB connector

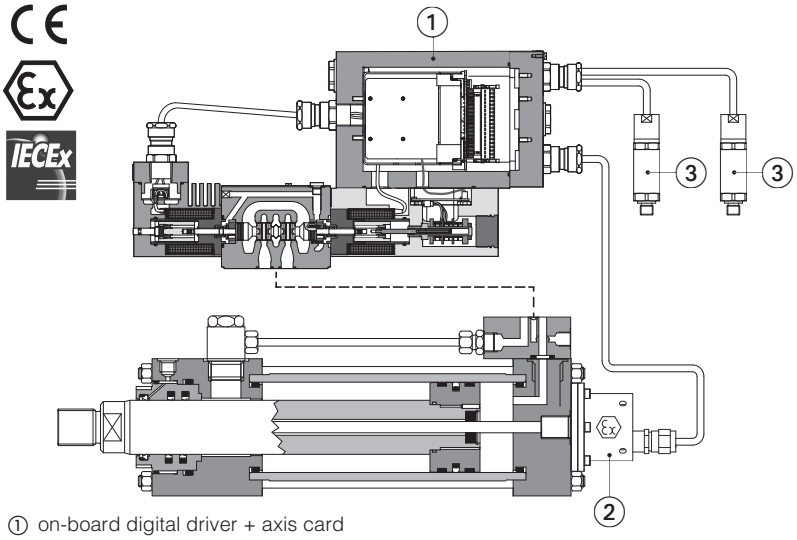
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

27 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX900	Operating and manintenance information for ex-proof proportional valves	**KX800**	Cable glands for ex-proof valves
GS500	Programming tools	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportionals with on-board axis card

direct, with LVDT transducer and zero spool overlap - **ATEX and IECEx**



① on-board digital driver + axis card
② transducer to feedback the axis position
③ pressure/force transducers

DKZA-TEZ-D-SF-NP-170*

DHZA-TEZ, DKZA-TEZ

Ex-proof digital servoproportional valves equipped with on-board driver plus axis card, LVDT position transducer and zero spool overlap to perform the position control of any linear or rotative hydraulic actuator.

They are certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The controlled actuator has to be equipped with integral or external ex-proof transducer (analog, potentiometer, SSI or Encoder) to feedback the axis position.

The valve can be operated by an external or internally generated reference position signal, see section 2.

Options SF, SL add the alternated pressure/force control to the basic position one, see section 3.

DHZA:
Size: **06** -ISO 4401
Max flow: **60 l/min**
Max pressure: **350 bar**

DKZA:
Size: **10** -ISO 4401
Max flow: **150 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DHZA	-	TEZ	-	D	-	SN	-	NP	-	0	70	-	L	5	/	M	/	*	*	/	*

Ex-proof servoproportional directional valves, direct
DHZA = size 06
DKZA = size 10

TEZ = on-board digital driver + axis card, one LVDT transducer

Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

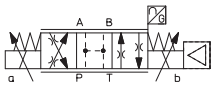
Alternated P/Q controls:
SN = none
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

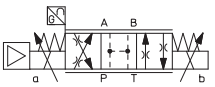
Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
0 = 06 **1** = 10

Configuration: **Standard** Option **/B**

70 =





Spool size:

	3 (L)	**5** (L,D)
DHZA =	18	28
DKZA =	45	75

Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics:

L = linear

D = differential-progressive

P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material, see section 9:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid with integral digital electronics at side of port A **(2)**
Y = external drain

Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)

Cable entrance threaded connection:
M = M20x1,5

(1) For possible combined options, see section 15
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

2 POSITION REFERENCE MODE

2.1 External reference generation

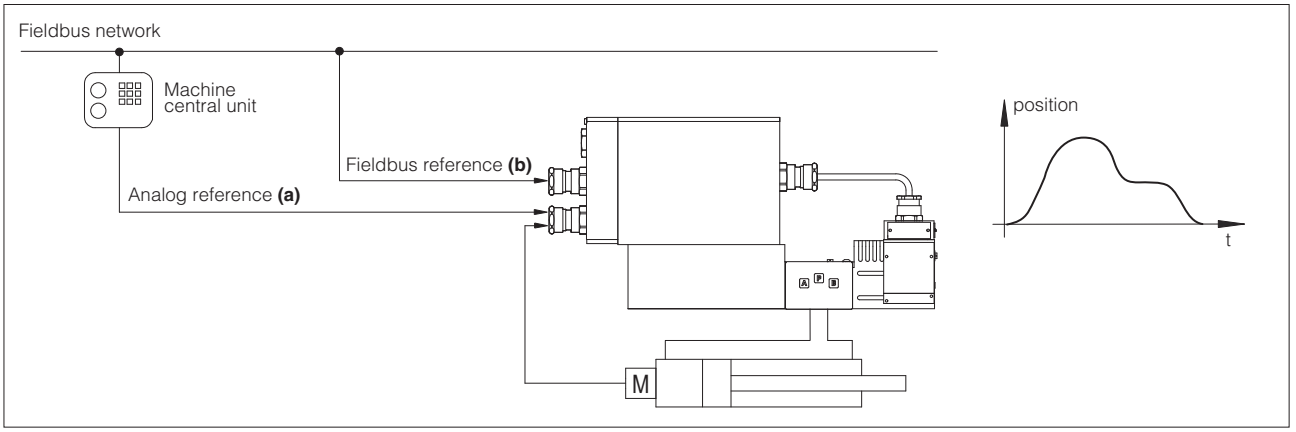
Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer.

The external reference signal can be software selected among:

Analog reference (a) - the controller receives in real time the reference signal from the machine electronic central unit by means analog input on the terminal board.

Fieldbus reference (b) - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication.

For fieldbus communication details, please refer to the controller user manual.



2.2 Internal reference generation

Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.

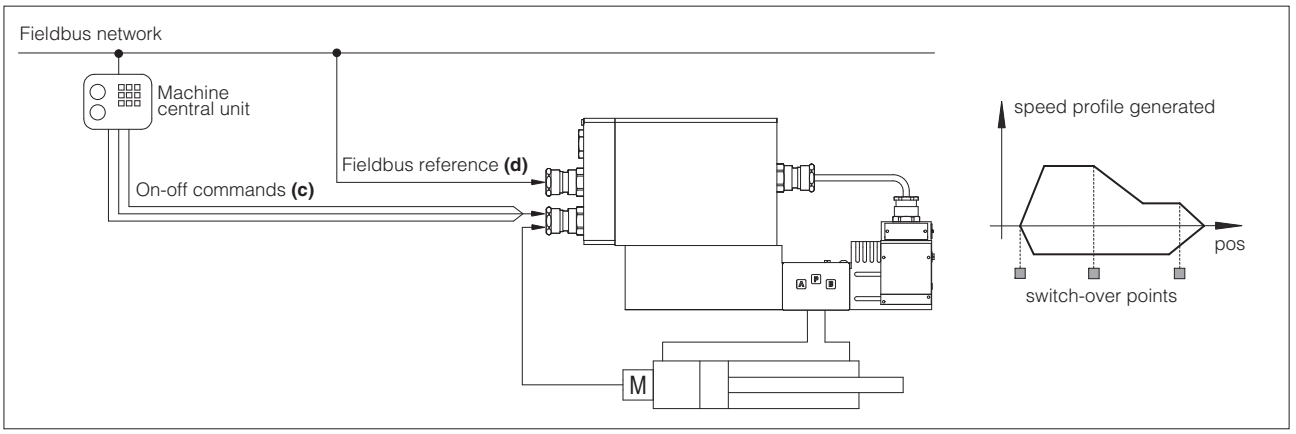
The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means :

- on-off commands ***(c)***

- fieldbus commands ***(d)***

Atos PC software allows to design a customized sequence of motion phases adapted to the specific application requirements: a range of predefined standard sequences are available in the Z-SW software.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.



Start / stop / switch-over commands examples

External digital input	on-off commands, on terminal board, are used to start/stop the cycle generation or to change the motion phase
External fieldbus input	on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase
Switch by position	switch-over from actual to following motion phase occurs when the actual position reaches a programmed value
Switch by time	switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation

Reference generation types examples

Absolute	a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control
Relative	as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software
Time	as 'Absolute' type but the controller automatically determines the speed and acceleration in order to reach the target absolute position in the fixed time internally set by software

3 ALTERNATED POSITION / FORCE CONTROL

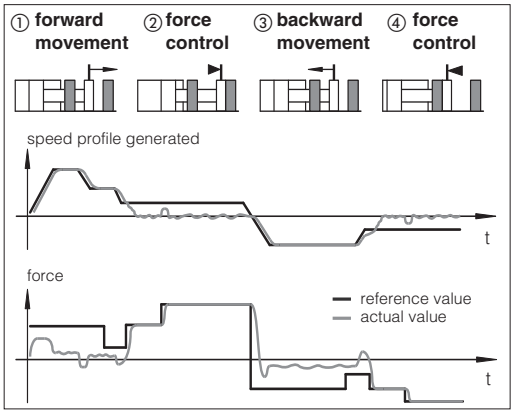
SF and **SL** options add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve driver, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

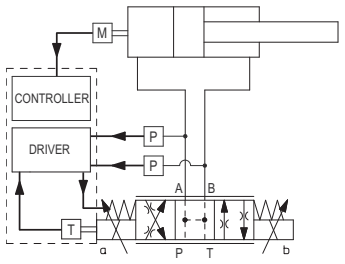
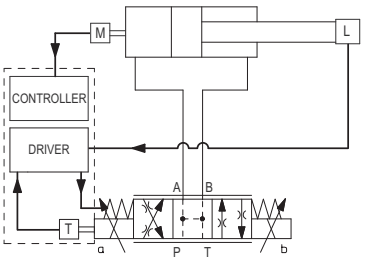
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the controller reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations

SF	SL
	
two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve spool transducer	M actuator position transducer	P pressure transducer	L load cell

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

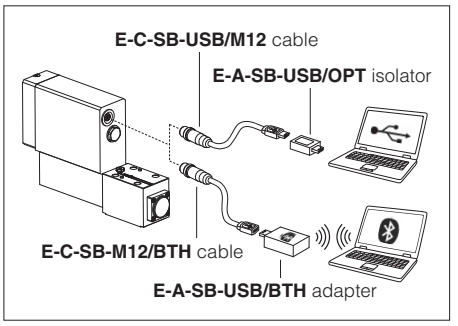
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

Z-SW-FULL support: NP (USB)
BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

Note: Z-SW programming software supports valves with option SF, SL for alternated control

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DHZA**			**DKZA**		
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y); **Y** = 10			ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y); **Y** = 10		
Spool type		**L3**	**L5**	**D5**	**L3**	**L5**	**D5**
Nominal flow [l/min]							
[l/min]	at Δp= 10 bar	18	28	28	45	75	75
Δp P-T	at Δp= 30 bar	30	50	50	80	130	130
	max permissible flow	40	60	60	90	150	150
Δp max P-T [bar]		70	50	50	40	40	40
Response time [ms] **(1)**		≤ 18			≤ 25		
Leakage [cm³]		<500 (at P = 100 bar); <1500 (at P = 350 bar)			<800 (at P = 100 bar); <2500 (at P = 315 bar)		
Hysteresis		≤ 0,2 [% of max regulation]					
Repeatability		± 0,1 [% of max regulation]					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) 0-100% step signal

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Position transducers power supply	+24 VDC @ max 100 mA and +5 VDC @ max 100 mA are software selectable; ±10 VDC @ max 14 mA minimum load resistance 700 Ω			
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the controller energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type		DHZA, DKZA					
Certifications		Multicertification Group II **ATEX IECEx**					
Solenoid certified code		**OZA-TEZ**					
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X			• IECEx: IECEx TPS 19.0004X		
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db			• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db		
Temperature class	Single solenoid valve	**T6**	**-**	**T5**		**T4**	**-**
	Double solenoid valve	**-**	**T4**	**-**		**-**	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C		≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C		-40 ÷ +70 °C	
Applicable Standards		EN 60079-0	EN 60079-1	EN 60079-31	IEC 60079-0	IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection		**M** = M20x1,5					

(1) The type examinator certificates can be downloaded from www.atos.com

(2) The controller and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only for **SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

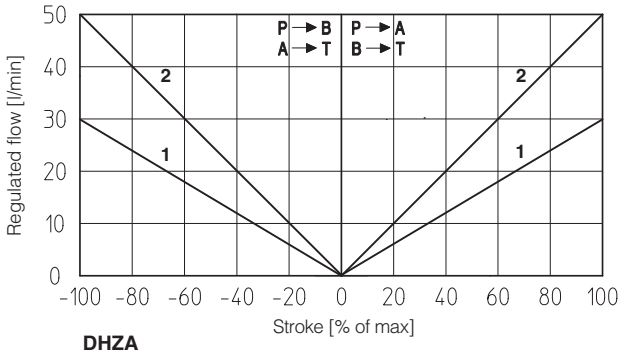
16 POSSIBLE COMBINED OPTIONS

For SN: /BI, /BY, /IY

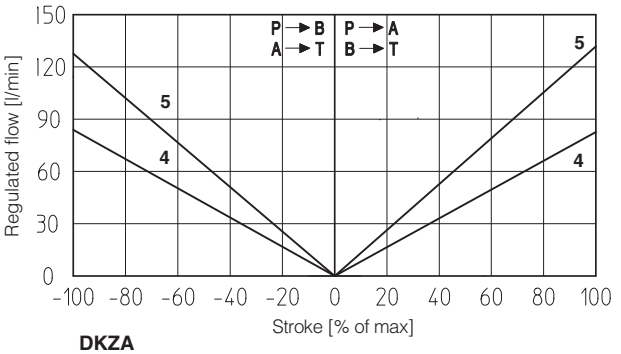
For SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

17 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

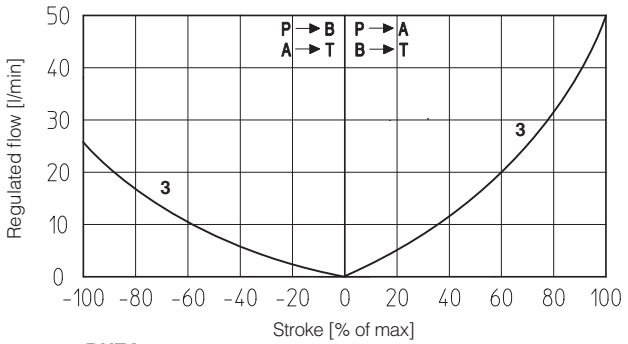
17.1 Regulation diagrams (values measure at Δp 30 bar P-T)



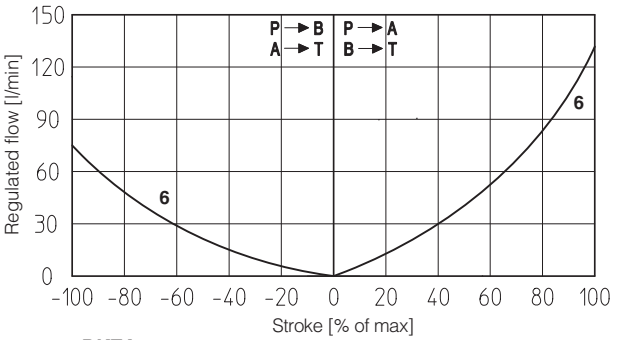
DHZA
1 = L3 **2** = L5



DKZA
4 = L3 **5** = L5



DHZA
3 = D5



DKZA
6 = D5

Note:
Hydraulic configuration vs. reference signal for configurations 71 and 73 (standard and option /B)

Reference signal $\begin{matrix}0 \div +10\ V\\12 \div 20\ mA\end{matrix}\Big\}$ P → A / B → T Reference signal $\begin{matrix}0 \div -10\ V\\12 \div 4\ mA\end{matrix}\Big\}$ P → B / A → T

18 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for controller's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for controller's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 10), depends on controller's reference mode, see section 2 :

External analog reference generation (see 2.1): input is used as reference for the controller axis position closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Fieldbus/internal reference generation (see 2.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.4 Pressure or force reference input signal (F_INPUT+) - only for **SF**, **SL**

Functionality of F_INPUT+ signal (pin 12), depends on selected controllers' reference mode and alternated control options, see section 3 :

SF, SL controls and external analog reference selected : input is used as reference for the controller pressure/force closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

SN control or fieldbus/internal reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.5 Position monitor output signal (P_MONITOR)

The controller generates an analog output signal (pin 9) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the controller (e.g. analog reference, fieldbus reference, position error, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

18.6 Pressure or force monitor output signal (F_MONITOR) - only for **SF**, **SL**

The controller generates an analog output signal (pin 11) according to alternated pressure/force control option:

SN control: output signal is proportional to the actual valve spool position

SF, SL controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the controller (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA.
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

18.7 Enable input signal (ENABLE)

To enable the controller, a 24VDC voltage has to be applied on pin 6.
When the Enable signal is set to zero the controller can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

18.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the controller (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.
Fault output signal can be used as digital output by software selection.

18.9 Position transducer input signal

A position transducer must be always directly connected to the controller. Select the correct controller execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).
Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.
Position analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 19.1).

18.10 Remote pressure/force transducer input signals - only for **SF**, **SL**

Analog remote pressure transducers or load cell can be directly connected to the controller.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 19.2).

19 ACTUATOR'S TRANSDUCER CHARACTERISTICS

19.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controllers, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.
Transducers with analog interface grant simple and cost effective solutions.

19.2 Pressure/force transducers

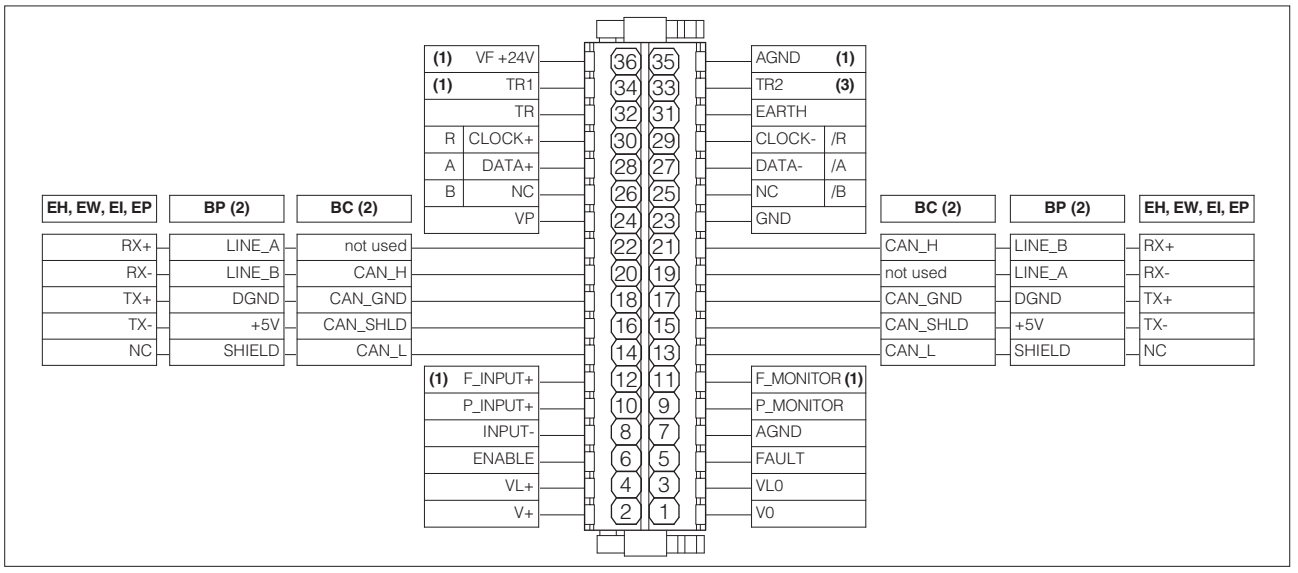
The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section 3 .
Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GX800** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

19.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				Pressure/Force
Execution	A		D		SF, SL
Input type	Potentiometer	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	±10 VDC	+24 VDC	+5 VDC / +24 VDC	+5 VDC / +24 VDC	+24 VDC
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos controller **(2)** Percentage of total stroke **(3)** For Balluff BTL7 with SSI interface only special code SA433 is supported

20 TERMINAL BOARD OVERVIEW



(1) Connections available only for **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) Connection available only for **SF**

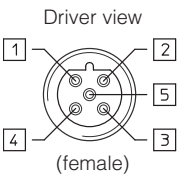
21 ELECTRONIC CONNECTIONS

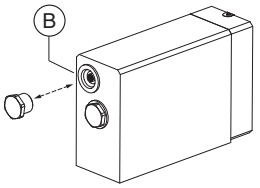
21.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	9	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal (SF, SL controls): ±10 VDC / ±20 mA max. range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

21.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





21.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

21.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

21.5 EH, EW, EI, EP fieldbus execution connections

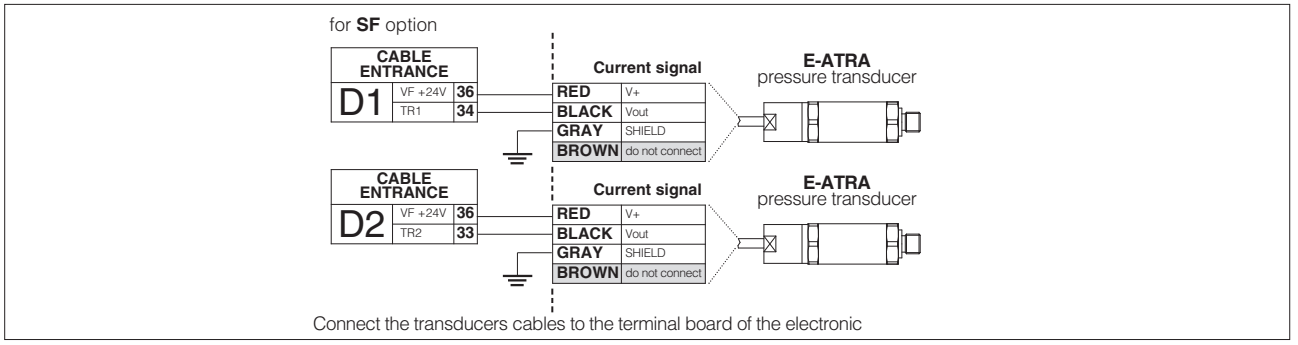
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

21.6 Remote pressure transducer connections - only for **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SL - Single transducer (1) Voltage	SL - Single transducer (1) Current	SF - Double transducers (1) Voltage	SF - Double transducers (1) Current
D1	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
D1	34	**TR1**	1st signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
D2	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
D2	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

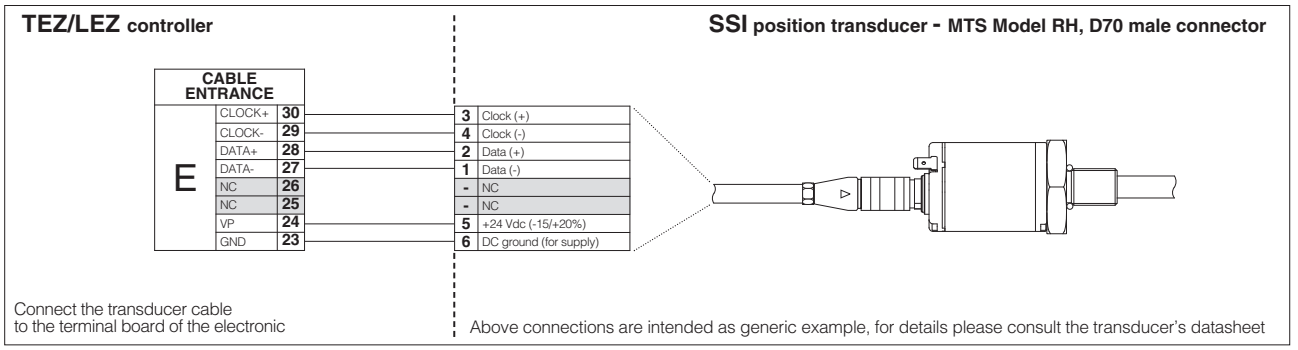


21.7 D execution - Digital position transducers connections

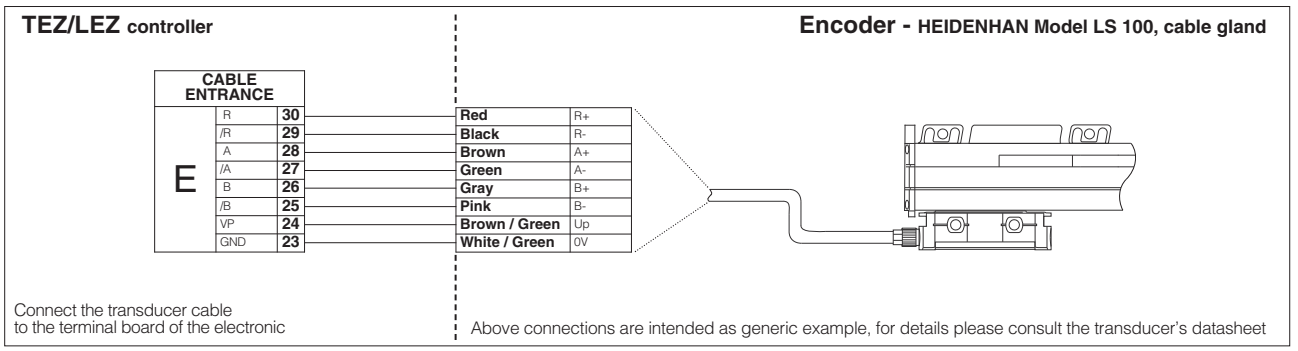
CABLE ENTRANCE	PIN	SSI - default transducer (1)			Encoder (1)		
		SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
E	30	**CLOCK+**	Serial syncronous clock (+)	Input - digital signal	**R**	Input channel R	Input - digital signal
	29	**CLOCK-**	Serial syncronous clock (-)		**/R**	Input channel /R	
	28	**DATA+**	Serial position data (+)		**A**	Input channel A	
	27	**DATA-**	Serial position data (-)		**/A**	Input channel /A	
	26	**NC**	Not connect	Do not connect	**B**	Input channel B	
	25	**NC**			**/B**	Input channel /B	
	24	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	23	**GND**	Common gnd for transducer powerand signals	Common gnd	**GND**	Common gnd for transducer power and signals	Common gnd

(1) Digital position transducer type is software selectable: Encoder or SSI, see 18.9

SSI connection - example



Encoder connection - example



21.8 A execution - Analog position transducers connector

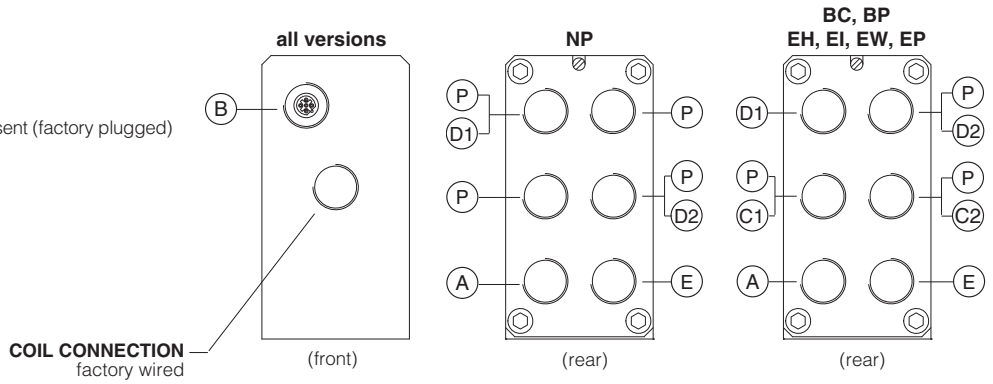
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES
E	32	**TR**	Signal transducer	Input - analog signal
	24	**VP**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	23	**GND**	Common gnd for transducer power and signals	Common gnd

22 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

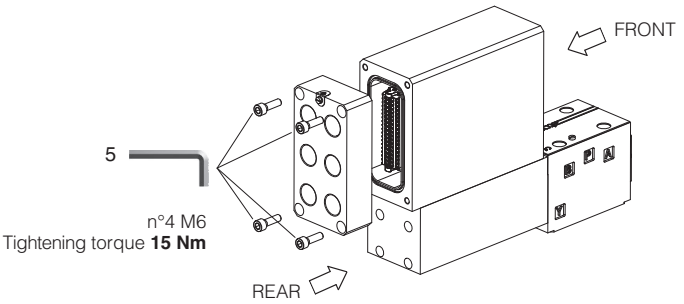
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (E) position transducer
- (P) threaded plug



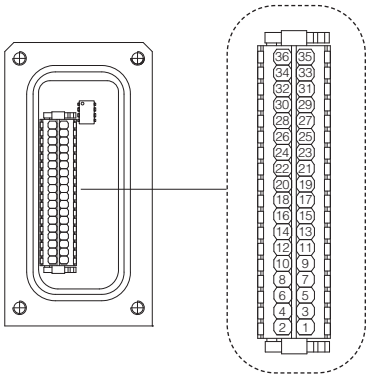
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

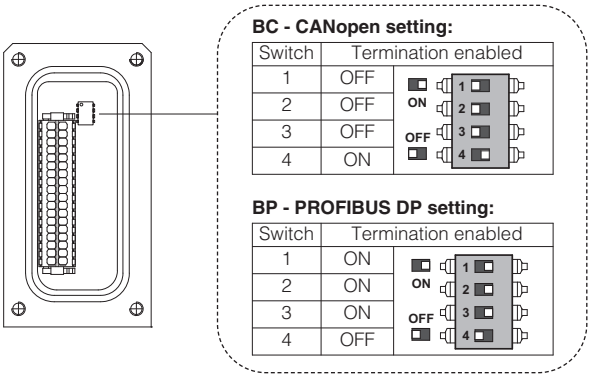


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 20



Fieldbus terminator only for BC and BP executions **(1)**



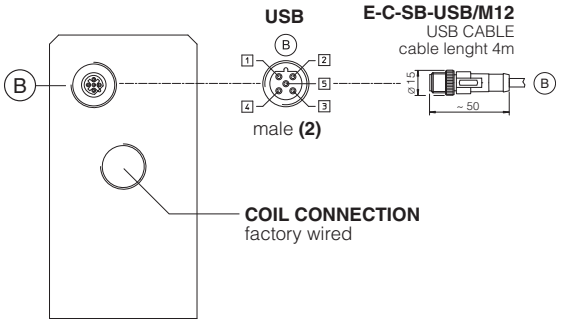
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

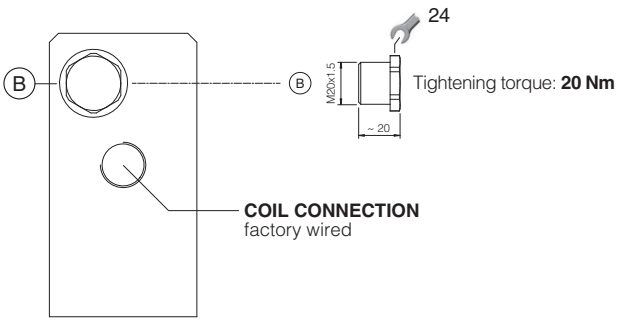
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

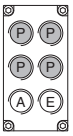
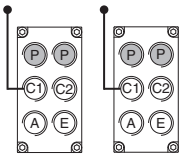
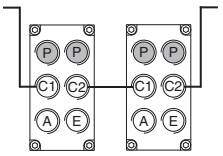


METALLIC PROTECTION CAP - supplied with the valves

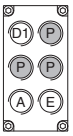
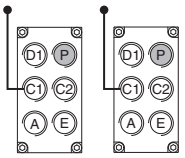
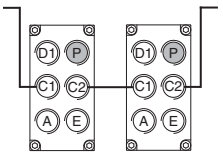


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

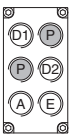
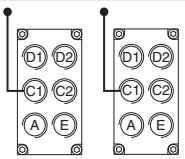
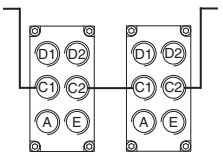
22.1 Cable glands and threaded plug for SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance		
NP	2	A - E	none	none		Cable entrance A, E are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	C1 A - E	1	C2		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged

22.2 Cable glands and threaded plug for SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance		
NP	3	D1 A - E	none	none		Cable entrance A, E, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

22.3 Cable glands and threaded plug for SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance		
NP	4	D1 D2 A - E	none	none		Cable entrance A, E, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	5	D1 - D2 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1, D2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	6	D1 - D2 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1, D2 are open for costumers

23 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:

Z-MAN-RA-LEZ - user manual for **TEZ** and **LEZ** with **SN**
Z-MAN-RA-LEZ-S - user manual for **TEZ** and **LEZ** with **SF**, **SL**

23.1 External reference and transducer parameters

Allow to configure the controller reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

23.2 PID control dynamics parameters

Allow to optimize and adapt the controller closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

23.3 Monitoring parameters

Allow to configure the controller monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 23.4)

23.4 Fault parameters

Allow to configure how the controller detects and reacts to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, controller disabling, etc.)

23.5 Valve characteristics compensation

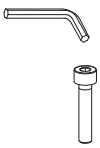
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

23.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

24 FASTENING BOLTS AND SEALS

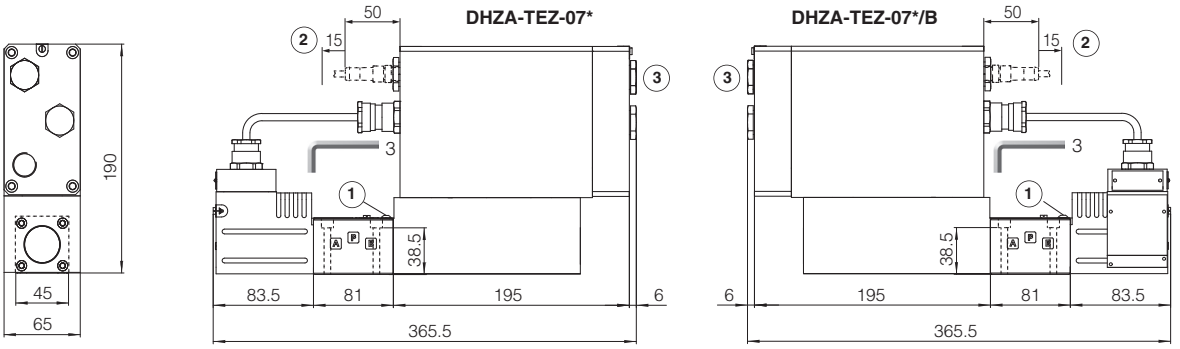
	DHZA	**DKZA**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

25 INSTALLATION DIMENSIONS [mm]

DHZA-TEZ

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface: 4401-03-03-0-05 without port X)

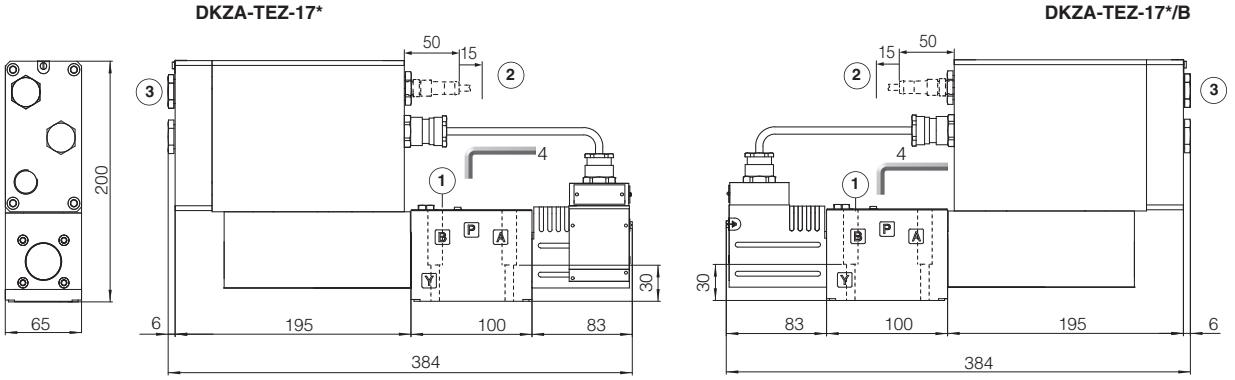
Mass [kg]	
DHZA-TEZ-07	8,9



DKZA-TEZ

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface: 4401-05-05-0-05 without port X)

Mass [kg]	
DKZA-TEZ-17	10,7



(1) = Air bleed off

(2) = Space to remove the USB connector

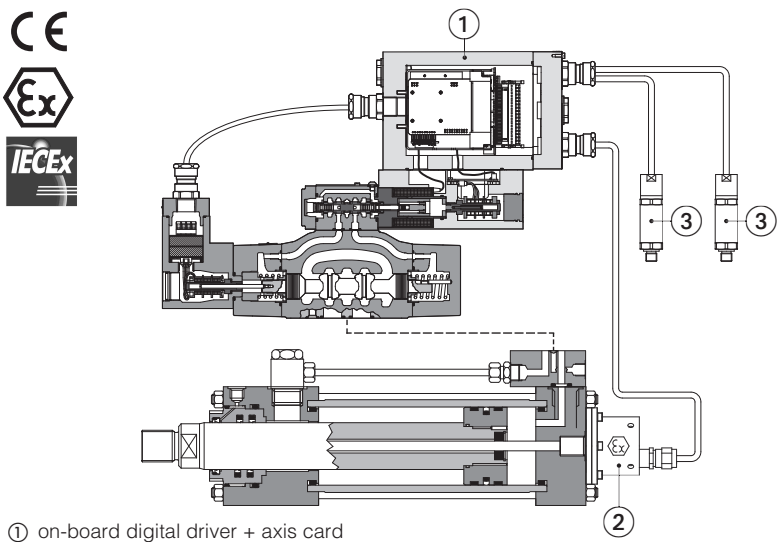
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

26 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900	Operating and manintenance information for ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
GX800	Ex-proof pressure transducer type E-ATRA-7
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportionals with on-board axis card

piloted, with two LVDT transducers and zero spool overlap - **ATEX and IECEx**



① on-board digital driver + axis card
② transducer to feedback the axis position
③ pressure/force transducers

DPZA-LEZ-D-SF-NP-27*

DPZA-LEZ

Ex-proof digital servoproportional valves equipped with on-board driver plus axis card, two LVDT position transducers (pilot valve and main stage) and zero spool overlap to perform the position control of any linear or rotative hydraulic actuator.

They are certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The controlled actuator has to be equipped with integral or external ex-proof transducer (analog, potentiometer, SSI or Encoder) to feedback the axis position.

The valve can be operated by an external or internally generated reference position signal, see section 2.

Options SF, SL add the alternated pressure/force control to the basic position one, see section 3.

Size: **10** ÷ **27** ISO 4401
Max flow: **180** ÷ **800 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPZA	- LEZ	- D	- SN	- NP	- 2	70	- L	5	/ M	/ *	*	/ *

DPZA: Ex-proof servoproportional directional valve, piloted

LEZ = on-board digital driver + axis card, two LVDT transducers

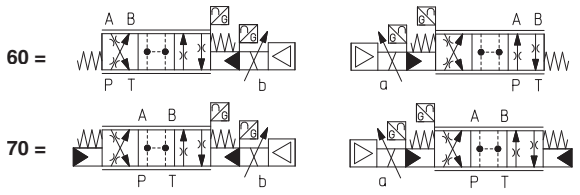
Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

Alternated P/Q controls:
SN = none
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

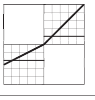
Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27

Configuration: **Standard** Option **/B**



Spool type, regulating characteristics:

L =  linear **T** =  non linear **(2)**

DL =  differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Spool size:

	3 (L)	**5** (L,DL)	**5** (T)
DPZA-1 =	-	100	-
DPZA-2 =	130	200	150
DPZA-4 =	-	340	-
DPZA-4M =	-	390	-

Nominal flow (l/min) at Δp 10bar P-T

Series number

Seals material, see section 10:
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (3):
B = solenoid at side of port A **(1)**
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting (standard for size 10)

Electronic options (3):
C = current feedback for pressure transducer 4÷20 mA, only for **SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Cable entrance threaded connection:
M = M20x1,5

(1) In standard configuration the solenoid with on-board digital driver and position transducer are at side A of main stage (side B of pilot valve)
(2) Only for configuration 70
(3) For possible combined options consult Atos technical office

2 POSITION REFERENCE MODE

2.1 External reference generation

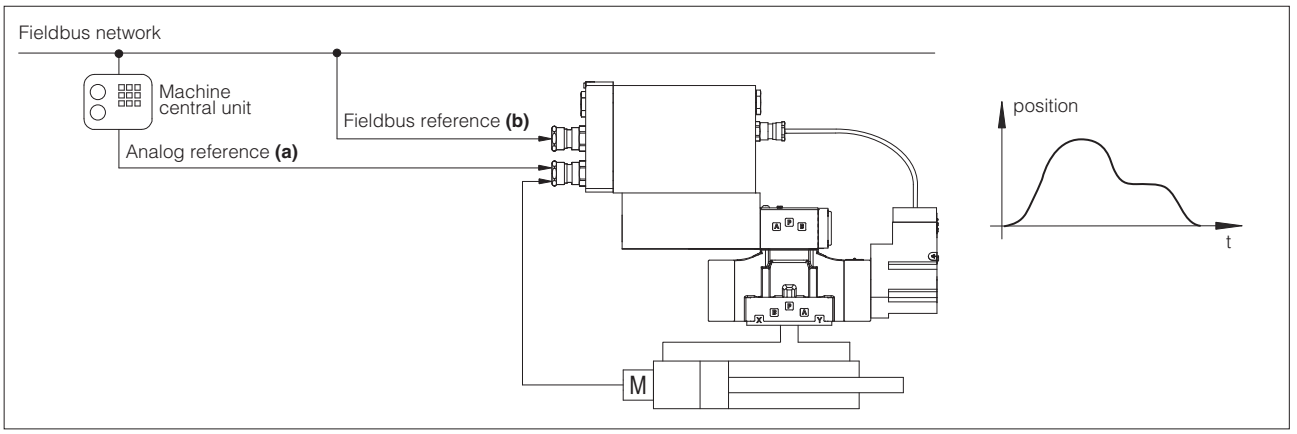
Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer.

The external reference signal can be software selected among:

Analog reference (a) - the controller receives in real time the reference signal from the machine electronic central unit by means analog input on the terminal board.

Fieldbus reference (b) - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication.

For fieldbus communication details, please refer to the controller user manual.



2.2 Internal reference generation

Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.

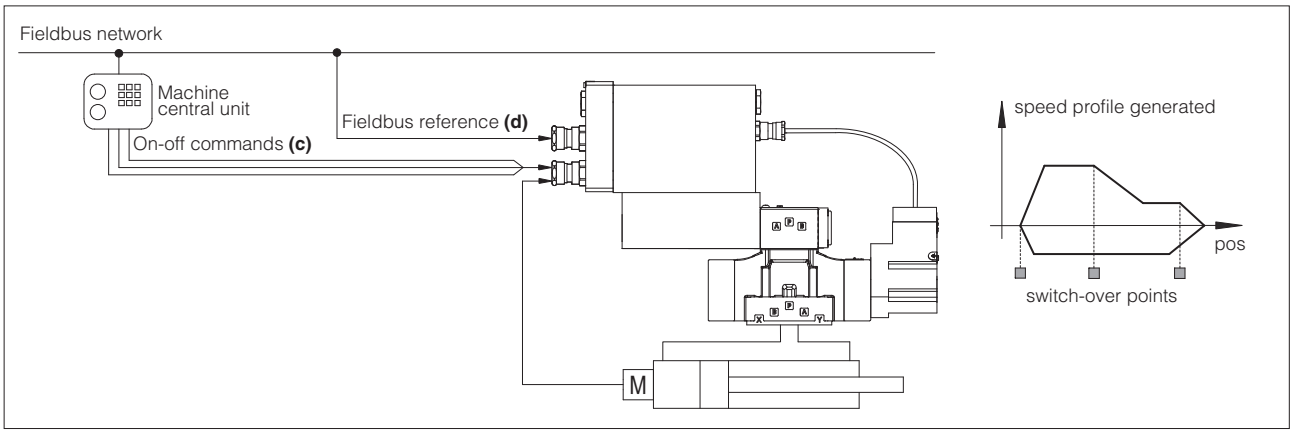
The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means :

*- on-off commands **(c)***

*- fieldbus commands **(d)***

Atos PC software allows to design a customized sequence of motion phases adapted to the specific application requirements: a range of predefined standard sequences are available in the Z-SW software.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.



Start / stop / switch-over commands examples

External digital input	on-off commands, on terminal board, are used to start/stop the cycle generation or to change the motion phase
External fieldbus input	on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase
Switch by position	switch-over from actual to following motion phase occurs when the actual position reaches a programmed value
Switch by time	switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation

Reference generation types examples

Absolute	a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control
Relative	as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software
Time	as 'Absolute' type but the controller automatically determines the speed and acceleration in order to reach the target absolute position in the fixed time internally set by software

3 ALTERNATED POSITION / FORCE CONTROL

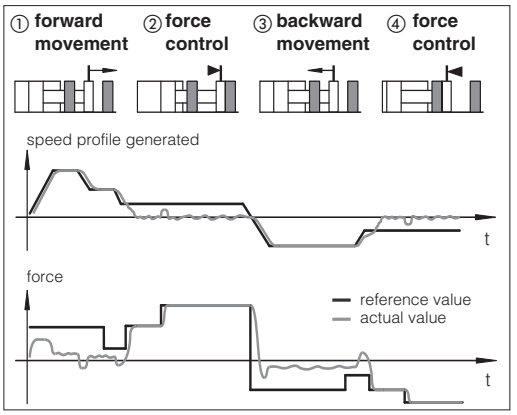
SF and **SL** options add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve driver, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

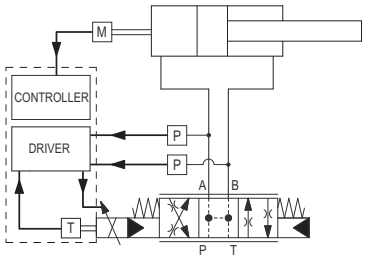
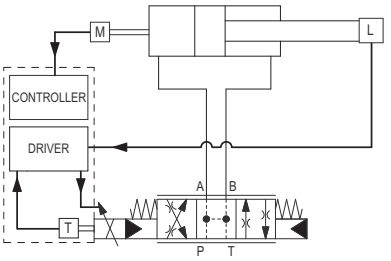
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the controller reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations

SF	SL
	
two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve spool transducer | M actuator position transducer | P pressure transducer | L load cell

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

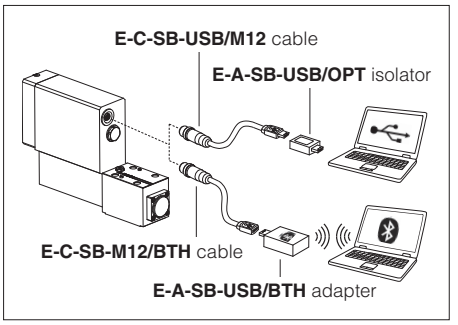
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

Z-SW-FULL support: NP (USB)
BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

Note: Z-SW programming software supports valves with option SF, SL for alternated control

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DPZA-*-1**	**DPZA-*-2**			**DPZA-*-4**	**DPZA-*-4M**
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;					
Spool type		**L5, DL5**	**L3**	**L5, DL5**	**T5**	**L5, DL5**	
Nominal flow [l/min]							
Δp P-T	Δp = 10 bar	100	130	200	150	340	390
	Δp = 30 bar	160	220	350	260	590	670
	Max permissible flow	180	320	440	360	680	800
Δp max P-T	[bar]	50	60	60	60	60	60
Piloting pressure	[bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)					
Piloting volume	[cm³]	1,4	3,7			9,0	11,3
Piloting flow **(1)**	[l/min]	1,7	3,7			6,8	8
Leakage	Pilot [cm³/min]	100/300	150/450			200/600	200/600
(2)	Main stage [l/min]	0,4/1,2	0,6/2,5			1,0/4,0	1,0/4,0
Response time **(1)**	[ms]	≤ 30	≤ 30			≤ 35	≤ 40
Hysteresis		≤ 0,1 [% of max regulation]					
Repeatability		± 0,1 [% of max regulation]					

(1) 0 ÷100 % step signal and pilot pressure 100 bar
(2) at P = 100/350 bar

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Position transducers power supply	+24 VDC @ max 100 mA and +5 VDC @ max 100 mA are software selectable; ±10 VDC @ max 14 mA minimum load resistance 700 Ω			
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the controller energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type	DPZA					
Certifications	Multicertification Group II **ATEX IECEx**					
Solenoid certified code	**OZA-LEZ**					
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X • IECEx: IECEx TPS 19.0004X					
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db • IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db					
Temperature class	**T6**		**T5**		**T4**	
Surface temperature	≤ 85 °C		≤ 100 °C		≤ 135 °C	
Ambient temperature **(2)**	-40 ÷ +40 °C		-40 ÷ +55 °C		-40 ÷ +70 °C	
Applicable Standards	EN 60079-0	EN 60079-1	EN 60079-31	IEC 60079-0	IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5					

(1) The type examinator certificates can be downloaded from www.atos.com

(2) The controller and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

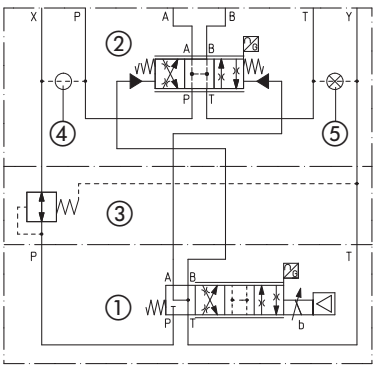
14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port B of the main stage.

D and **E** = Pilot and drain configuration can be modified as shown in section 22.
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:
Option /D Internal drain.
Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZA-2 = 28 bar
DPZA-2, -4 and -4M = 40 bar
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.
Pressure reducing valve is standard for DPZA-1, for other sizes add **/G** option.

FUNCTIONAL SCHEME - example of configuration 70



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

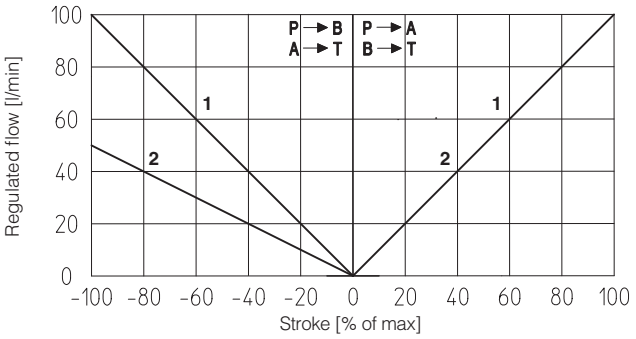
15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

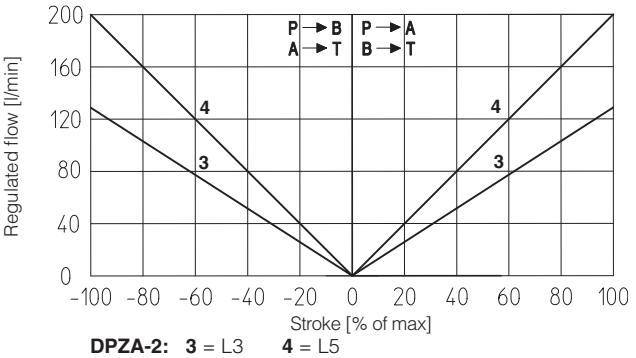
C = Only for **SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

16 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

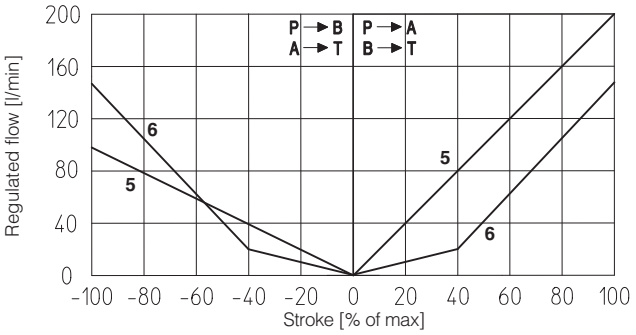
16.1 Regulation diagrams (values measure at Δp 10 bar P-T)



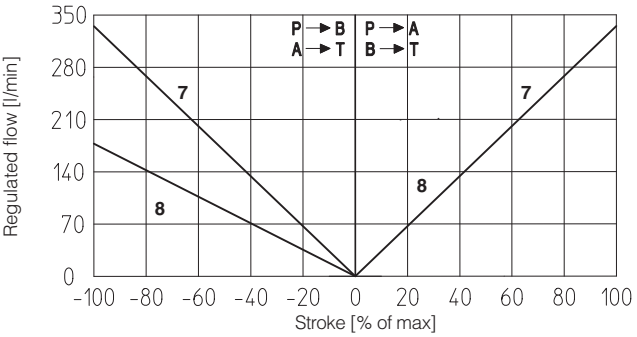
DPZA-1: **1** = L5 **2** = DL5



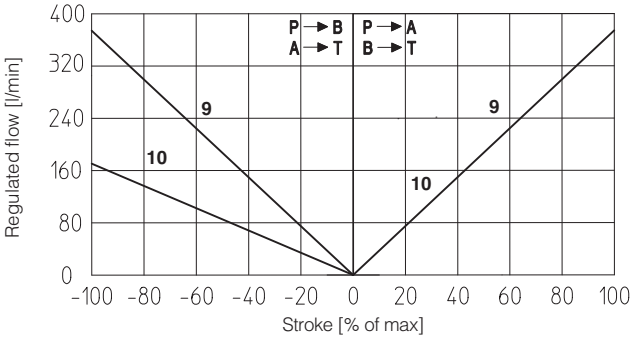
DPZA-2: **3** = L3 **4** = L5



DPZA-2: **5** = DL5 **6** = T5



DPZA-4: **7** = L5 **8** = DL5



DPZA-4M: **9** = L5 **10** = DL5

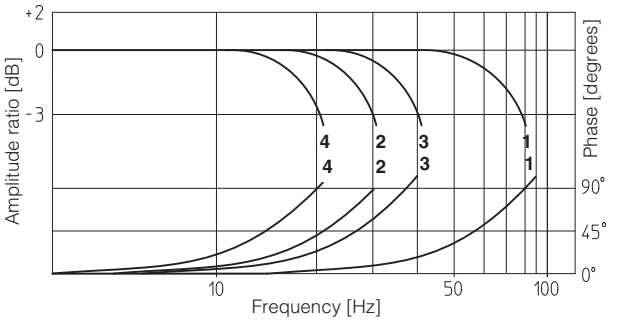
Note: Hydraulic configuration vs. reference signal
for configurations 60 and 70 (standard and option /B)

Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ - 10 V / 4 ÷ 12 mA } P → B / A → T

16.2 Bode diagrams

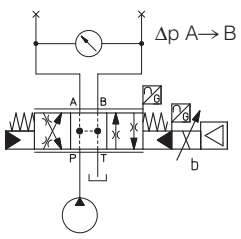
Stated at nominal hydraulic conditions.

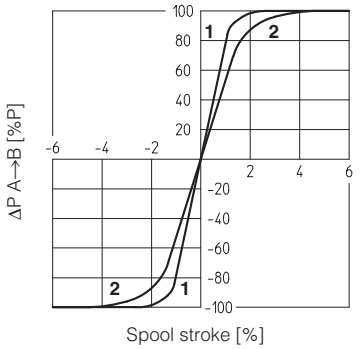


1 = DPZA-1 / DPZA-2 } ± 5% **2** = DPZA-1 / DPZA-2 } ± 100%

3 = DPZA-4 / DPZA-4M } ± 5% **4** = DPZA-4 / DPZA-4M } ± 100%

16.3 Pressure gain





1 = DPZA-1

2 = DPZA-2
DPZA-4
DPZA-4M

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for controller's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for controller's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 10), depends on controller's reference mode, see section 2 :

External analog reference generation (see 2.1): input is used as reference for the controller axis position closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Fieldbus/internal reference generation (see 2.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only for **SF**, **SL**

Functionality of F_INPUT+ signal (pin 12), depends on selected controllers' reference mode and alternated control options, see section 3 :

SF, SL controls and external analog reference selected : input is used as reference for the controller pressure/force closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

SN control or fieldbus/internal reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Position monitor output signal (P_MONITOR)

The controller generates an analog output signal (pin 9) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the controller (e.g. analog reference, fieldbus reference, position error, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for **SF**, **SL**

The controller generates an analog output signal (pin 11) according to alternated pressure/force control option:

SN control: output signal is proportional to the actual valve spool position

SF, SL controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the controller (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA.
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE)

To enable the controller, a 24VDC voltage has to be applied on pin 6.
When the Enable signal is set to zero the controller can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

17.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the controller (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.
Fault output signal can be used as digital output by software selection.

17.9 Position transducer input signal

A position transducer must be always directly connected to the controller. Select the correct controller execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).
Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.
Position analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 18.1).

17.10 Remote pressure/force transducer input signals - only for **SF**, **SL**

Analog remote pressure transducers or load cell can be directly connected to the controller.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 18.2).

18 ACTUATOR'S TRANSDUCER CHARACTERISTICS

18.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controllers, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.
Transducers with analog interface grant simple and cost effective solutions.

18.2 Pressure/force transducers

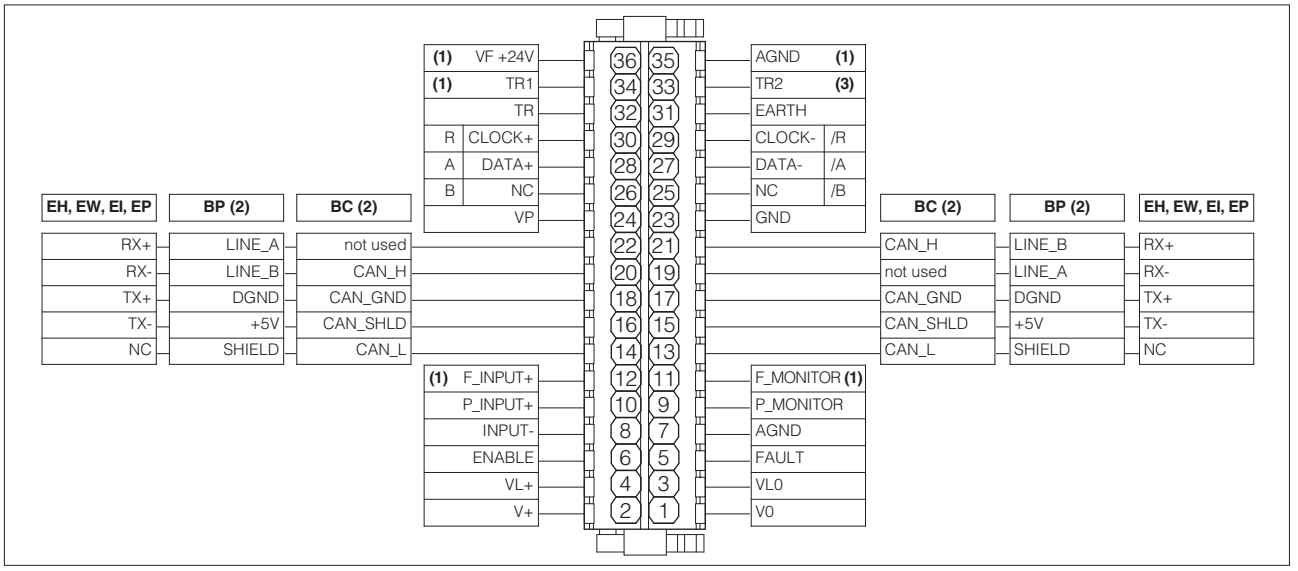
The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section 3 .
Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GX800** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

18.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				**Pressure/Force**
Execution	**A**		**D**		**SF, SL**
Input type	Potentiometer	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	±10 VDC	+24 VDC	+5 VDC / +24 VDC	+5 VDC / +24 VDC	+24 VDC
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos controller **(2)** Percentage of total stroke **(3)** For Balluff BTL7 with SSI interface only special code SA433 is supported

19 TERMINAL BOARD OVERVIEW



(1) Connections available only for **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) Connection available only for **SF**

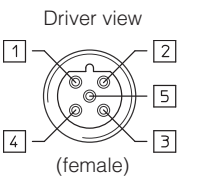
20 ELECTRONIC CONNECTIONS

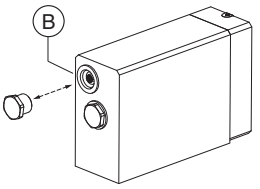
20.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	9	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal (SF, SL controls): ±10 VDC / ±20 mA max. range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

20.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





20.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

20.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

20.5 EH, EW, EI, EP fieldbus execution connections

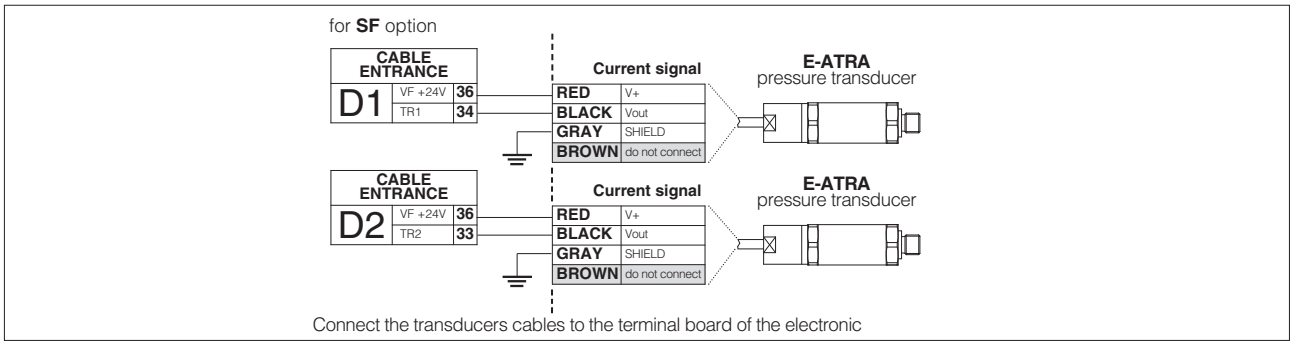
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

20.6 Remote pressure transducer connections - only for **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SL - Single transducer (1)		SF - Double transducers (1)	
					Voltage	Current	Voltage	Current
D1	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
D2	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

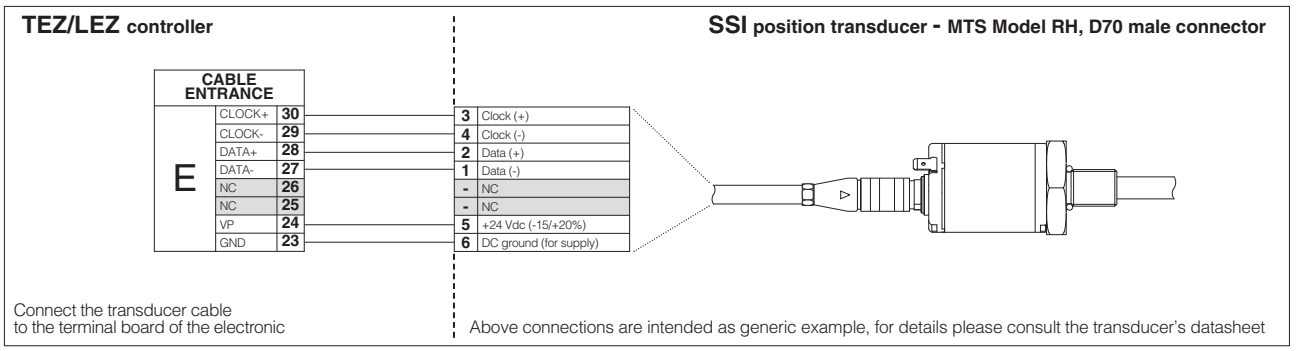


20.7 D execution - Digital position transducers connections

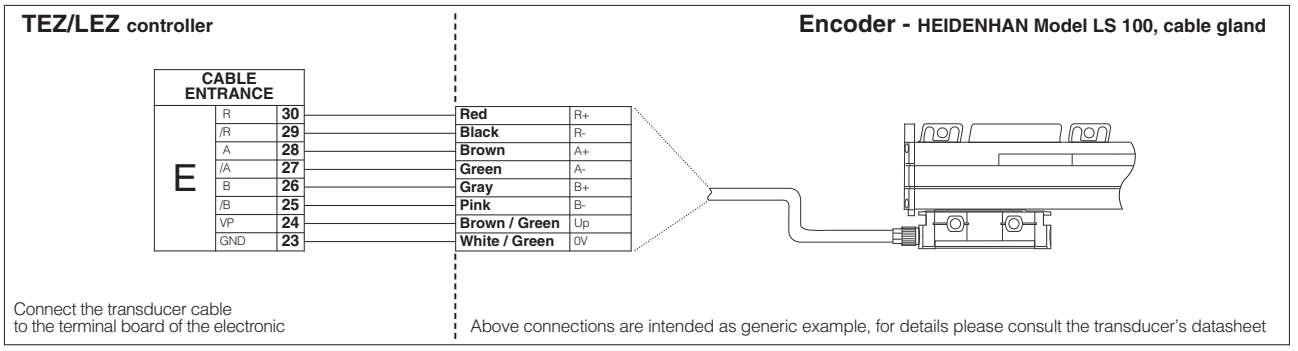
CABLE ENTRANCE	PIN	SSI - default transducer (1)			Encoder (1)		
		SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
E	30	**CLOCK+**	Serial syncronous clock (+)	Input - digital signal	**R**	Input channel R	Input - digital signal
	29	**CLOCK-**	Serial syncronous clock (-)		**/R**	Input channel /R	
	28	**DATA+**	Serial position data (+)		**A**	Input channel A	
	27	**DATA-**	Serial position data (-)		**/A**	Input channel /A	
	26	**NC**	Not connect	Do not connect	**B**	Input channel B	
	25	**NC**			**/B**	Input channel /B	
	24	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	23	**GND**	Common gnd for transducer powerand signals	Common gnd	**GND**	Common gnd for transducer power and signals	Common gnd

(1) Digital position transducer type is software selectable: Encoder or SSI, see 17.9

SSI connection - example



Encoder connection - example



20.8 A execution - Analog position transducers connector

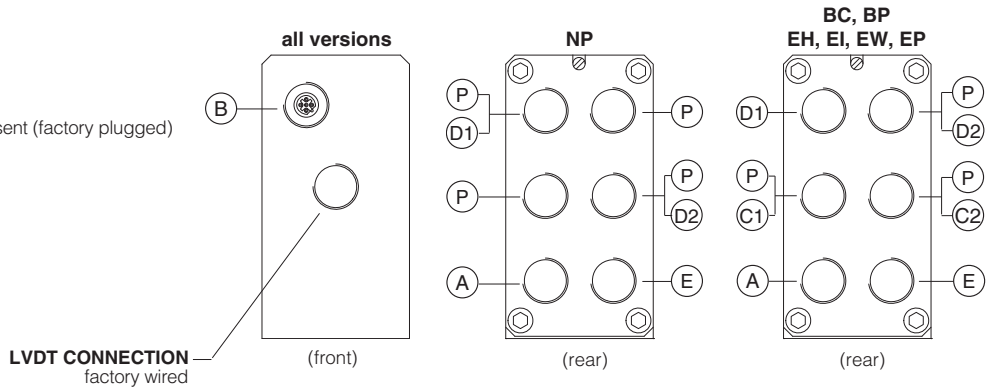
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES
E	32	**TR**	Signal transducer	Input - analog signal
	24	**VP**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	23	**GND**	Common gnd for transducer power and signals	Common gnd

21 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

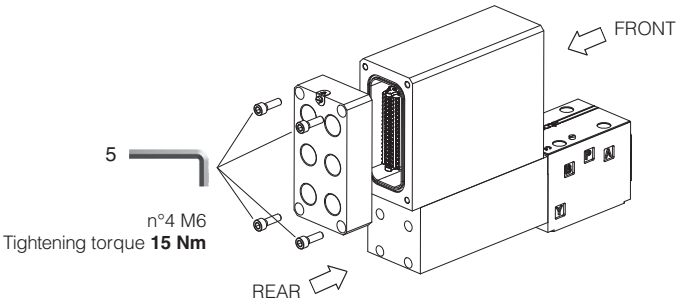
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (E) position transducer
- (P) threaded plug



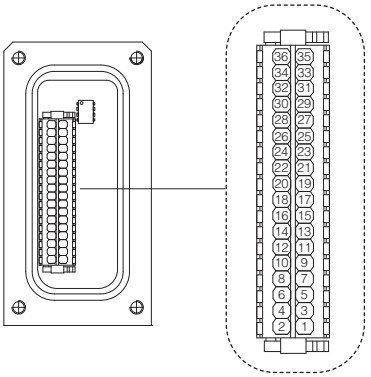
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

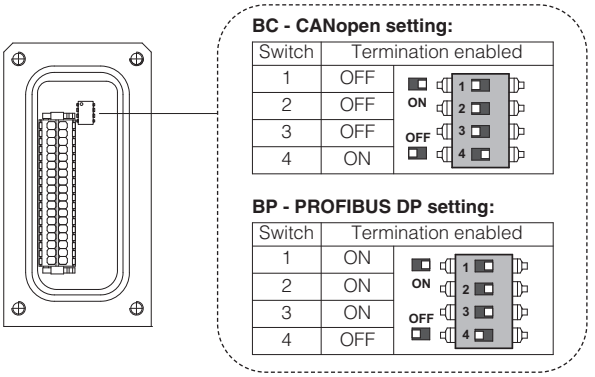


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 19



Fieldbus terminator only for BC and BP executions **(1)**



BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

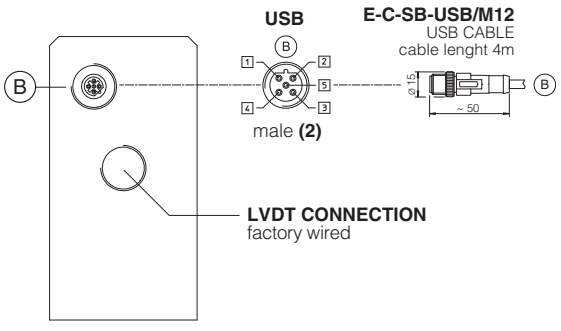
ON / OFF

BP - PROFIBUS DP setting:

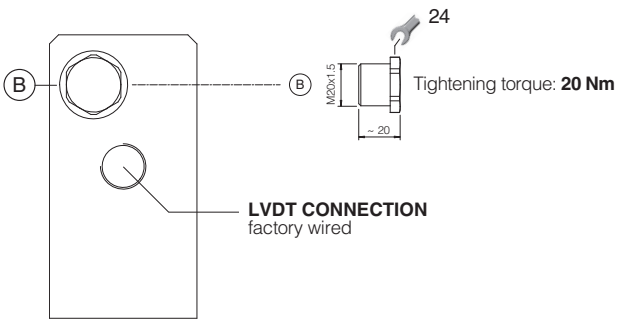
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

ON / OFF

USB CONNECTOR

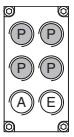
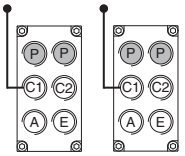
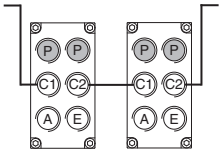


METALLIC PROTECTION CAP - supplied with the valves

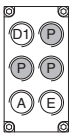
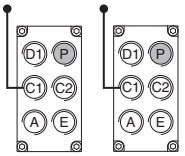
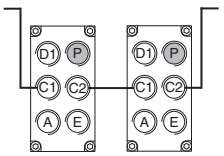


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

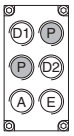
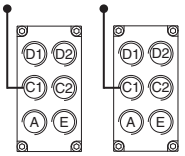
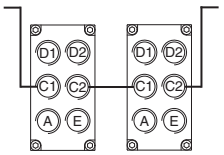
21.1 Cable glands and threaded plug for SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	2	A - E	none	none		Cable entrance A, E are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	C1 A - E	1	C2		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged

21.2 Cable glands and threaded plug for SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	3	D1 A - E	none	none		Cable entrance A, E, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

21.3 Cable glands and threaded plug for SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	4	D1 D2 A - E	none	none		Cable entrance A, E, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	5	D1 - D2 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1, D2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	6	D1 - D2 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1, D2 are open for costumers

22 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:

Z-MAN-RA-LEZ - user manual for **TEZ** and **LEZ** with **SN**
Z-MAN-RA-LEZ-S - user manual for **TEZ** and **LEZ** with **SF**, **SL**

22.1 External reference and transducer parameters

Allow to configure the controller reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

22.2 PID control dynamics parameters

Allow to optimize and adapt the controller closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

22.3 Monitoring parameters

Allow to configure the controller monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 22.4)

22.4 Fault parameters

Allow to configure how the controller detects and reacts to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, controller disabling, etc.)

22.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

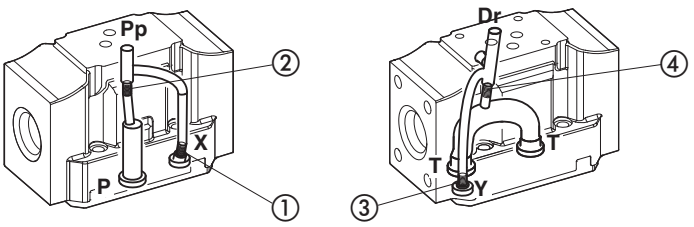
22.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

23 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

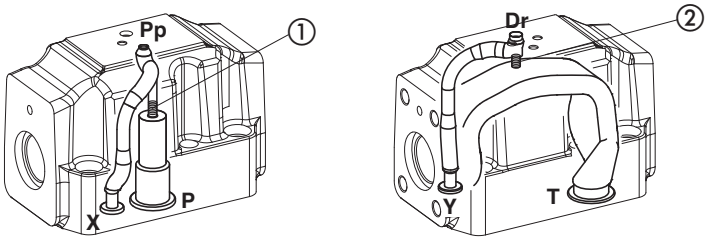
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZA-1 **Pilot channels** **Drain channels**



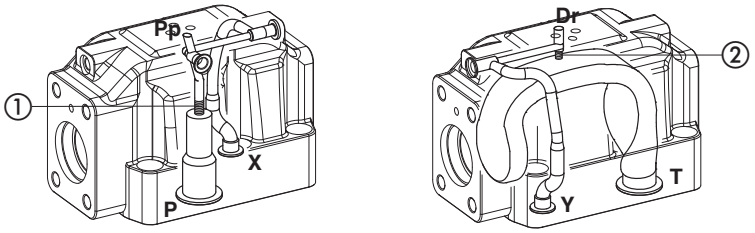
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 **Pilot channels** **Drain channels**



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4 **Pilot channels** **Drain channels**



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

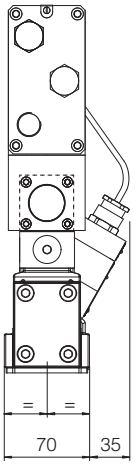
24 FASTENING BOLTS AND SEALS

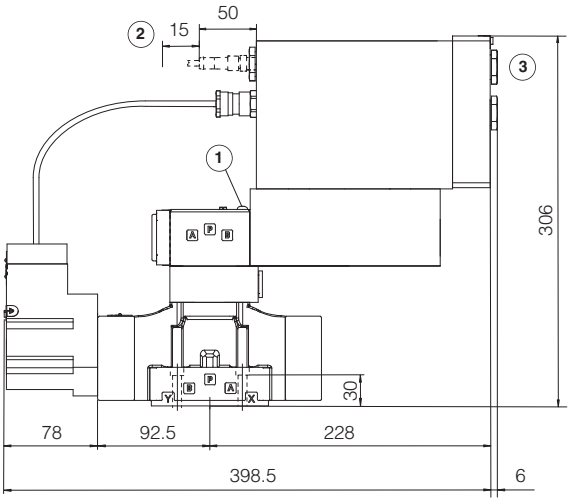
Type	Size	Fastening bolts	Seals
DPZA	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

DPZA-LEZ-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)

Mass [kg]	
DPZA-*-17*	13,7
Option /G	+0,9

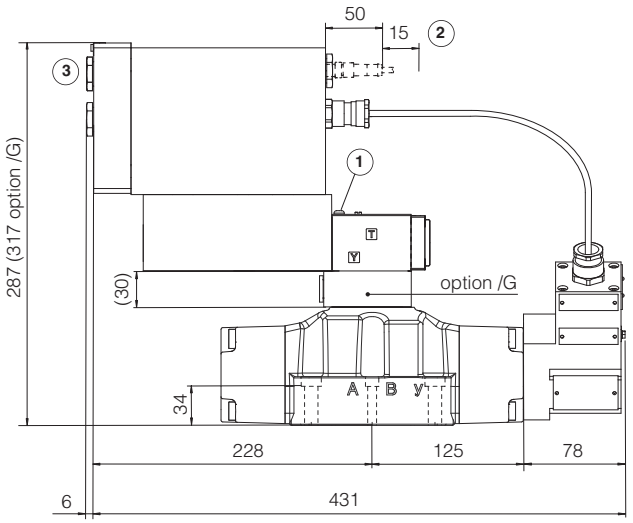


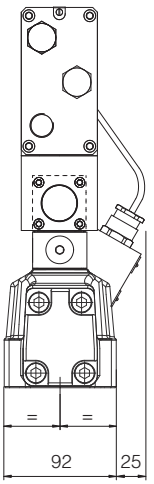


DPZA-LEZ-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
(see table P005)

Mass [kg]	
DPZA-*-27*	17,9
Option /G	+0,9





(1) = Air bleed off

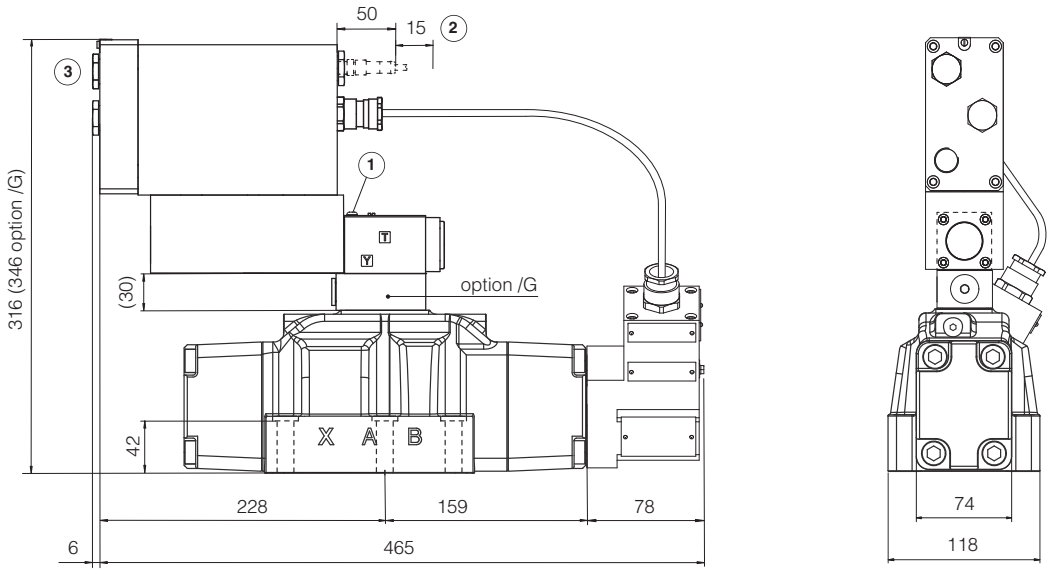
(2) = Space to remove the USB connector

(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

DPZA-LEZ-*-4
DPZA-LEZ-*-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
(see table P005)

Mass [kg]	
DPZA-*-4*	23,1
DPZA-*-4M*	23,1
Option /G	+0,9



(1) = Air bleed off

(2) = Space to remove the USB connector

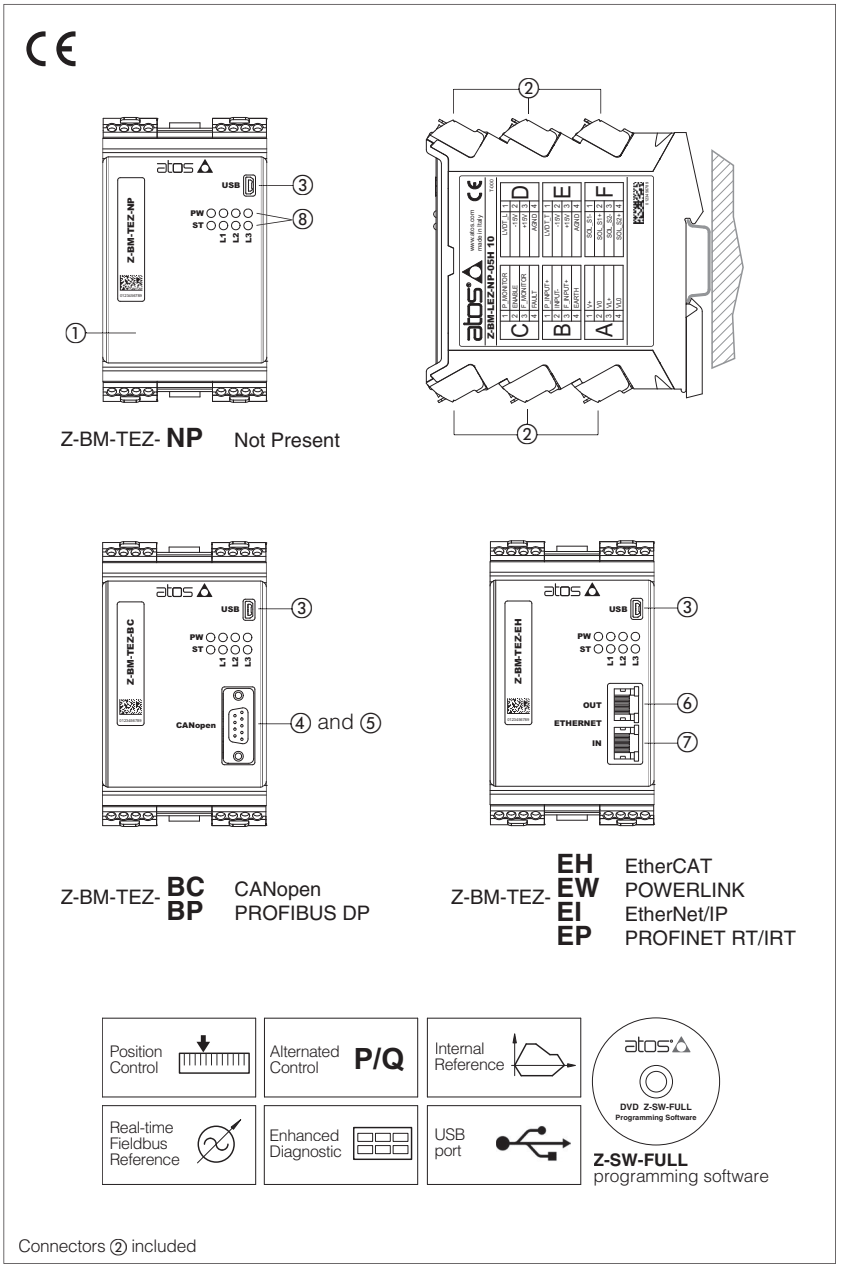
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

26 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX900	Operating and manintenance information for ex-proof proportional valves	**KX800**	Cable glands for ex-proof valves
GS500	Programming tools	**P005**	Mounting surfaces for electrohydraulic valves

Digital Z-BM-TEZ/LEZ axis cards with driver functionality

DIN-rail format, for position and force controls



Z-BM-TEZ/LEZ

Digital axis cards ① perform the driver functions for proportional valves plus the position closed loop control of the linear or rotative actuator to which the proportional valve is connected.

Z-BM-TEZ execution controls direct and pilot operated directional valves with one LVDT transducer.

Z-BM-LEZ execution controls directional pilot operated valves with two LVDT transducers.

The controlled actuator has to be equipped with integral or external position transducer (analog, SSI or Encoder) to feedback the axis position.

The controller is operated by an external or internally generated reference position signal (see section 4).

A pressure/force alternated control may be set by software additionally to the position control: a pressure/force transducer has to be assembled into the actuator and connected to the controller; a second pressure/force reference signal is required.

Atos PC software allows to customize the controller configuration to the specific application requirements.

Electrical Features:

- up to 11 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 8.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Internal generation of motion cycle
- Setting of axis's dynamic response (PID) to optimize the application performances
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Complete diagnostics of axis status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

Z-BM	-	TEZ	-	NP	-	01H	/	*	*	/	*

Z-BM — Off-board electronic axis card in DIN rail format

TEZ = digital full driver + axis card, for valves with one LVDT transducer
LEZ = digital full driver + axis card, for valves with two LVDT transducers

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

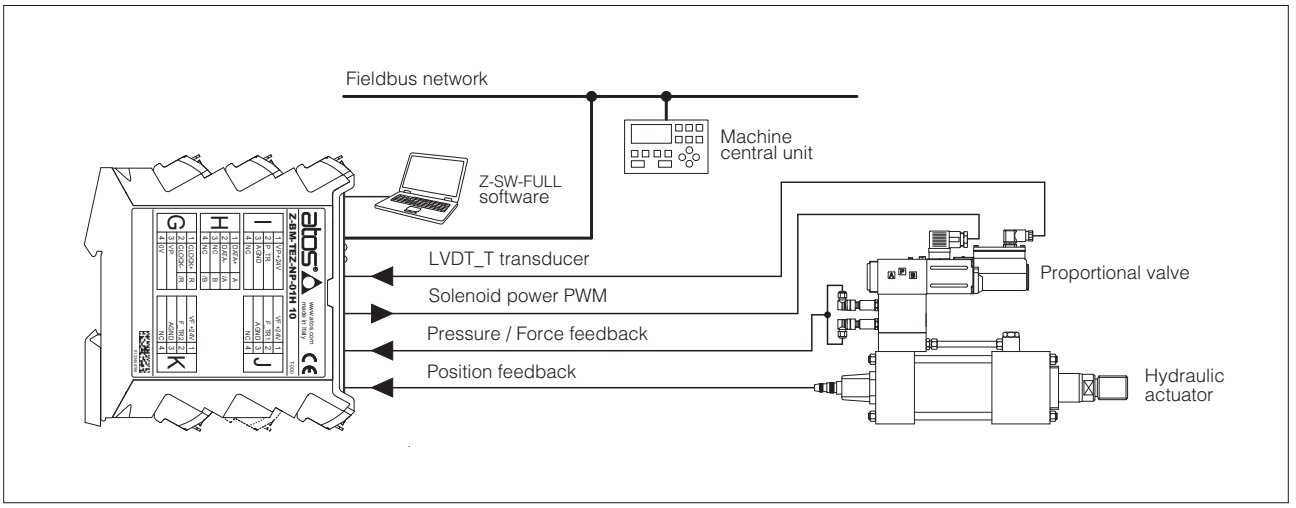
01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TEZ**)

Options, see section 3 :
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for LVDT transducers, only in combination with option A

Series number

Set code (see section 9)

2 BLOCK DIAGRAM EXAMPLE



Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

Valves	Directional		
Standard Data sheet	**DHZO-T, DKZOR-T** F165	**DLHZO-T, DLKZOR-T** F180	**DPZO-L** F175
Ex-proof Data sheet	-	**DLHZA-T, DLKZA-T** FX140	-
Controller model	**Z-BM-TEZ**		**Z-BM-LEZ**

4 POSITION REFERENCE MODE

4.1 External reference generation

Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer.

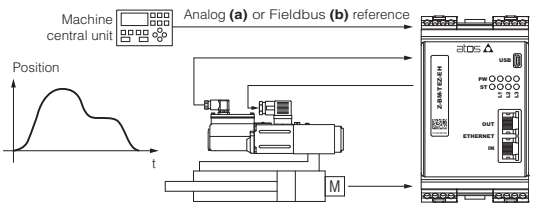
The external reference signal can be software selected among:

Analog reference (a) - the controller receives in real time the reference signal from the machine electronic central unit by means analog input (see 8.2) limiting speed, acceleration and deceleration values.

Fieldbus reference (b) - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication limiting speed, acceleration and deceleration values.

For fieldbus communication details, please refer to the controller user manual.

External reference generation



4.2 Internal reference generation

Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer. The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means of:

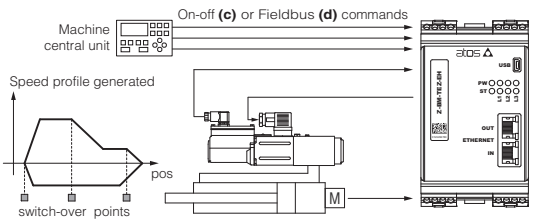
- on-off commands ***(c)***

- fieldbus commands ***(d)***

Atos PC software allows to design a customized sequence of motion phases through a range of pre-defined standard commands.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.

Internal reference generation



Start / stop / switch-over commands examples

External digital input	on-off commands are used to start/stop the cycle generation or to change the motion phase
External fieldbus input	on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase
Switch by position	switch-over from actual to following motion phase occurs when the actual position reaches a programmed value
Switch by time	switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation
Switch by internal status	switch-over from internal status are used to start/stop the cycle generation or to change the motion phase

Reference generation types examples

Absolute	a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control
Relative	as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software

5 ALTERNATED POSITION / FORCE CONTROL

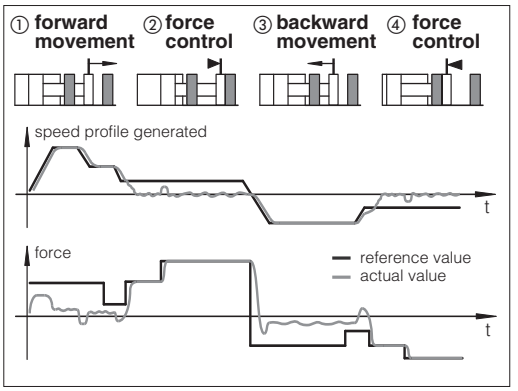
Alternated pressure or force closed loop control can be added to the actuator's standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

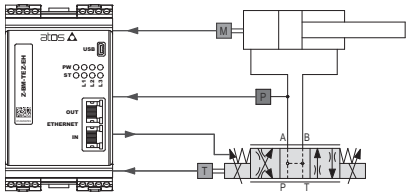
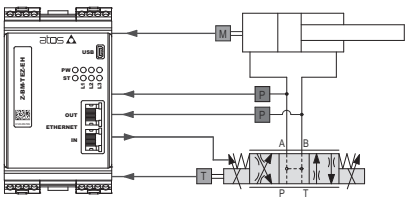
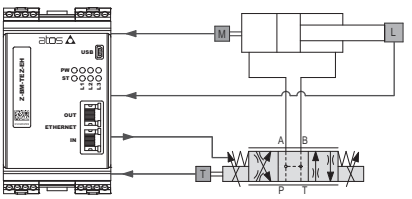
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the controller reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations - software selectable

SP	SF	SL
		
one remote pressure transducer has to be installed on the actuator's port to be controlled	two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve's spool transducer M actuator's position transducer P pressure transducer L load cell

SP – position/pressure control
Adds pressure control to standard position control and permits to limit the max force in one direction controlling in closed loop the pressure acting on one side of the hydraulic actuator. A single pressure transducer has to be installed on hydraulic line to be controlled.

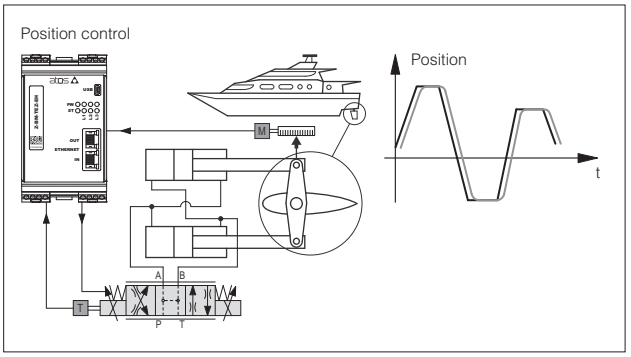
SF – position/force control
Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

SL – position/force control
Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

General Notes:

- servoproportional type DLHZO, DLKZOR and DPZO-L are strongly recommended for high accuracy applications see tech tables **F180**, **F175**
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault, see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **GS002**
- Atos technical service is available for additional evaluations related to specific applications usage

6 APPLICATION EXAMPLES

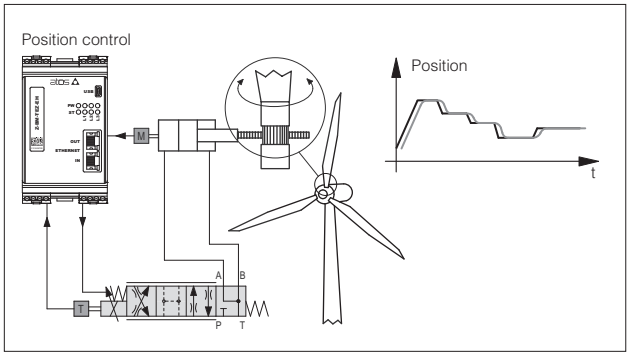


Hydraulic steering wheel in marine applications

Rudder controls on motor yachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-TEZ/LEZ controllers perform the rudder position control system, ensuring accurate and repetitive regulations for a comfortable ride, thanks to:

- analog position reference mode for real time controls
- analog position transducer for simple and compact solution
- position PID control parameters to optimize the system response
- complete diagnostic information for advanced system monitoring

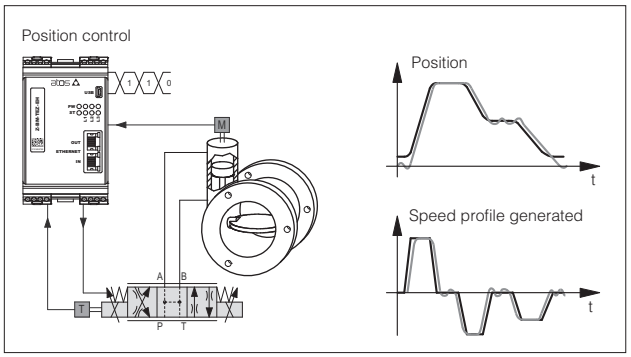


Wind turbines

The pitch control of the rotor blades is required to maximize the energy production. Accurate positioning, decentralized intelligence as well as long service life and reliability are required.

Z-BM-TEZ/LEZ controllers perform high quality regulation of the blade pitch simplifying the system architecture, thanks to:

- SSI digital position transducer for high precision control
- complete remote system management with fieldbus interface
- position PID selection to adapt the position control to the different wind conditions

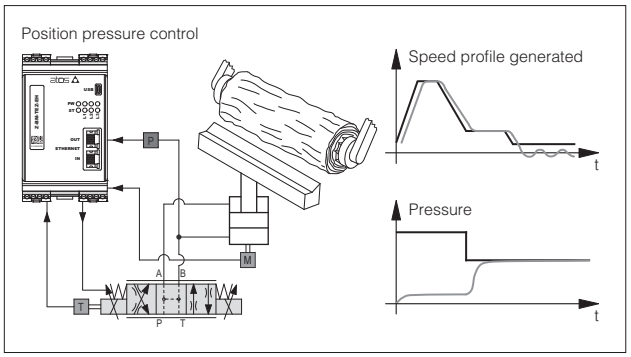


Process valves

Process valves motion regulation requires smooth and remote controls due to wide distributed applications.

Z-BM-TEZ/LEZ controllers allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings for standing alone axis control
- potentiometer position transducer for compact and cost effective solution
- fieldbus connection for easy parameterization and remote commands

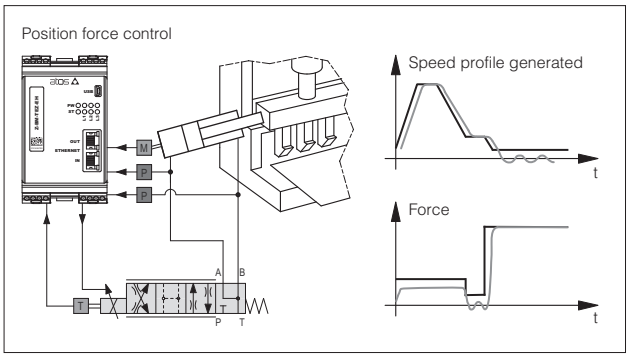


Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

Z-BM-TEZ/LEZ controllers allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings
- analog position transducer for simple and reliable solution
- pressure transducer for alternated pressure control
- fieldbus connection for remote parameterization, commands, and controller state indication

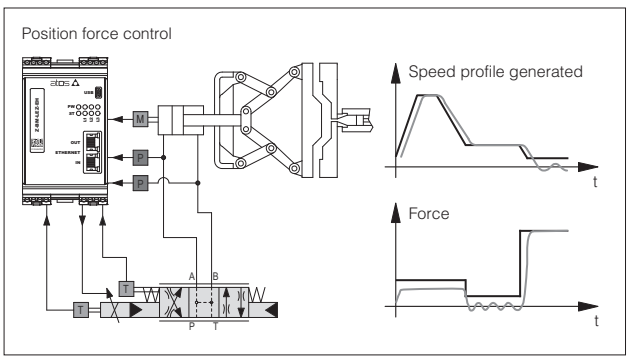


Bending Machines

Machine tools for cold-forming flat sheets require complete, automatic, programmable and flexible machine control to produce sheet metal panels from punched blank.

Z-BM-TEZ/LEZ controller combine high level position regulation with accurate force control to provide in a single device a complete and dedicated solution, thanks to:

- internal reference generation to simplify the machine control cycle
- digital position sensor for high resolution measurement system
- two pressure transducers for alternated force control
- fieldbus interface for easy machine control integration
- auxiliary digital outputs for system status indication (target reached, force control active)



Die-casting machinery

Clamp movements in die-casting phases involve fast/slow motion cycle with accurate and repetitive alternated position/force controls for the mould safety functions.

Z-BM-TEZ/LEZ controllers, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:

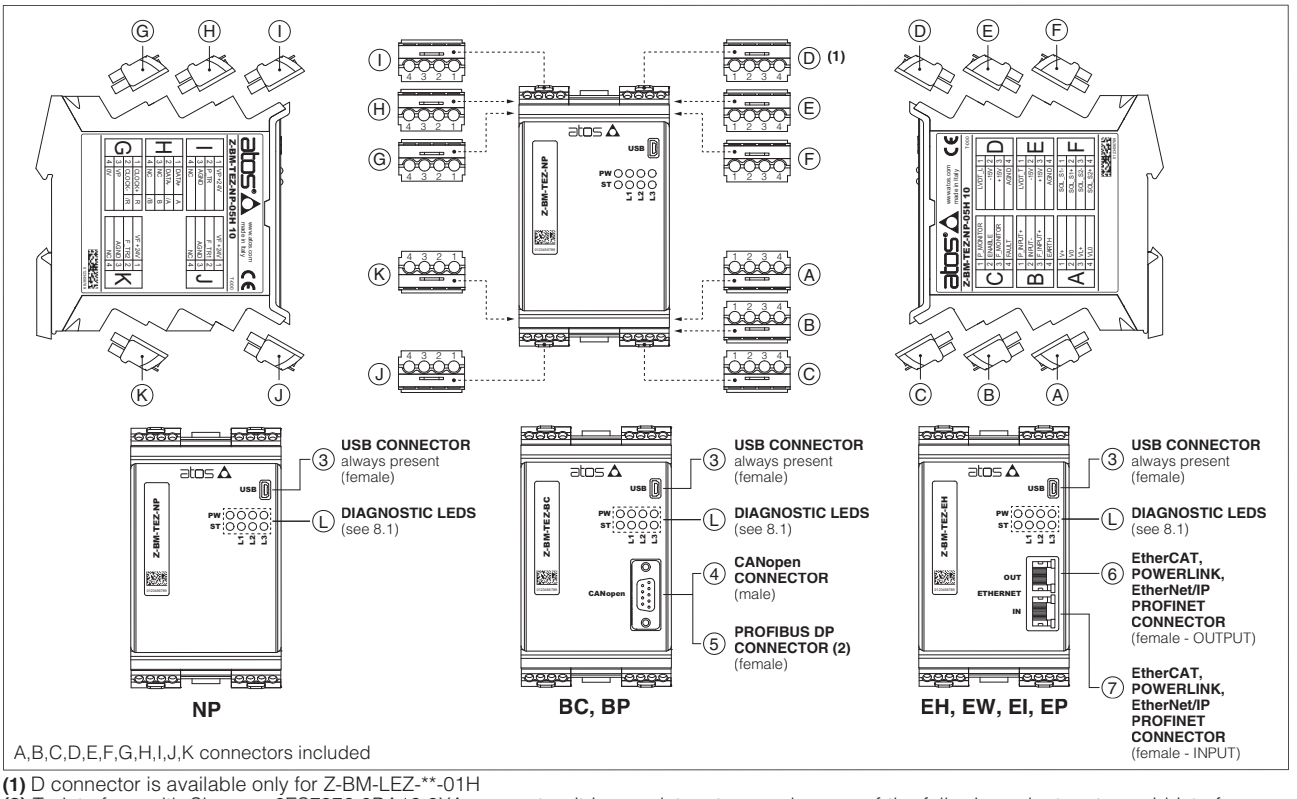
- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics

7 MAIN CHARACTERISTICS

Power supplies (see 10.1, 10.2)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)				
Max power consumption	50 W				
Current supplied to solenoids	IMAX = 3.0 A for standard driver IMAX = 2.5 A for ex-proof driver (**/A option**)				
Analog input signals (see 10.3, 10.4)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω				
Monitor outputs (see 10.5, 10.6)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance				
Enable input (see 10.7)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ				
Fault output (see 10.8)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)				
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, position control monitoring, valve spool transducer malfunctions, alarms history storage function				
Position transducers power supply	+24 VDC @ max 100 mA or +5 VDC @ max 100 mA are software selectable				
Pressure/Force transducers power supply	+24 VDC @ max 100 mA				
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715				
Operating temperature	-20 ÷ +50 °C (storage -25 ÷ +85 °C)				
Mass	Approx. 450 g				
Additional characteristics	8 leds for diagnostic; protection against reverse polarity of power supply				
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)				
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006				
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX	
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet				
Max conductor size (see 15)	2,5 mm²				

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

8 CONNECTIONS AND LEDS



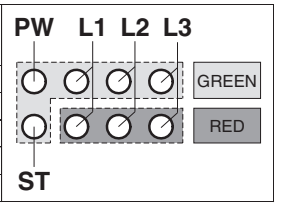
(1) D connector is available only for Z-BM-LEZ-**-01H

(2) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector: DG909MF1 - the connector will be oriented upwards; DG909MF3 - the connector will be oriented downwards

8.1 Diagnostic LEDs (L)

Eight leds show controller operative conditions for immediate basic diagnostics. Please refer to the controler user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET
L1	VALVE STATUS			LINK/ACT			
L2	NETWORK STATUS			NETWORK STATUS			
L3	SOLENOID STATUS			LINK/ACT			
PW	OFF = Power supply OFF		ON = Power supply ON				
ST	OFF = Fault present		ON = No fault				



8.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 10.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 10.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 VDC for driver's logic and communication (see 10.2)	Input - power supply
	A4	**VL0**	Power supply 0 VDC for driver's logic and communication (see 10.2)	Gnd - power supply
B	B1	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range. default is ±10 VDC (see 10.3)	Input - analog signal **Software selectable**
	B2	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	B3	**F_INPUT+**	Pressure/Force reference input signal (SP, SF, SL controls): ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 10.4)	Input - analog signal **Software selectable**
	B4	**EARTH**	Connect to system ground	
C	C1	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND; default is ±10 VDC (see 10.5)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the controller, referred to VL0 (see 10.7)	Input - on/off signal
	C3	**F_MONITOR**	Pressure/Force (SP, SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND; default is ±10 VDC (see 10.6)	Output - analog signal **Software selectable**
	C4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 10.8)	Output - on/off signal
D (1)	D1	**LVDT_L**	Main stage valve position transducer signal (see 10.11)	Input - analog signal
	D2	**-15V**	Main stage valve position transducer power supply -15V	Output power supply
	D3	**+15V**	Main stage valve position transducer power supply +15V	Output power supply
	D4	**AGND**	Common gnd for transducer power and monitor outputs	Common gnd
E	E1	**LVDT_T**	Direct valve or pilot valve position transducer signal (see 10.11)	Input - analog signal
	E2	**-15V**	Direct valve or pilot valve position transducer power supply -15V	Output power supply
	E3	**+15V**	Direct valve or pilot valve position transducer power supply +15V	Output power supply
	E4	**AGND**	Common gnd for transducer power and monitor outputs	Common gnd
F	F1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	F2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	F3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	F4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM
G	G1	Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4		
	G2			
	G3			
	G4			
H	H1	Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4		
	H2			
	H3			
	H4			
I	I1	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	I2	**P_TR1**	Analog position transducer input signal ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 10.9)	Input - analog signal **Software selectable**
	I3	**AGND**	Common gnd for transducer power and signals	Common gnd
	I4	**NC**	Do not connect	
J	J1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	J2	**F_TR1**	1st signal pressure/force transducer: ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 10.10)	Input - analog signal **Software selectable**
	J3	**AGND**	Common gnd for transducer power and signals	Common gnd
	J4	**NC**	Do not connect	
K	K1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	K2	**F_TR2**	2nd signal pressure transducer (only for SF): ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 10.10)	Input - analog signal **Software selectable**
	K3	**AGND**	Common gnd for transducer power and signals	Common gnd
	K4	**NC**	Do not connect	

(1) D connector is available only for Z-BM-LEZ-**-01H

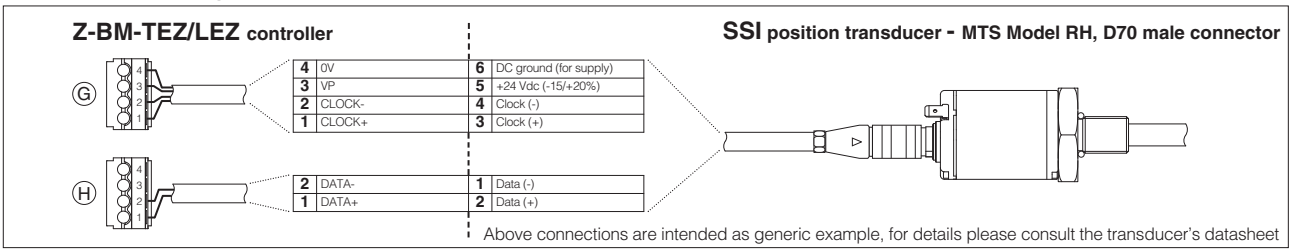
8.3 SSI connectors signals - 4 pin

G	G1	**CLOCK+**	Serial synchronous clock (+)	Output - on/off signal
	G2	**CLOCK-**	Serial synchronous clock (-)	Output - on/off signal
	G3	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power and signals	Common gnd

H	H1	**DATA+**	Serial position data (+)	Input - on/off signal
	H2	**DATA-**	Serial position data (-)	Input - on/off signal
	H3	**NC**	Do not connect	
	H4	**NC**	Do not connect	

Note: for Balluff BTL7 with SSI interface only special code SA433 is supported

SSI connection - example

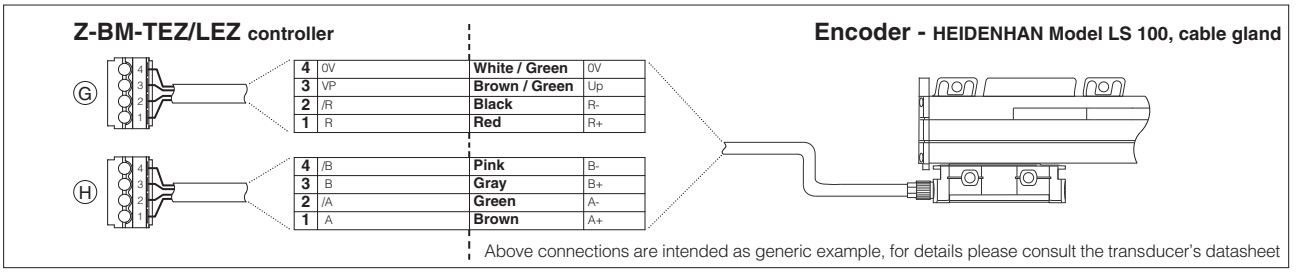


8.4 Encoder connectors signals - 4 pin

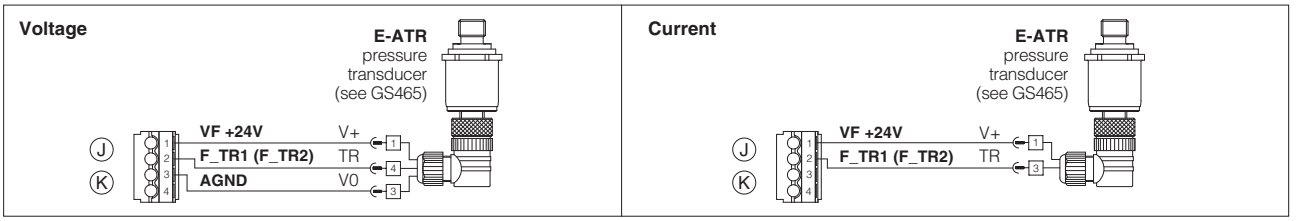
G	G1	**R**	Input channel R	Input - on/off signal
	G2	**/R**	Input channel /R	Input - on/off signal
	G3	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power and signals	Common gnd

H	H1	**A**	Input channel A	Input - on/off signal
	H2	**/A**	Input channel /A	Input - on/off signal
	H3	**B**	Input channel B	Input - on/off signal
	H4	**/B**	Input channel /B	Input - on/off signal

Encoder connection - example



8.5 Pressure/force transducers connection - example



8.6 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥ ⑦ **EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**TX-**	Transmitter - orange
3	**RX+**	Receiver - white/green
6	**RX-**	Receiver - green

(1) shield connection on connector's housing is recommended

9 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of controllers's model code (see section 1). For correct set code selection, please include in the controller order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

10 SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **F003** and in the user manuals included in the Z-SW programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

10.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

10.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

10.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on controllers' reference mode, see section 4 :
external analog reference generation (see 4.1): input is used as reference for the controller position closed loop.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC

fieldbus/internal reference generation (see 4.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

10.4 Pressure or force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected controllers' reference mode and alternated control options, see section 5 :
SP, SL, SF controls and external analog reference selected : input is used as reference for the controller pressure/force closed loop.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC

SN control or fieldbus/internal reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC

10.5 Position monitor output signal (P_MONITOR)

The controller generates an analog output signal (pin C1) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the controller (e.g. analog reference, fieldbus reference, position error, valve spool position).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA; default is ±10 VDC

10.6 Pressure or force monitor output signal (F_MONITOR)

The controller generates an analog output signal (pin C3) according to alternated pressure/force control option:
SN control: output signal is proportional to the actual valve spool positio
SP, SL, SF controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the controller (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA; default is ±10 VDC

10.7 Enable Input Signal (ENABLE)

To enable the controller, a 24VDC voltage has to be applied on pin C2
When the Enable signal is set to zero the controller can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

10.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the controller (solenoid short circuits/not connected, reference or transducer signalcable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC
Fault status is not affected by the status of the Enable input signal.
Fault output signal can be used as digital output by software selection.

10.9 Position transducer input signals

A position transducer must be always directly connected to the controller. Position digital input signals are factory preset to binary SSI, they can be reconfigured via software selecting between binary/gray SSI, Encoder or generic transducer with analog interface.
Input signals can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC
Refer to position transducer characteristics to select the transducer type according to specific application requirements, see section 11 .

10.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - SP, SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the controller.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements, see section 11 .

10.11 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the controller using ±15 VDC supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

10.12 Possible combined options: /AC

11 ACTUATOR'S TRANSDUCER CHARACTERISTICS

11.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controllers, depending to the system requirements: analog signal (analog), SSI or Encoder (digital).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

11.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer (see section 5). Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

11.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position			Pressure/Force
Input type	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	+24 Vdc	+5 Vdc or +24 Vdc	+5 Vdc or +24 Vdc	+24 Vdc
Controller Interface	0 ÷ 10V or 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc or 4 ÷ 20 mA
Max speed	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by Atos controller **(2)** percentage of total stroke **(3)** for Balluff BTL7 with SSI interface only special code SA433 is supported

12 VALVE SETTINGS AND PROGRAMMING TOOLS

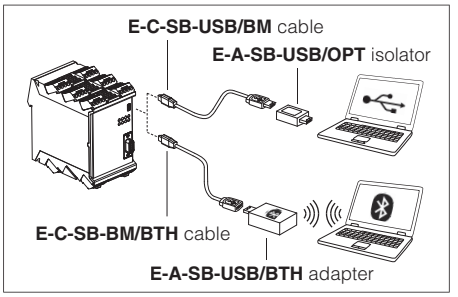
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**). For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

Z-SW-FULL support: NP (USB) PS (Serial) IR (Infrared)
BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

DVD programming software, to be ordered separately:

Z-SW-FULL DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

Z-SW-FULL-N DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of Z-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

13 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:
Z-MAN-BM-LEZ - user manual for **Z-BM-LEZ** and **Z-BM-TEZ**

13.1 External reference and transducer parameters

Allow to configure the controller reference and transducer inputs, analog or digital, to match the specific application requirements:
- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

13.2 PID control dynamics parameters

Allow to optimize and adapt the controller closed loop to the wide range of hydraulic system characteristics:
- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

13.3 Monitoring parameters

Allow to configure the controller monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:
- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 13.4)

13.4 Fault parameters

Allow to configure how the controller detect and react to alarm conditions:
- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, controller disabling, etc.)

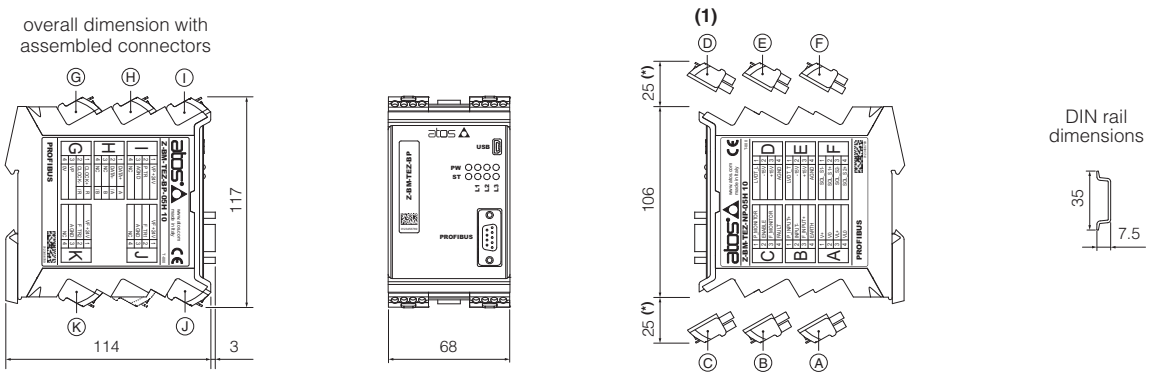
13.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:
- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

13.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 4.2).

14 OVERALL DIMENSIONS [mm]



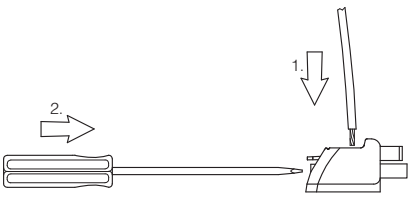
A,B,C,D,E,F,G,H,I,J,K connectors included

(*) Space to remove the connectors

(1) D connector is available only for Z-BM-LEZ-**-01H

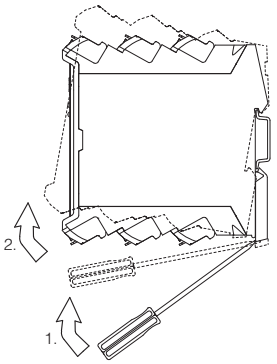
15 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the controller from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the controller



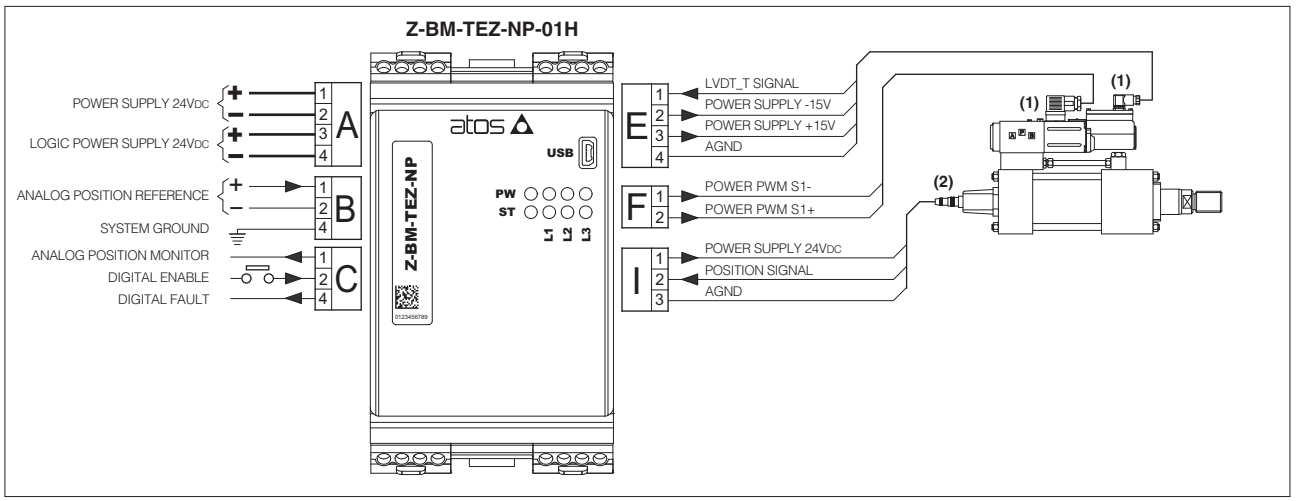
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(eg. connector A can not be inserted into connector slot of B,C,D,E,F,G,H,I,J,K)

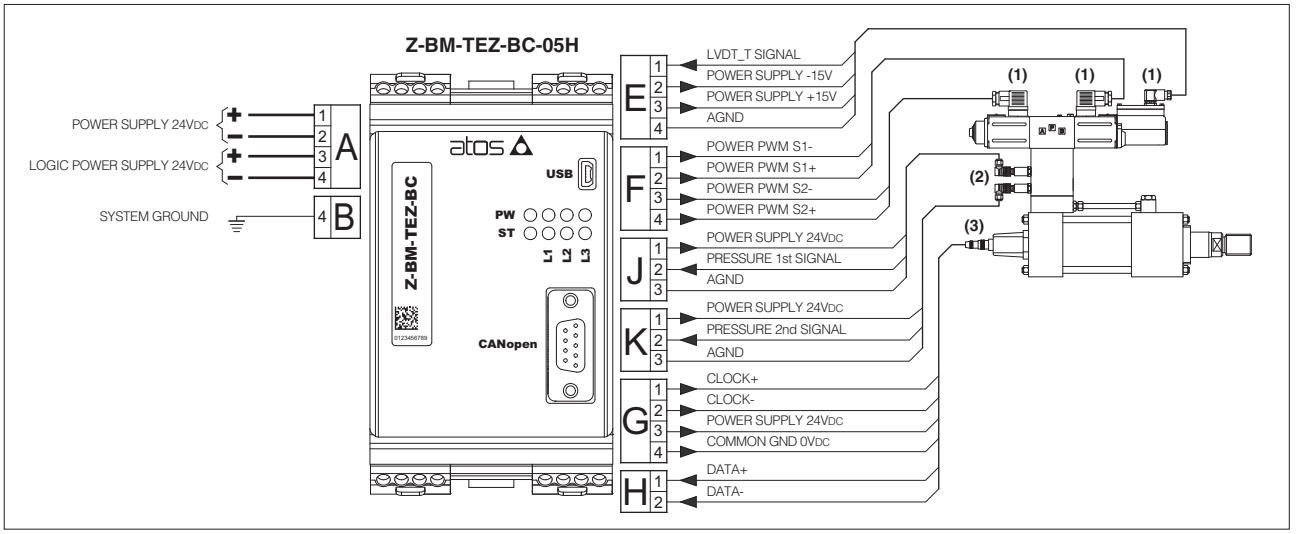
16 WIRING EXAMPLES

16.1 Position control - analog reference - analog position transducer



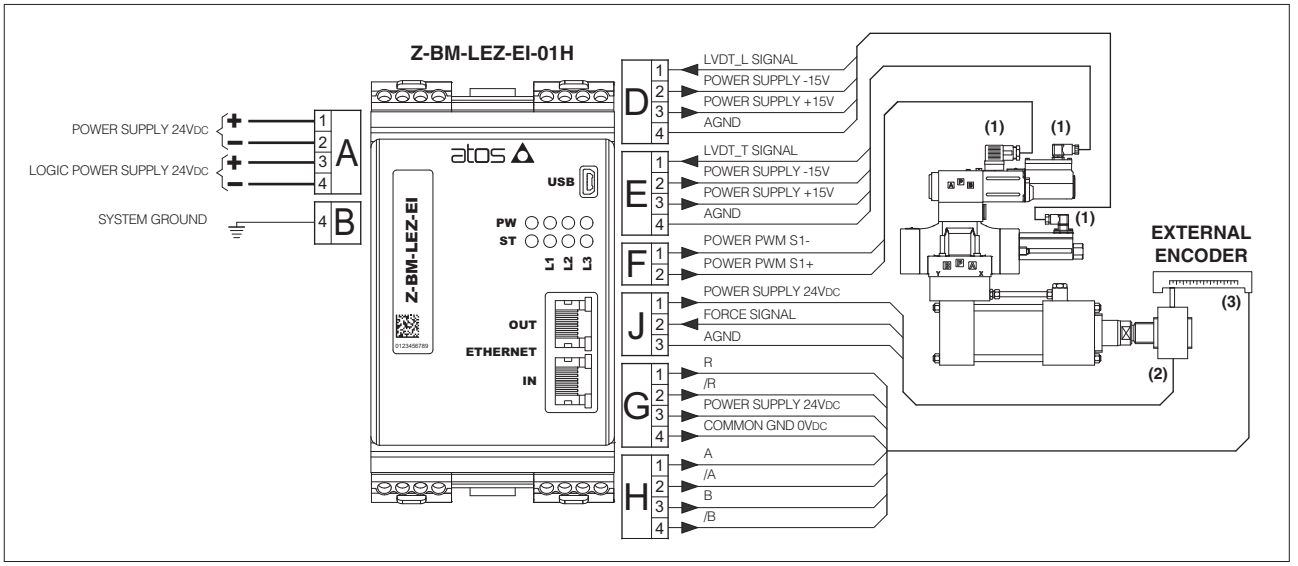
(1) For valve electrical connections please refer to the specific technical table
(2) The analog position transducer connections are intended as generic example, for details please consult the transducer's datasheet

16.2 Alternated position/force control - CANopen reference - SSI position transducer - 2 analog pressure transducers



(1) For valve electrical connections please refer to the specific technical table
(2) Pressure transducers connections are shown with voltage signal output; for connections with current signal output see 8.5
(3) The SSI position transducer connections are intended as generic example, for details please consult the transducer's datasheet

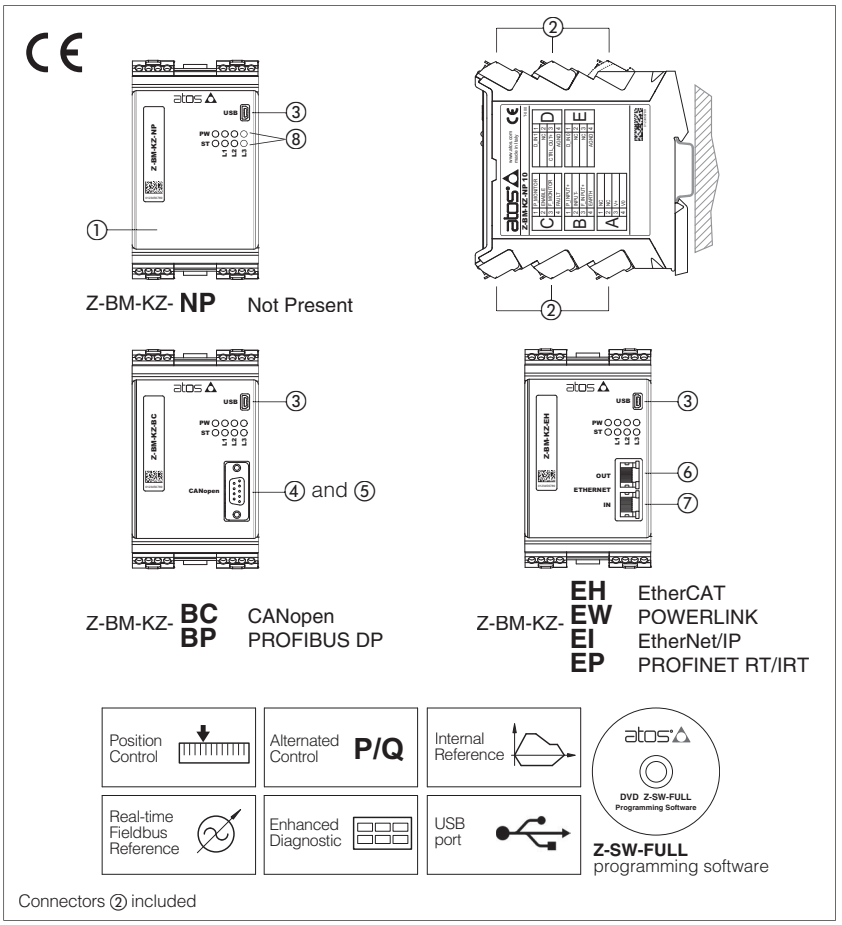
16.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



(1) For valve electrical connections please refer to the specific technical table
(2) Load cell connections is shown with voltage signal output; please consult the load cell datasheet for details about connections
(3) The Encoder position transducer connections are intended as generic example, for details please consult the transducer's datasheet

Digital Z-BM-KZ axis cards

DIN-rail format, for position and force controls



Z-BM-KZ

Digital axis cards ① perform the position closed loop of linear or rotative hydraulic axes.

The controller generates a reference signal to the proportional valve which regulates the hydraulic flow to the actuator.

The controlled actuator has to be equipped with integral or external position transducer (analog, SSI or Encoder) to feedback the axis position.

The controller is operated by an external or internally generated reference position signal (see section 4).

A pressure/force alternated control may be set by software additionally to the position control: a pressure/force transducer has to be assembled into the actuator and connected to the controller; a second pressure/force reference signal is required.

Atos PC software allows to customize the controller configuration to the specific application requirements.

Electrical Features:

- 10 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 8.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

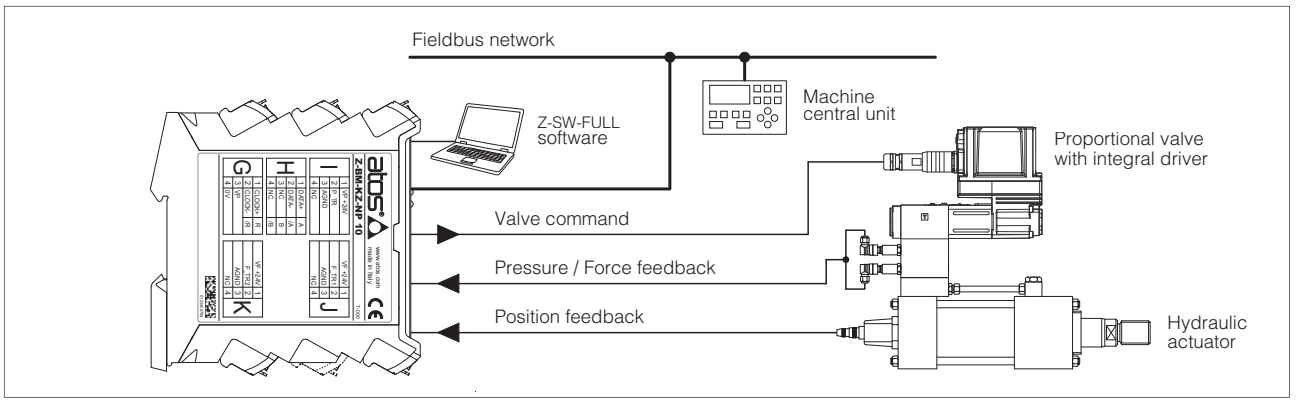
Software Features:

- Intuitive graphic interface
- Internal generation of motion cycle
- Setting of axis's dynamic response (PID) to optimize the application performances
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Complete diagnostics of axis status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

Z-BM	-	KZ	-	NP	*
Off-board electronic axis card in DIN rail format		Alternated position / force (or position / pressure) control module		**Fieldbus interface**, USB port always present: **NP** = Not Present **BC** = CANopen **BP** = PROFIBUS DP **EH** = EtherCAT **EW** = POWERLINK **EI** = EtherNet/IP **EP** = PROFINET RT/IRT	Series number

2 BLOCK DIAGRAM EXAMPLE



Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

Valves	Directional					
Standard Data sheet	**DHZO-TEB, DKZOR-TEB** FS168	**DHZO-TES, DKZOR-TES** FS168	**DLHZO-TEB, DLKZOR-TEB** FS180	**DLHZO-TES, DLKZOR-TES** FS180	**DPZO-LEB** FS178	**DPZO-LES** FS178
Ex-proof Data sheet	-	**DHZA-TES, DKZA-TES** FX135	-	**DLHZA-TES, DLKZA-TES** FX150	-	**DPZA-LES** FX235
Controller model	**Z-BM-KZ**					

4 POSITION REFERENCE MODE

4.1 External reference generation

Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer. It generates a reference signal for the proportional valve which regulates the hydraulic flow to the actuator.

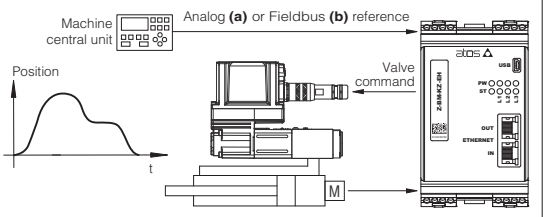
The external reference signal can be software selected among:

Analog reference (a) - the controller receives in real time the reference signal from the machine electronic central unit by means analog input (see 8.2) limiting speed, acceleration and deceleration values.

Fieldbus reference (b) - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication limiting speed, acceleration and deceleration values.

For fieldbus communication details, please refer to the controller user manual.

External reference generation



4.2 Internal reference generation

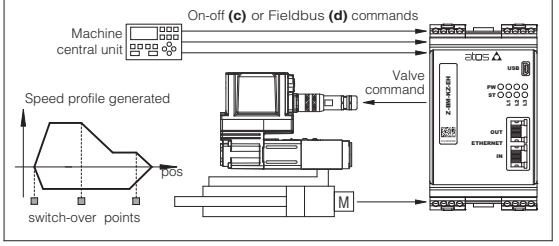
Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.It generates a reference signal for the proportional valve which regulates the hydraulic flow to the actuator.

The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means of:

- on-off commands ***(c)***

- fieldbus commands ***(d)***

Internal reference generation



Atos PC software allows to design a customized sequence of motion phases through a range of pre-defined standard commands.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.

Start / stop / switch-over commands examples

External digital input	on-off commands are used to start/stop the cycle generation or to change the motion phase
External fieldbus input	on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase
Switch by position	switch-over from actual to following motion phase occurs when the actual position reaches a programmed value
Switch by time	switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation
Switch by internal status	switch-over from internal status are used to start/stop the cycle generation or to change the motion phase

Reference generation types examples

Absolute	a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control
Relative	as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software

5 ALTERNATED POSITION / FORCE CONTROL

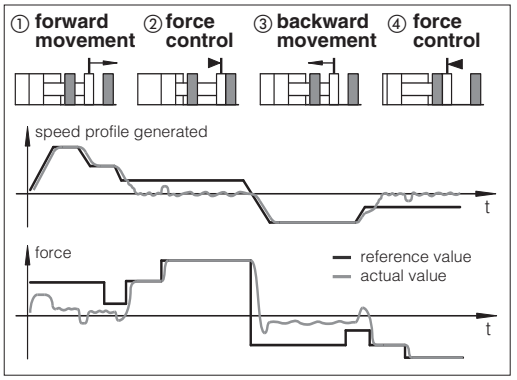
Alternated pressure or force closed loop control can be added to the actuator's standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

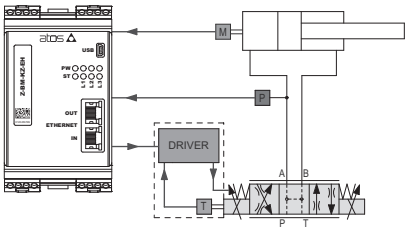
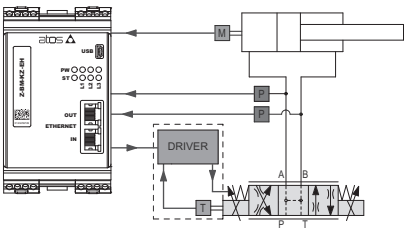
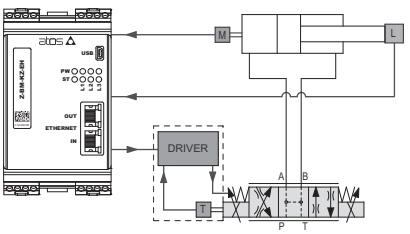
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the controller reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



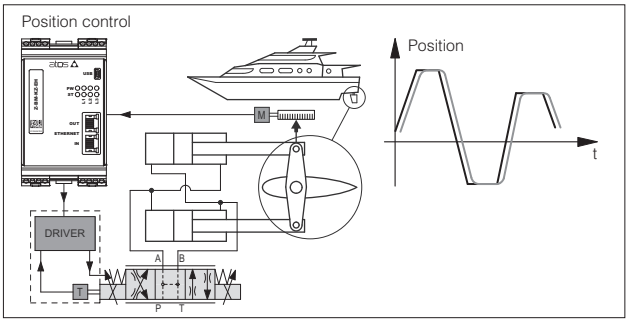
Alternated control configurations - software selectable

SP	SF	SL
		
one remote pressure transducer has to be installed on the actuator's port to be controlled	two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T	valve's spool transducer	M	actuator's position transducer	P	pressure transducer	L	load cell

SP – position/pressure control
Adds pressure control to standard position control and permits to limit the max force in one direction controlling in closed loop the pressure acting on one side of the hydraulic actuator. A single pressure transducer has to be installed on hydraulic line to be controlled.
SF – position/force control
Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.
SL – position/force control
Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.
General Notes:
- servoproportional type DLHZO, DLKZOR, DPZO-L are strongly recommended for high accuracy applications - see tech tables **FS180**, **FS178**
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **GS002**
- Atos technical service is available for additional evaluations related to specific applications usage

6 APPLICATION EXAMPLES

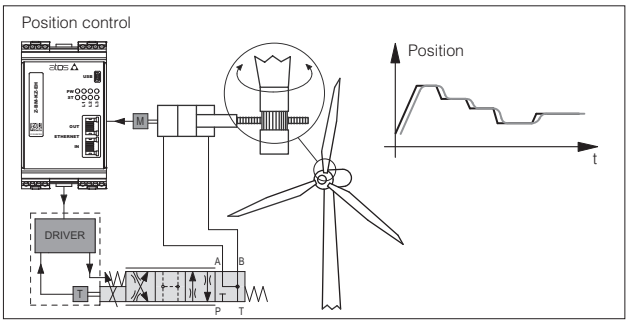


Hydraulic steering wheel in marine applications

Rudder controls on motor yachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-KZ controllers perform the rudder position control system, ensuring accurate and repetitive regulations for a comfortable ride, thanks to:

- analog position reference mode for real time controls
- analog position transducer for simple and compact solution
- position PID control parameters to optimize the system response
- complete diagnostic information for advanced system monitoring

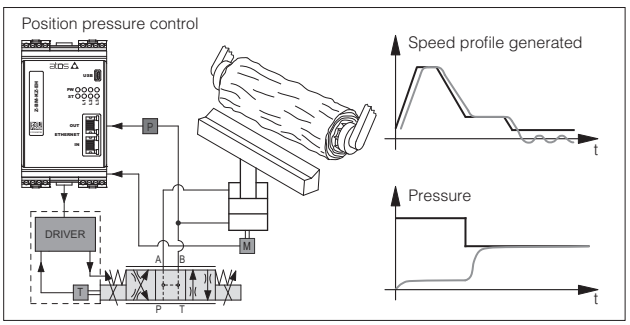


Wind turbines

The pitch control of the rotor blades is required to maximize the energy production. Accurate positioning, decentralized intelligence as well as long service life and reliability are required.

Z-BM-KZ controllers perform high quality regulation of the blade pitch simplifying the system architecture, thanks to:

- SSI digital position transducer for high precision control
- complete remote system management with fieldbus interface
- position PID selection to adapt the position control to the different wind conditions

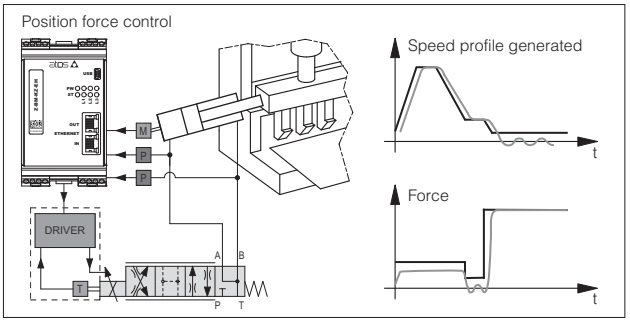


Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

Z-BM-KZ controllers allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings
- analog position transducer for simple and reliable solution
- pressure transducer for alternated pressure control
- fieldbus connection for remote parameterization, commands, and controller state indication

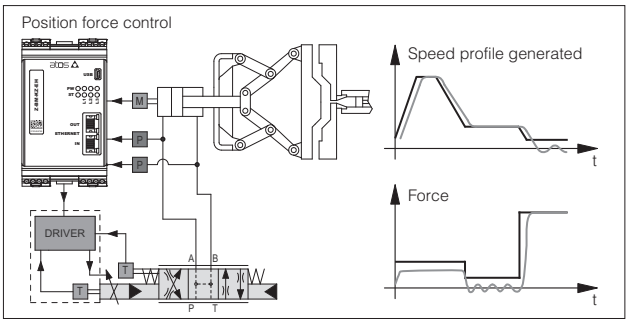


Bending Machines

Machine tools for cold-forming flat sheets require complete, automatic, programmable and flexible machine control to produce sheet metal panels from punched blank.

Z-BM-KZ controller combine high level position regulation with accurate force control to provide in a single device a complete and dedicated solution, thanks to:

- internal reference generation to simplify the machine control cycle
- digital position sensor for high resolution measurement system
- two pressure transducers for alternated force control
- fieldbus interface for easy machine control integration
- auxiliary digital outputs for system status indication (target reached, force control active)



Die-casting machinery

Clamp movements in die-casting phases involve fast/slow motion cycle with accurate and repetitive alternated position/force controls for the mould safety functions.

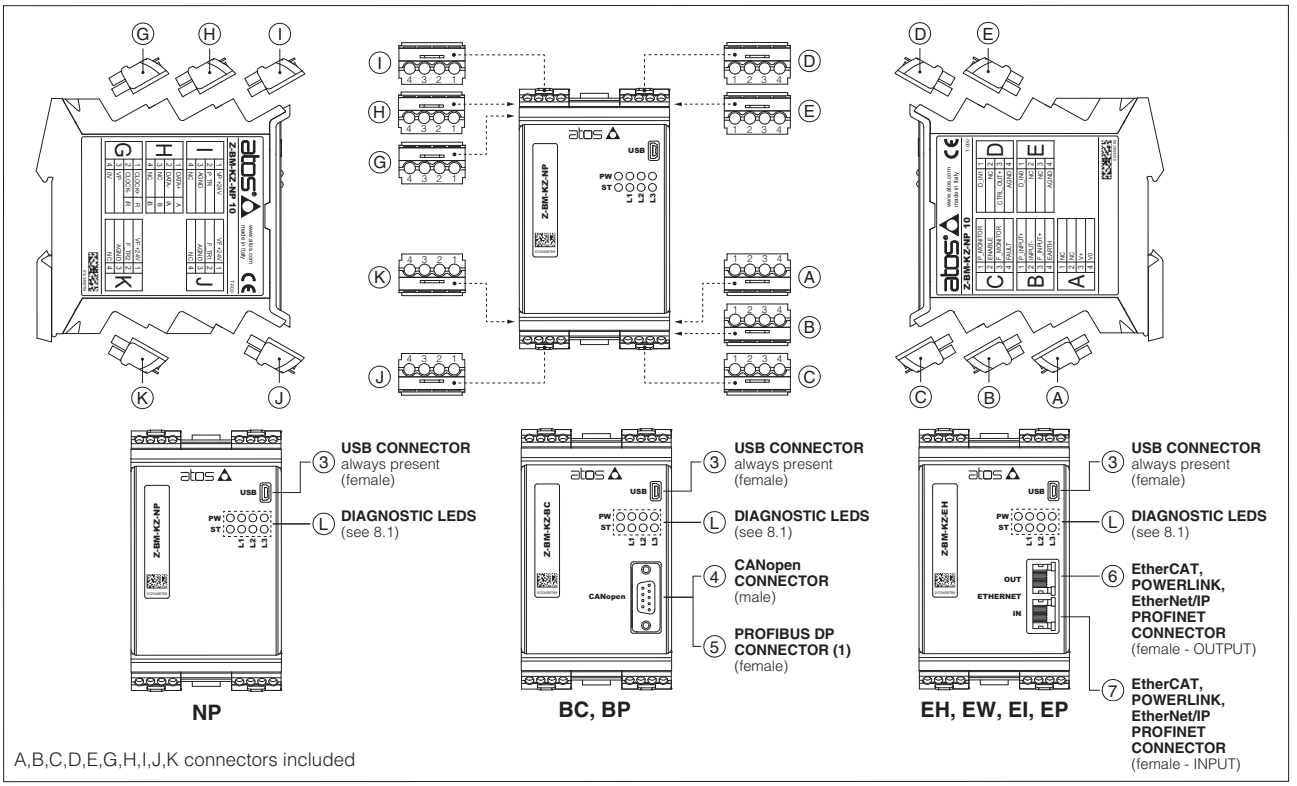
Z-BM-KZ controllers, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:

- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics

7 MAIN CHARACTERISTICS

Power supply	(see 9.1)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption		10 W			
Analog input signals	(see 9.2, 9.3)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs Control output	(see 9.4, 9.5) (see 9.10)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input Digital inputs	(see 9.6) (see 9.11)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	(see 9.7)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms		Cable break with current reference signal, over/under temperature, position control monitoring			
Position transducers power supply		+24 VDC @ max 100 mA or +5 VDC@ max 100 mA are software selectable			
Pressure/Force transducers power supply		+24 VDC @ max 100 mA			
Format		Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature		-20 ÷ +50 °C (storage -25 ÷ +85 °C)			
Mass		Approx. 450 g			
Additional characteristics		8 leds for diagnostic; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)		According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Compliance		RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface		USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer		not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable		LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet			
Max conductor size	(see 14)	2,5 mm²			

8 CONNECTIONS AND LEDS

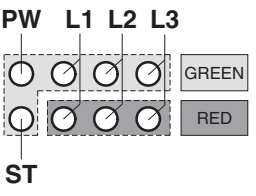


(1) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector: DG909MF1 - the connector will be oriented upwards; DG909MF3 - the connector will be oriented downwards

8.1 Diagnostic LEDs (L)

Eight leds show controller operative conditions for immediate basic diagnostics. Please refer to the controler user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET
L1	VALVE STATUS			LINK/ACT			
L2	NETWORK STATUS			NETWORK STATUS			
L3	ALARM STATUS			LINK/ACT			
PW	OFF = Power supply OFF		ON = Power supply ON				
ST	OFF = Fault present		ON = No fault				



8.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**NC**	Do not connect	
	A2	**NC**	Do not connect	
	A3	**V+**	Power supply 24 VDC (see 9.1)	Input - power supply
	A4	**V0**	Power supply 0 VDC (see 9.1)	Gnd - power supply
B	B1	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.2)	Input - analog signal **Software selectable**
	B2	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	B3	**F_INPUT+**	Pressure/Force reference input signal (SP, SF, SL controls): ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.3)	Input - analog signal **Software selectable**
	B4	**EARTH**	Connect to system ground	
C	C1	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND; default is ±10 VDC (see 9.4)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the controller, referred to V0 (see 9.6)	Input - on/off signal
	C3	**F_MONITOR**	Pressure/Force (SP, SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND; default is ±10 VDC (see 9.5)	Output - analog signal **Software selectable**
		NC	For EW, EI, EP executions the F_MONITOR is not available: do not connect	
	C4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to V0 (see 9.7)	Output - on/off signal
D	D1	**D_IN1**	Digital input 0 ÷ 24VDC, referred to AGND (see 9.11)	Input - on/off signal
	D2	**NC**	Do not connect	
	D3	**CTRL_OUT+**	Control output signal for external driver, referred to AGND (see 9.10)	Output - analog signal **Software selectable**
	D4	**AGND**	Common gnd for digital input and control output	Common gnd
E	E1	**D_IN0**	Digital input 0 ÷ 24VDC, referred to AGND (see 9.11)	Input - on/off signal
	E2	**NC**	Do not connect	
	E3	**NC**	Do not connect	
	E4	**AGND**	Common gnd for digital input and monitor outputs	Common gnd
G	G1		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4	
	G2			
	G3			
	G4			
H	H1		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4	
	H2			
	H3			
	H4			
I	I1	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	I2	**P_TR1**	Analog position transducer input signal ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.8)	Input - analog signal **Software selectable**
	I3	**AGND**	Common gnd for transducer power and signals	Common gnd
	I4	**NC**	Do not connect	
J	J1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	J2	**F_TR1**	1st signal pressure/force transducer: ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.9)	Input - analog signal **Software selectable**
	J3	**AGND**	Common gnd for transducer power and signals	Common gnd
	J4	**NC**	Do not connect	
K	K1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	K2	**F_TR2**	2nd signal pressure transducer (only for SF): ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.9)	Input - analog signal **Software selectable**
	K3	**AGND**	Common gnd for transducer power and signals	Common gnd
	K4	**NC**	Do not connect	

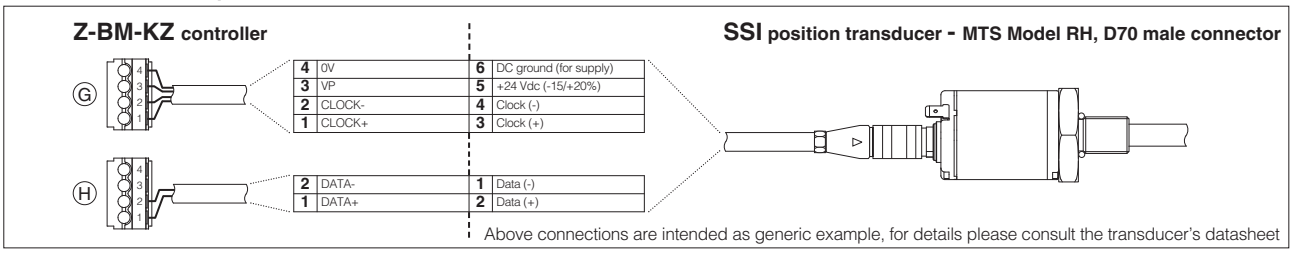
8.3 SSI connectors signals - 4 pin

G	G1	**CLOCK+**	Serial synchronous clock (+)	Output - on/off signal
	G2	**CLOCK-**	Serial synchronous clock (-)	Output - on/off signal
	G3	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power and signals	Common gnd

H	H1	**DATA+**	Serial position data (+)	Input - on/off signal
	H2	**DATA-**	Serial position data (-)	Input - on/off signal
	H3	**NC**	Do not connect	
	H4	**NC**	Do not connect	

Note: for Balluff BTL7 with SSI interface only special code SA433 is supported

SSI connection - example

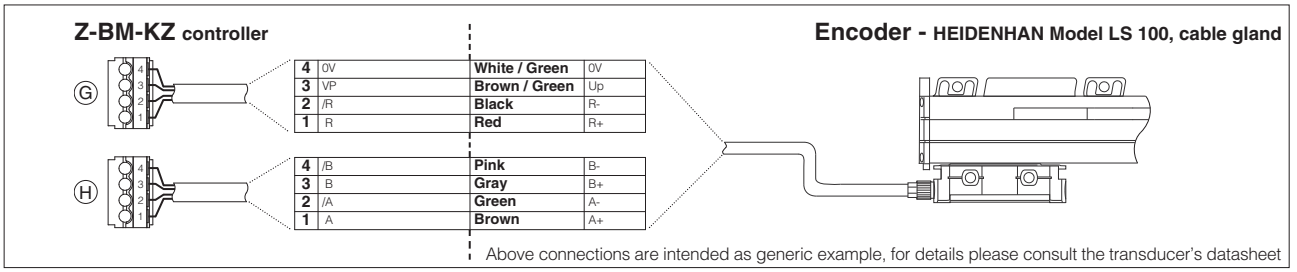


8.4 Encoder connectors signals - 4 pin

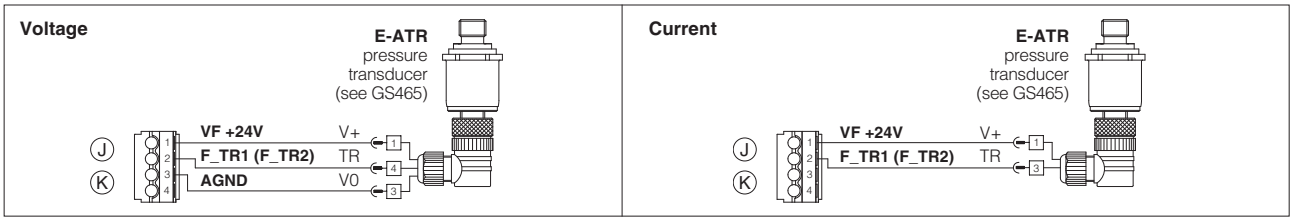
G	G1	**R**	Input channel R	Input - on/off signal
	G2	**/R**	Input channel /R	Input - on/off signal
	G3	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power and signals	Common gnd

H	H1	**A**	Input channel A	Input - on/off signal
	H2	**/A**	Input channel /A	Input - on/off signal
	H3	**B**	Input channel B	Input - on/off signal
	H4	**/B**	Input channel /B	Input - on/off signal

Encoder connection - example



8.5 Pressure/force transducers connection - example



8.6 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥⑦ **EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

(1) shield connection on connector's housing is recommended

9 SIGNALS SPECIFICATIONS

Atos digital controllers are CE marked according to the applicable directives (e.g. Immunity/Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the prescriptions shown in tech table **F003** and in the user manuals included in the Z-SW programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

9.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 500 mA fast fuse.

9.2 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on controllers' reference mode, see section 4 :
external analog reference generation (see 4.1): input is used as reference for the controller axis position closed loop.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC

fieldbus/internal reference generation (see 4.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

9.3 Pressure or force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected controllers' reference mode and alternated control options, see section 5 :
SP, SL, SF controls and external analog reference selected : input is used as reference for the controller pressure/force closed loop.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC

SN control or fieldbus/internal reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC

9.4 Position monitor output signal (P_MONITOR)

The controller generates an analog output signal (pin C1) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the controller (e.g. analog reference, fieldbus reference, position error, valve spool position).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA; default is ±10 VDC

9.5 Pressure or force monitor output signal (F_MONITOR)

The controller generates an analog output signal (pin C3) according to alternated pressure/force control option:
SN control: output signal is proportional to the actual valve spool position
SP, SL, SF controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the controller (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA; default is ±10 VDC

9.6 Enable Input Signal (ENABLE)

To enable the controller, a 24 VDC voltage has to be applied on pin C2.
When the Enable signal is set to zero the controller can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

9.7 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the controller (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC
Fault status is not affected by the status of the Enable input signal.
Fault output signal can be used as digital output by software selection.

9.8 Position transducer input signals

A position transducer must be always directly connected to the controller. Position digital input signals are factory preset to binary SSI, they can be reconfigured via software selecting between binary/gray SSI, Encoder or generic transducer with analog interface.
Input signals can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC
Refer to position transducer characteristics to select the transducer type according to specific application requirements, see section 10 .

9.9 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - SP, SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the controller.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements, see section 10 .

9.10 Control output signal (CTRL_OUT+)

The error signal processed by the control algorithms generates the control output signal (pin D3) for the external driver of the proportional valve which operates the hydraulic flow to the actuator.
The output range and polarity are software selectable within ±10 VDC (for voltage) or ± 20 mA (for current) maximum range referred to the analog ground AGND on pin D4; default setting is ±10 VDC

9.11 Digital input signals (D_IN0 and D_IN1)

Two on-off input signals are available on the pin E1 and D1. For each input by the Z-SW software, it is possible to set the polarity and to match a proper condition within the following:

- pressure/force PID selection (default)
- start/stop/switch-over command in case of internal reference generation (see 4.2)
- specific operative command for hydraulic axis mode (referencing mode, jog mode, automatic mode)
- jog command
- disable pressure / force alternated control

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
E1	0	24 VDC	0	24 VDC
D1	0	0	24 VDC	24 VDC

10 ACTUATOR'S TRANSDUCER CHARACTERISTICS

10.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controllers, depending to the system requirements: analog signal (analog), SSI or Encoder (digital).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

10.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer (see section 5). Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

10.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position			Pressure/Force
Input type	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	+24 VDC	+5 VDC or +24 VDC	+5 VDC or +24 VDC	+24 VDC
Controller Interface	0 ÷ 10V or 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC or 4 ÷ 20 mA
Max speed	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by Atos controller **(2)** percentage of total stroke **(3)** for Balluff BTL7 with SSI interface only special code SA433 is supported

11 VALVE SETTINGS AND PROGRAMMING TOOLS

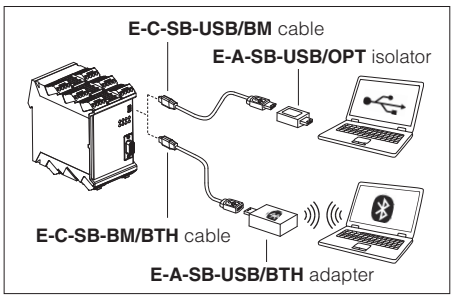
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

Z-SW-FULL support: NP (USB) PS (Serial) IR (Infrared)
BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

DVD programming software, to be ordered separately:

Z-SW-FULL DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

Z-SW-FULL-N DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of Z-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

12 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:
Z-MAN-BM-KZ - user manual for **Z-BM-KZ**

12.1 External reference and transducer parameters

Allow to configure the controller reference and transducer inputs, analog or digital, to match the specific application requirements:
- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

12.2 PID control dynamics parameters

Allow to optimize and adapt the controller closed loop to the wide range of hydraulic system characteristics:
- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

12.3 Monitoring parameters

Allow to configure the controller monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:
- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 12.4)

12.4 Fault parameters

Allow to configure how the controller detect and react to alarm conditions:
- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, controller disabling, etc.)

12.5 Valve characteristics compensation

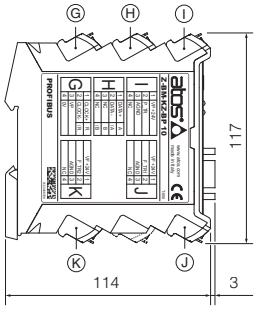
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:
- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

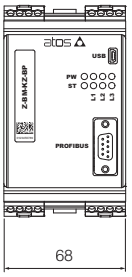
12.6 Motion phases parameters

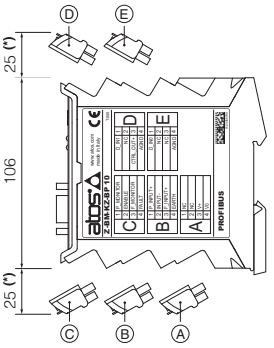
When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 4.2).

13 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors







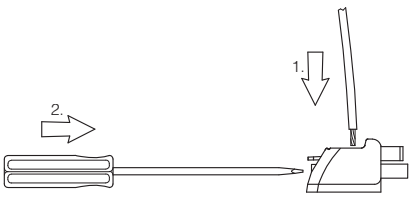
DIN rail dimensions

A,B,C,D,E,G,H,I,J,K connectors included

(*) Space to remove the connectors

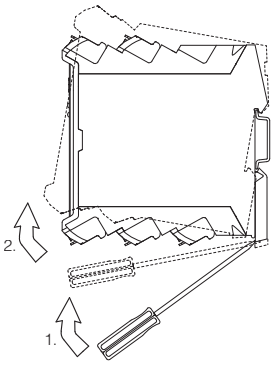
14 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the controller from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the controller



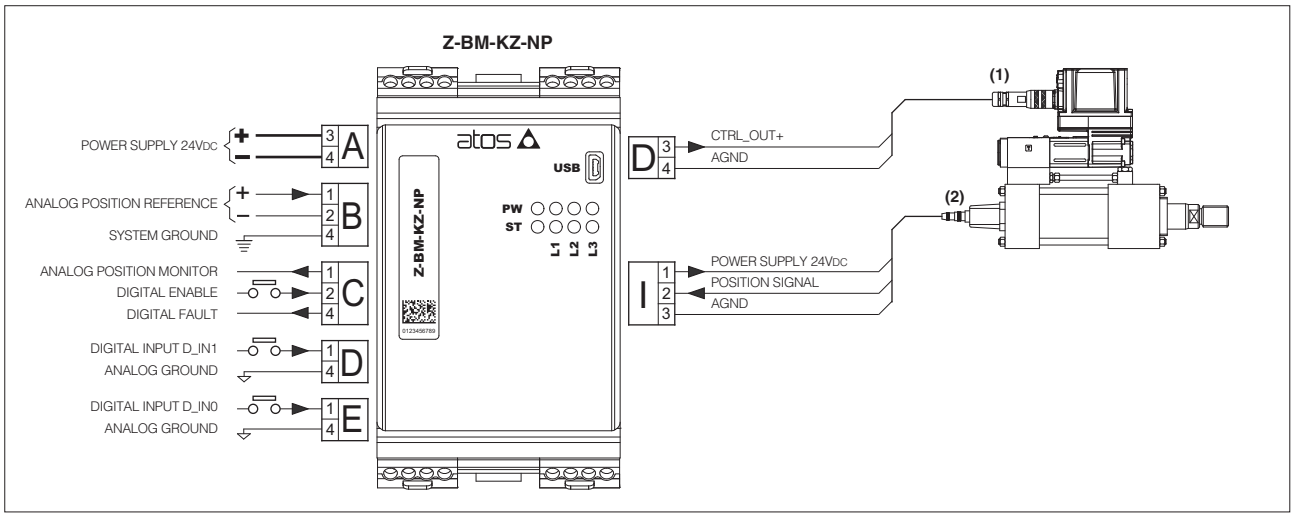
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B,C,D,E,G,H,I,J,K)

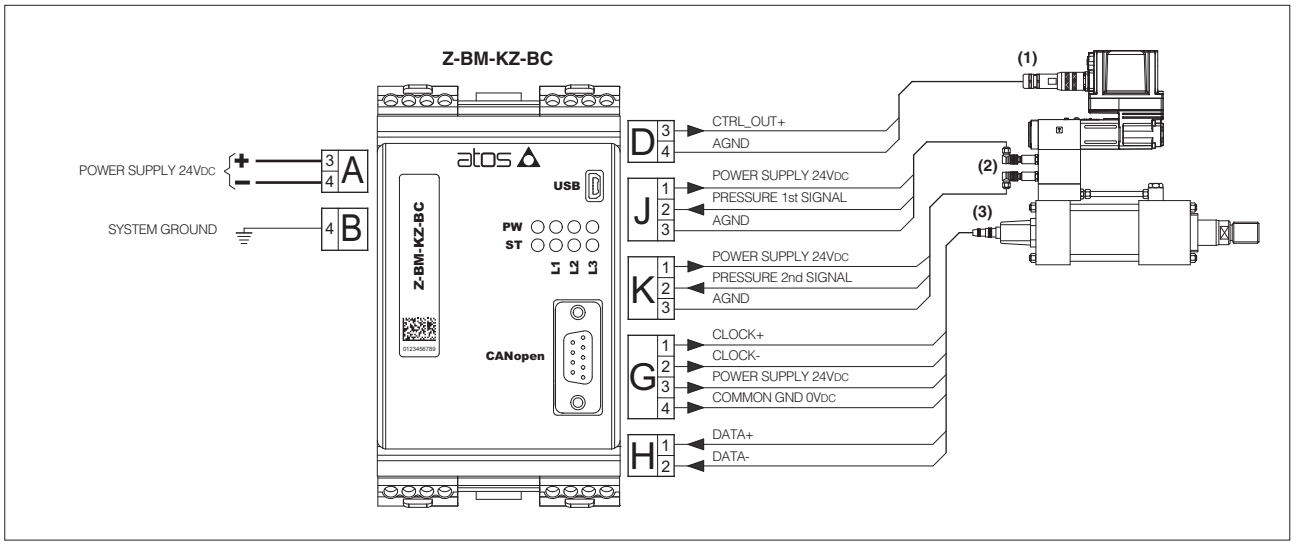
15 WIRING EXAMPLES

15.1 Position control - analog reference - analog position transducer



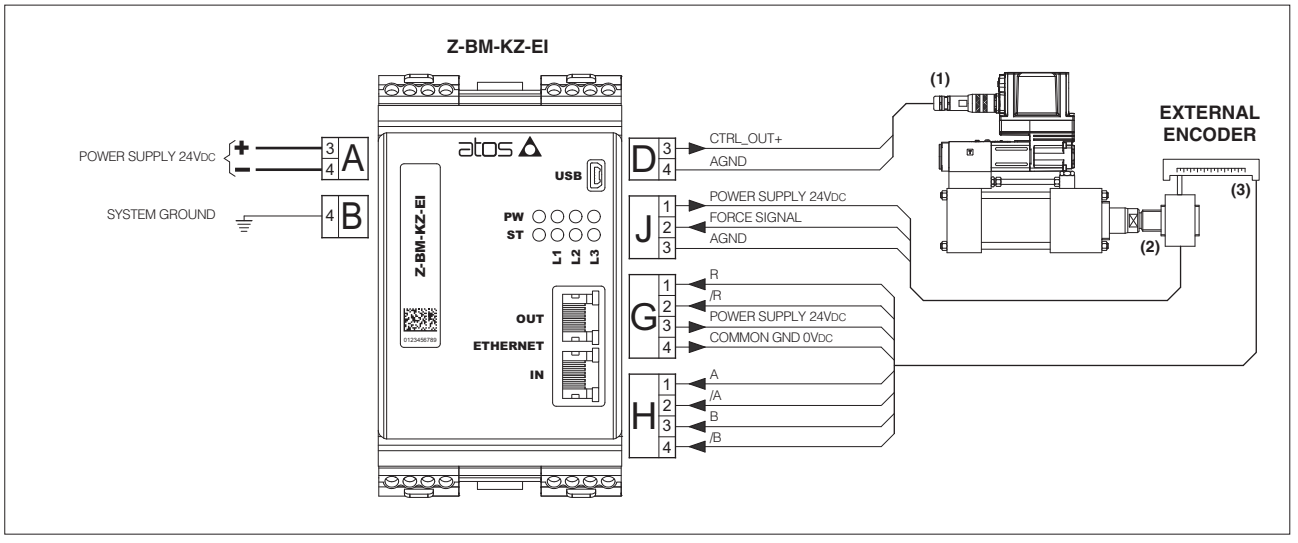
(1) For valve driver electrical connections please refer to the specific technical table
(2) The analog position transducer connections are intended as generic example, for details please consult the transducer's datasheet

15.2 Alternated position/force control - CANopen reference - SSI position transducer - 2 analog pressure transducers



(1) For valve driver electrical connections please refer to the specific technical table
(2) Pressure transducers connections are shown with voltage signal output; for connections with current signal output see 8.5
(3) The SSI position transducer connections are intended as generic example, for details please consult the transducer's datasheet

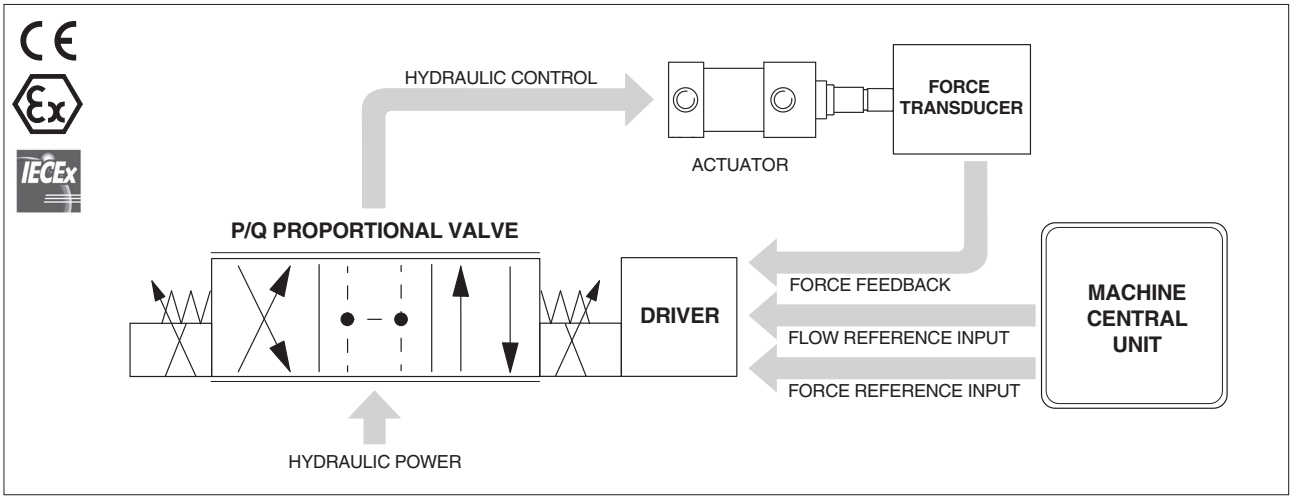
15.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



(1) For valve driver electrical connections please refer to the specific technical table
(2) Load cell connections is shown with voltage signal output; please consult the load cell datasheet for details about connections
(3) The Encoder position transducer connections are intended as generic example, for details please consult the transducer's datasheet

Ex-proof digital proportional valves with P/Q control

directional valves with LVDT transducer and on board driver



1 GENERAL DESCRIPTION

The ex-proof proportional directional valves with P/Q control are identified by option SP, SF or SL and they are designed to perform the alternated regulation of speed/position/force of hydraulic actuators.
These options add the closed loop control of pressure (for SP) or force (for SF and SL) to the standard direction and flow regulation operated by the servoproportional and high performance proportional directional valves.

Note: for simplification, the following description always refers to the “force control”, even if for the SP option the control is the “pressure”.

The switching from the flow control to the force control is automatically performed by the valve thanks to a sophisticated algorithm.
The advantage offered by this solution is the high accurate and high dynamic control of the machine actuator in terms of direction, speed, position and force, all performed by a single valve.

2 FUNCTIONAL DESCRIPTION

The alternated P/Q control is operated by means of two electronic reference signals sent from the machine central unit to the valve driver: one for flow regulation and one for regulation. The valve driver has to be interfaced to a remote pressure transducer or to a load cell for the measurement and feedback of the actual pressure or force.
The SP option controls the pressure on A user port and it has to be interfaced to a single pressure transducer
The SF option controls the force by measuring the delta p across A and B user ports and it has to be interfaced to two pressure transducers
The SL option directly controls the actuator force and it has to be interfaced to a load cell
See section 4 for configuration examples

A dedicated algorithm automatically selects which control (flow or force) will be active time by time. The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations.
The flow regulation is active when the actual system force measured by the force transducer is lower than the relevant input reference signal.
The valve normally works to regulate the flow by controlling in closed-loop the spool position through the integral LVDT transducer.
The force control is activated when the actual system force, measured by remote transducers, reaches the setpoint defined by the relevant force reference input signal and meets the regulation requirements defined within the control algorithm.
The flow regulation is consequently reduced to keep steady the closed loop regulation of the force.
If the force decreases below its input reference signal, the flow control returns active.

The dynamic response of the force control can be adapted to different system characteristics, by setting the internal PID parameters using Atos PC software. Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.

3 VALVES RANGE

Options SP, SF, SL are available for ex-proof high performance proportional directional valves and ex-proof servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.
Valve’s performance characteristics and overall dimensions remains unchanged as per specific FX** technical tables.

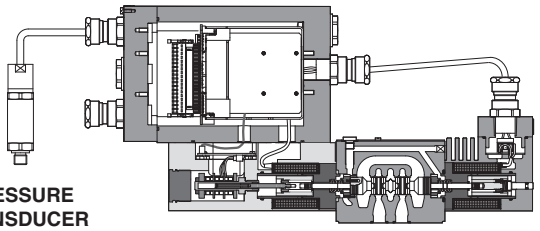
Servoproportionals:
DLHZA-TES, DLKZA-TES - direct, zero spool overlap, sleeve execution - technical tables **FX150**
DHZA-TES, DKZA-TES - direct, zero spool overlap - technical tables **FX135**
DPZA-LES - piloted, zero spool overlap - technical table **FX235**
LIQZA-LES - 3-way servocartridges - technical table **FX380**

Servoproportionals with TEZ/LEZ axis controller:
DLHZA-TEZ, DLKZA-TEZ - direct, zero spool overlap, sleeve execution - technical tables **FX610**
DHZA-TEZ, DKZA-TEZ - direct, zero spool overlap - technical tables **FX620**
DPZA-LEZ - piloted, zero spool overlap - technical tables **FX630**

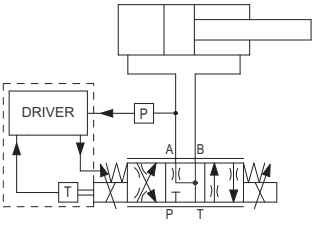
High perfomance proportionals:
DHZA-TES, DKZA-TES - direct, positive spool overlap - technical table **FX130**
DPZA-LES - piloted, positive spool overlap - technical table **FX230**

4 SP, SF, SL CONFIGURATION EXAMPLES

SP - Pressure Control - 1 pressure transducer

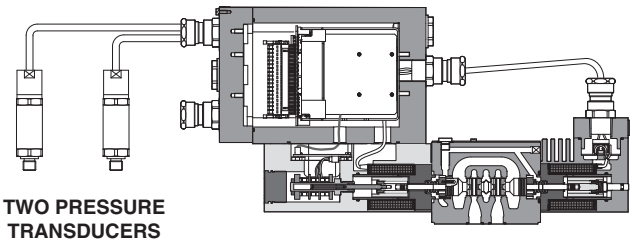


e.g. DHZA-TES- **SP**

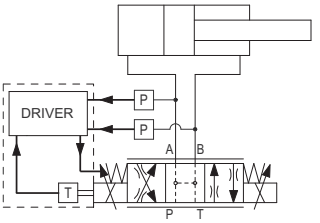


one remote pressure transducer has to be installed on the actuator's port to be controlled.
In this example the SP option regulates the pressure on port A

SF - Force Control - 2 pressure transducers

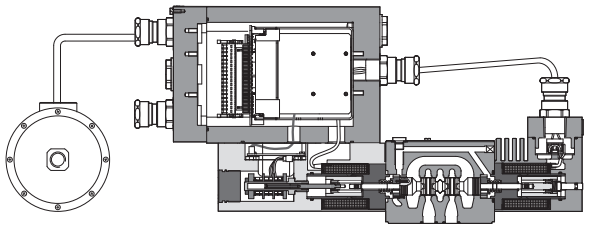


e.g. DHZA-TES- **SF**

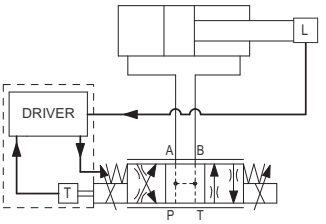


two remote pressure transducers have to be installed on the actuator's ports A and B.
The bore and rod dimensions of the actuator have to be input into the valve software, which calculates the relevant areas:
A1 = bore area; A2 = ring area
The SF option directly controls the actuator force (F) as result of the following calculation:
F = △p (Pa-Pb) x △ area (A1 – A2)

SL - Force Control - 1 load cell



e.g. DHZA-TES- **SL**



one load cell transducer has to be installed between the actuator and the controlled load
The SL option directly control the actuator force

5 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **F003** and in the user manuals included in the E-SW-* programming software.

6 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC/PQ supports: NP (USB)

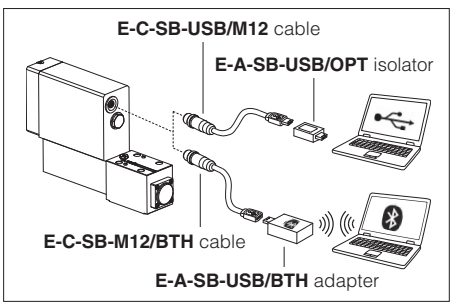
E-SW-FIELDBUS/PQ and **Z-SW-FULL** support:

NP (USB) - only Z-SW-FULL

BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

7 FUNCTIONAL EXAMPLES

The following functional examples are just generic reference of the possible applications of with ex-proof proportional directional valves with alternated P/Q control, **SP**, **SF**, **SL**.
Please contact Atos technical department for additional evaluations related to specific applications usage.

7.1 High-dynamic pressure reducing controls - only for **SP**

Directional proportional valves with zero spool overlap and SP control, are operated in 3-way hydraulic configuration to obtain high-dynamic pressure reducing control on the A (or B) user port:

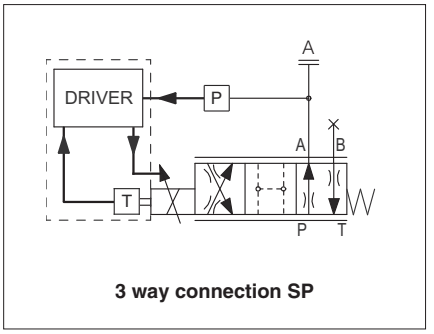
- flow reference signal is used to limit the maximum flow during the pressure regulation
- pressure reference signal is used to regulate the pressure on the valve's A user port; the rapid/repeatable response of the pressure control is performed in high dynamics by the directional valve's closed loop regulation

Requirements:

- an ex-proof remote pressure transducer has to be installed in the hydraulic system on the controlled user port (when using 4 way valves either A or B port can be used while the not controlled port must be plugged)
- zero overlap valves without fail safe position are recommended;

⚠ Positive overlap valves with PABT ports closed in central position are not suitable for this application

High-dynamic - only for **SP**



3 way connection SP

7.2 Single effect actuators with speed/pressure/force controls - only for **SP** or **SL**

Directional proportional valves with SP or SL control, are operated in 3-way hydraulic configuration to control speed/pressure (force) on single effect actuators:

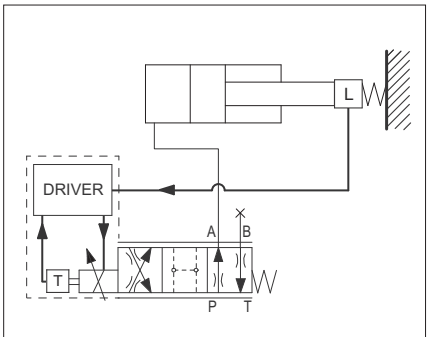
- flow reference signal is used to regulate the actuator's forward and backward speed while pressure (force) reference signal is used to limit the maximum pushing pressure (force) to the actuator
  or
- pressure (force) reference signal is used to regulate the actuator pushing pressure (force) while flow reference signal is used to limit the maximum actuator speed

Requirements:

- for SP control a remote ex-proof pressure transducer has to be installed in the hydraulic system on the actuator pushing port
- for SL control a remote force transducer has to be installed between the actuator and the controlled load
- zero overlap valves without fail safe position are recommended;

⚠ Positive overlap valves with PABT ports closed in central position are not suitable for this application

Single effect - only for **SP** or **SL**



3 way connection SL

7.3 Double effect actuators with speed/pressure controls - only for **SP**

Directional proportional valves with SP control, regulate speed/pressure on double effect actuators:

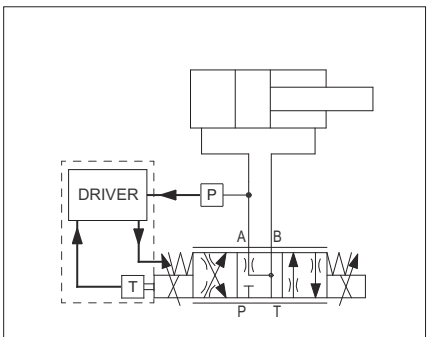
- flow reference signal is used to regulate the actuator's forward and backward speed while pressure reference signal is used to limit the maximum pushing pressure of the actuator
  or
- pressure reference signal is used to regulate the actuator pushing pressure while flow reference signal is used to limit the maximum forward and backward actuator speed

Requirements:

- an ex-proof remote pressure transducer has to be installed on the actuator's pushing port
- a dedicated Q5 spool with strong "meter-in" characteristic in central position has to be used; during pressure regulation, the not controlled port remains connected to T line to avoid any back pressure - see section 7.4

⚠ Positive overlap valves with PABT ports closed are not suitable for this application

Double effect - only for **SP**

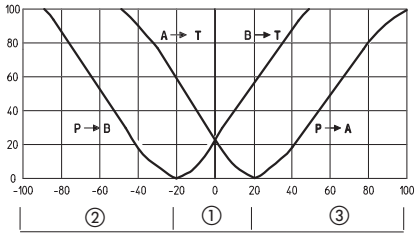


4 way connection SP

7.4 Q5 spool for 4 way connection with SP control

type Q5

Allows fast direction reverse during motion phases (e.g. ejector motion with max strain limitation)



① depressuring (pressure control active)

② backward movements (flow control active)

③ forward movements (flow or pressure control active)

7.5 Double effect actuators with force limit/regulation - only for **SF** or **SL**

4 way directional proportional valves with SF or SL control, regulate speed/force on double effect actuators:

- flow reference signal is used to regulate the actuator's forward and backward speed while force reference signal is used to limit the maximum pushing and pulling force of the actuator

  or
- force reference signal is used to regulate the actuator pushing and pulling force while flow reference signal is used to limit the maximum actuator speed

Requirements:

- for SF two ex-proof remote pressure transducers have to be installed on the both actuator's ports
- for SL one ex-proof push/pull load cell transducer has to be installed between the actuator and the controlled load
- zero overlap valves are recommended; positive overlap valves with PABT ports closed in central position are not suitable for this application

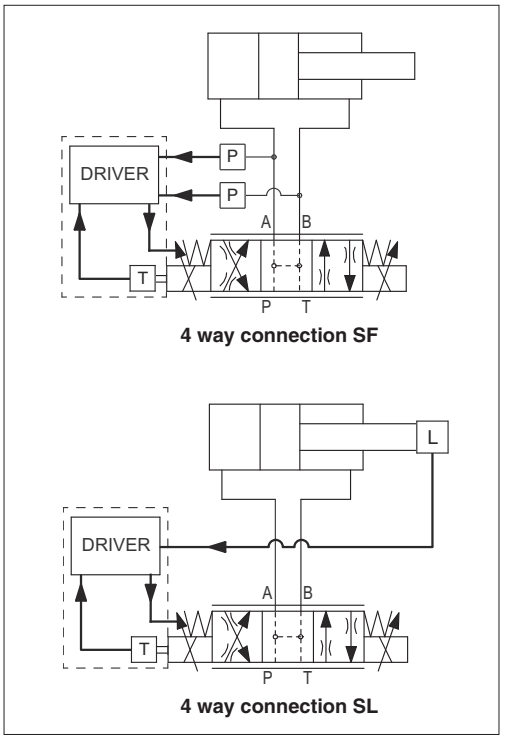
Advantages:

- force control is possible in both push and pull directions
- SL allows a more precise force control despite of a more complex installation of the ex-proof load cell transducer
- SF allows to add force control also into existing systems thanks to the simple installation of pressure transducers

Control modes:

- Flow priority: flow reference signal is used to move forward and backward the actuator while force is limited/regulated in both push and pull direction
- Force priority: force reference signal is used to control both push and pull forces while flow is limited/regulated in both direction

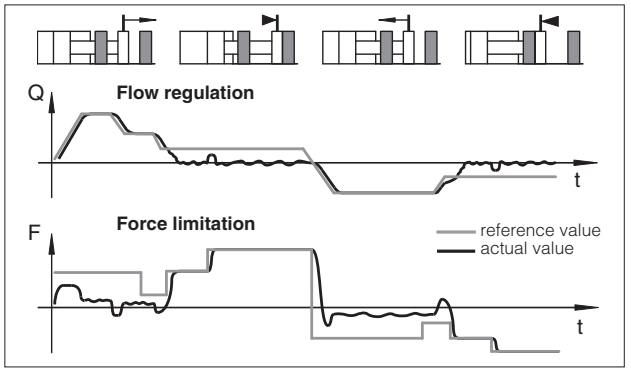
Double effect - only for **SF** or **SL**



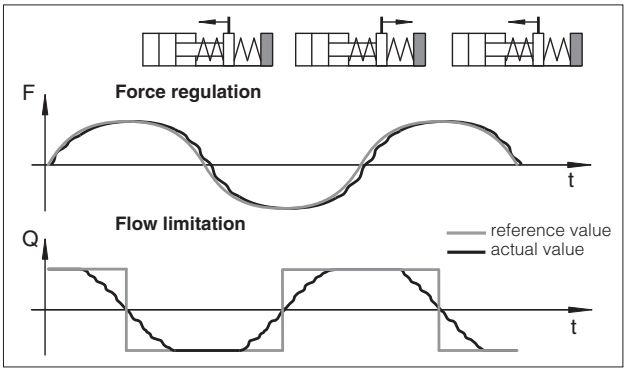
Notes:

auxiliary check valves are recommended to intercept A and B lines in case of specific hydraulic configuration requirements in absence of power supply or fault

7.6 Flow priority



7.7 Force priority



8 PRESSURE/FORCE TRANSDUCER CHARACTERISTICS

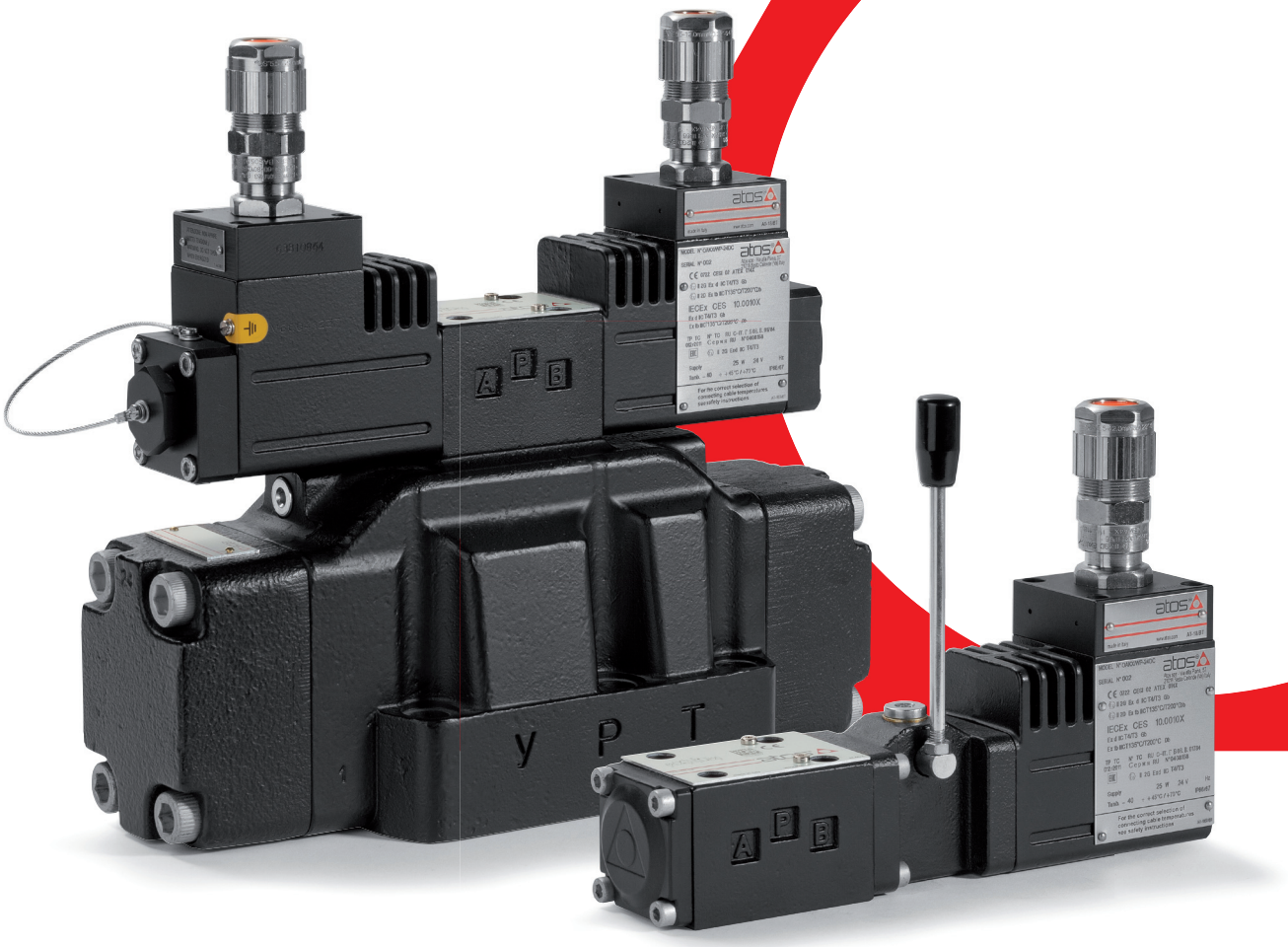
The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducers.

Pressure/force controls require to install remote pressure transducers or load cell to measure the actual pressure/force values:

- **Pressure Transducers:** allow easy system integration and cost effective solution for both pressure and force controls, see tech table **GX800** for E-ATRA-7 ex-proof pressure transducer details
- **Load Cell Transducers:** allow the user to get high accuracy and precise regulations for force control, but it increases the complexity of the mechanical installation

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115÷120 % of the maximum regulated pressure/force.

3 ON-OFF VALVES



INDEX

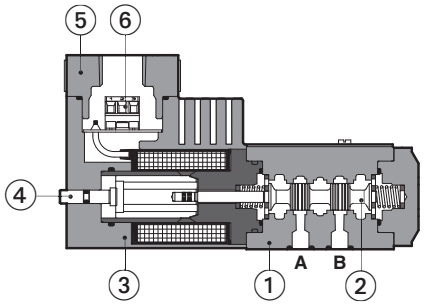
ON-OFF VALVES

Ex-ia

Supplementary components range available on **www.atos.com**

Ex-proof solenoid directional valves

on-off, direct, spool type - **ATEX, IECEx, EAC, PESO** or **cULus**



DHA-06*

① valve body
② spool
③ ex-proof solenoid
④ manual override
⑤ threaded connections for cable gland
⑥ internal terminal board for cable connection

DHA

On-off, spool type directional valves equipped with ex-proof solenoids certified for safe operation in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

DHA valves are **SIL** compliance with IEC 61508 (TÜV certified)

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **06** - ISO 4401
Max flow: **70 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHA	/	*	-	0	63	1/2	/	M	/	*	24DC	*	/	*

DHA: Ex-proof solenoid directional valve, direct, spool type

Certification type:
Multicertification ATEX, IECEx, EAC:
- = omit for Group II 2G / II 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

Valve size (ISO 4401)
0 = 06

Configuration, see section 2 :

Spool type, see section 2 :

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (5)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
A = solenoid at side of port B (for single solenoid valves)
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap
Hand lever options (4):
MV = vertical hand lever
AMV = vertical hand lever installed at side of port B

Voltage code, see section 5

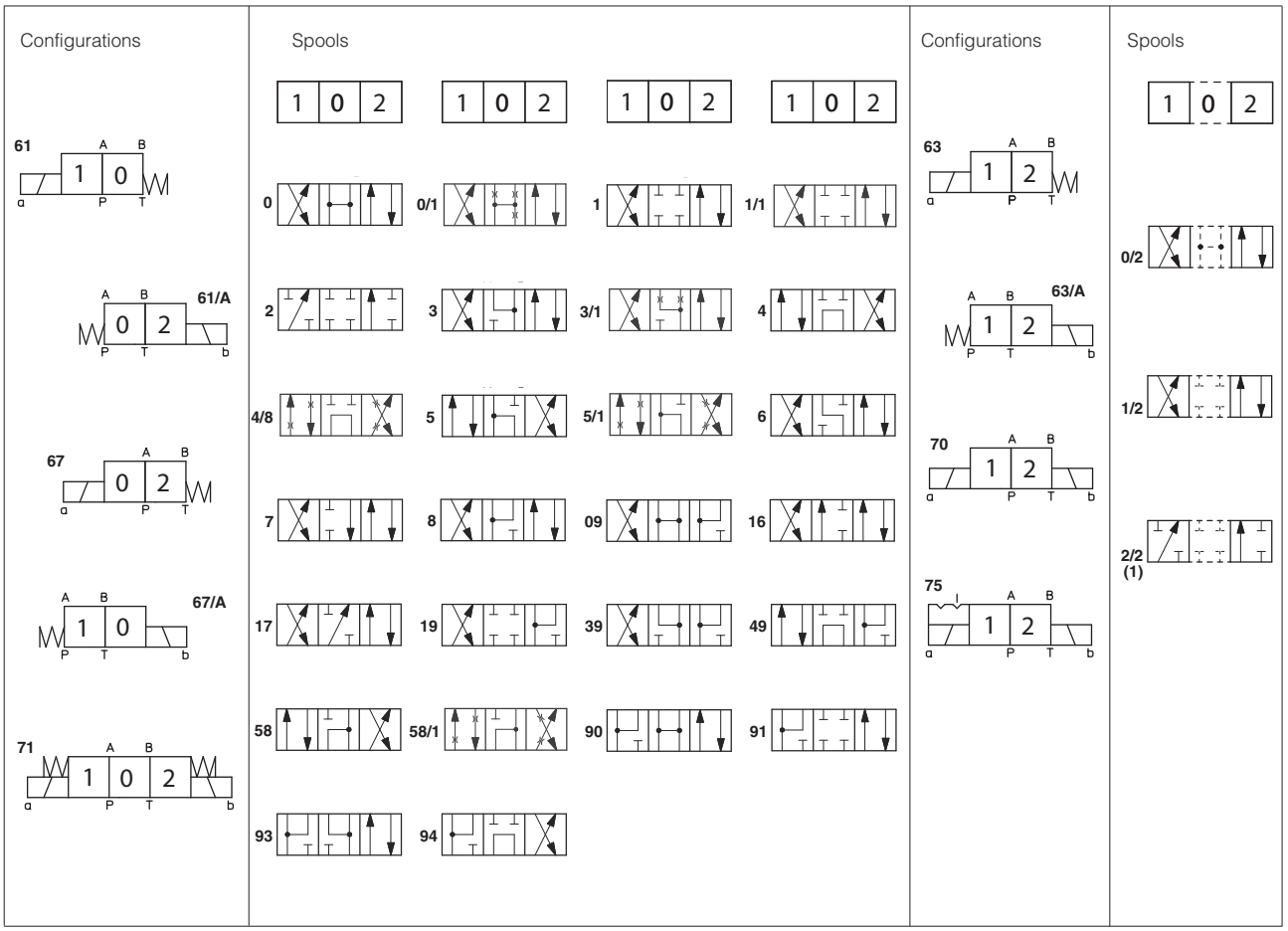
Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining)
(3) For possible combined options, see 12.1
(4) Options MV and AMV are available only for configuration **61, 61/A, 63, 63/A, 71** and with spool type **0, 0/2, 1, 1P, 1/2, 1/2P, 3, 3P, 4, 7**. Not available in combination with option **WP**
(5) Approved only for the Italian market

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND SPOOLS (representation according to ISO 1219-1)



For spool type 2 and 2/2 port T of the valve must be connected to tank if the operating pressure exceed the max T pressure reported at section 4
(1): not available for configuration 75

2.1 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4**, **5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1**.
  They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 1/2, 3, 8** are available as **1P, 1/2P, 3P, 8P** to limit valve internal leakages.

3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Operating pressure	Ports P,A,B: **350** bar; Port T **210** bar
Rated flow	See diagrams Q/Δp at section 13
Maximum flow	**70 l/min**, see operating limits at section 14

5 ELECTRICAL CHARACTERISTICS

Valve type		DHA	DHA/M	DHA/UL
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W		12W
Coil insulation		class H		
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor		100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature.

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type	DHA		DHA/M	DHA/UL	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American cULus **cULus**	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

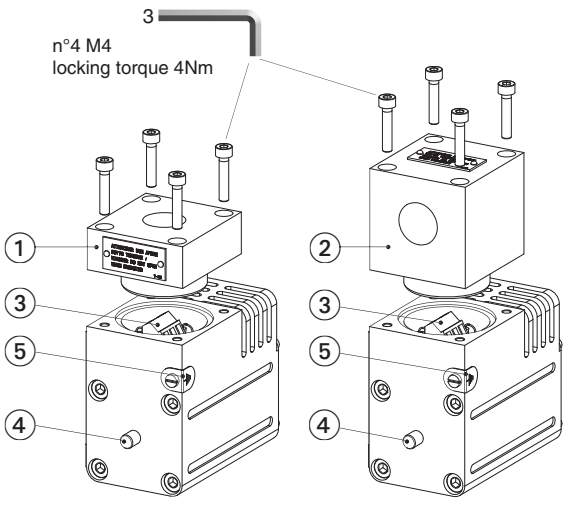
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 SIL compliance with IEC 61508: 2010

DHA (multicertified for surface and mining) meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

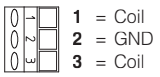
9 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

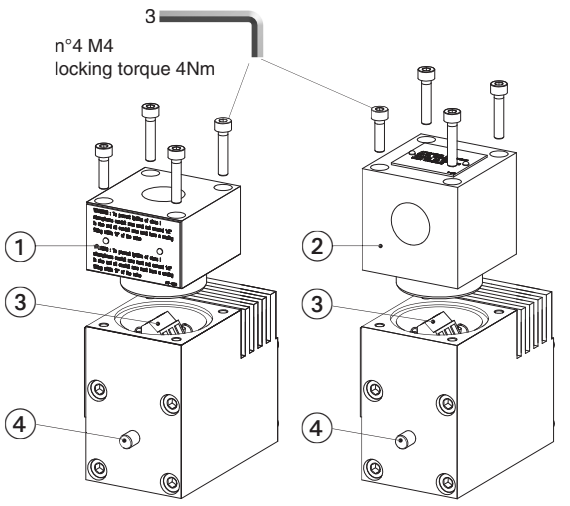
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

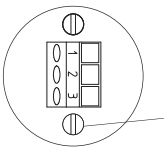
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override



⚠ **Pay attention to coil polarity**

1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

11 CABLE GLANDS only for Multicertification

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 OPTIONS

A = solenoid at side of port B (for single solenoid valves)

O = Horizontal cable entrance , to be selected in case of limited verical space

WP = Manual override protected by metallic cap

Hand lever option:

MV = Auxiliary vertical hand levers

This option allows to operate the valves in absence of electrical power supply, i.e. during commissioning, maintenance or in case of emergency.
When the valve is electrically operated the hand lever remains stopped in its rest position
The hand lever execution does not affect the performances of the original valves

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

AMV= Vertical hand lever installed at side of port B

Notes:

Options **MV** and **AMV** are available only for configuration **61, 61/A, 63, 63/A, 71** and with spool type **0, 0/2, 1, 1P, 1/2, 1/2P, 3, 3P, 4, 7**

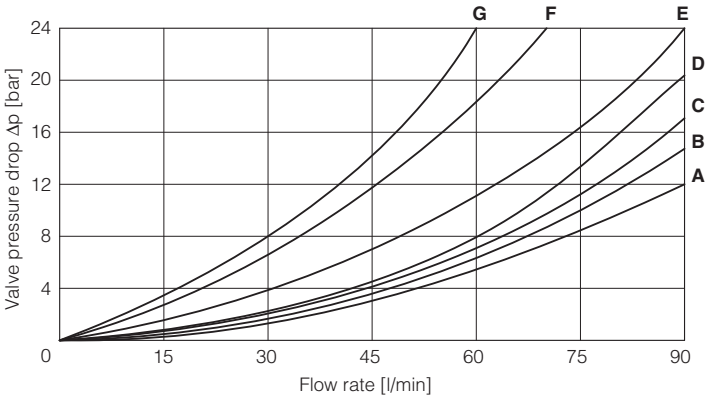
Not available in combination with option **WP**

MV option and **AMV** allow to operate the valve in absence of electrical power supply.
For detailed description of DHA with hand lever option see tech. table **E138**

12.1 Possible combined options: /AO, /AWP, /OWP, /AMV, /OMV, /AOWP, /AOMV

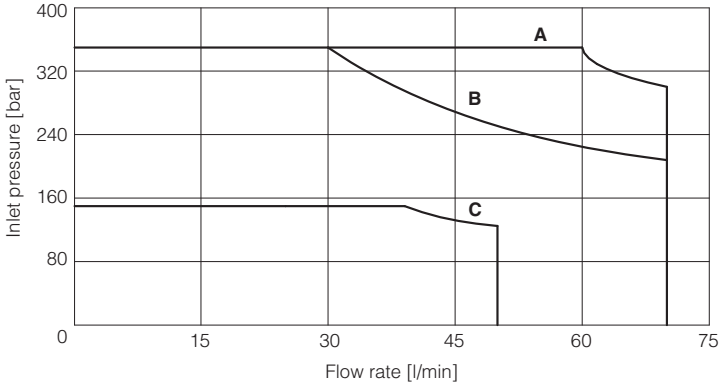
13 Q/Δp DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1	A	A	C	C	D
1, 1/1	D	C	C	C	
3, 3/1	D	D	A	A	
4, 4/8, 5, 5/1, 49, 58, 58/1, 94	F	F	G	C	E
1/2, 0/2	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8	A	A	E	E	
2	D	D			
2/2	F	F			
09, 19, 90, 91	E	E	D	D	
39, 93	F	F	G	G	



14 OPERATING LIMITS (based on mineral oil ISO VG 46 at 50°C)

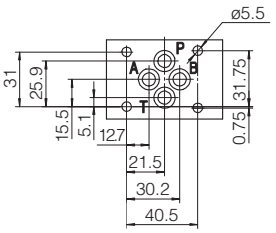
Spool type	diagram
0, 0/1, 1, 1/1, 8	**A**
0/2,1/2, 3, 6, 7	**B**
2, 2/2, 3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39 49, 58, 58/1, 09, 90, 91, 93, 94	**C**



15 INSTALLATION DIMENSIONS [mm] - Multicertified and UL

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

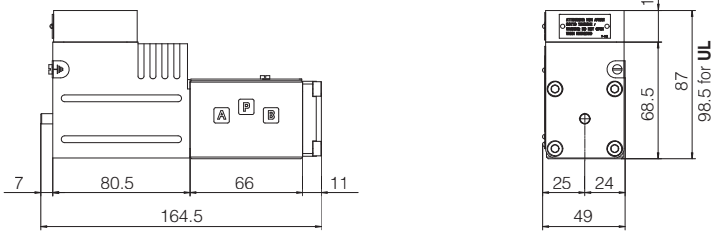
Valve's bottom view



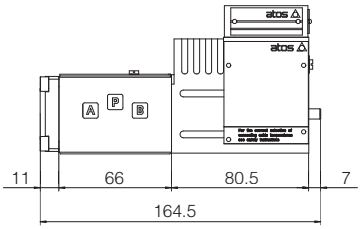
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

Mass [kg]	
DHA-06	2,65
DHA-07	4,3
Option /O	+0,35
Option /WP	+0,25

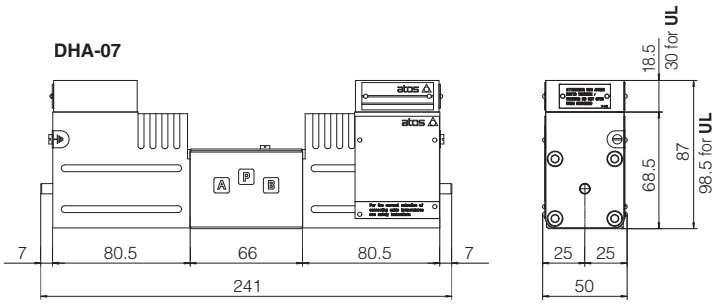
DHA-06



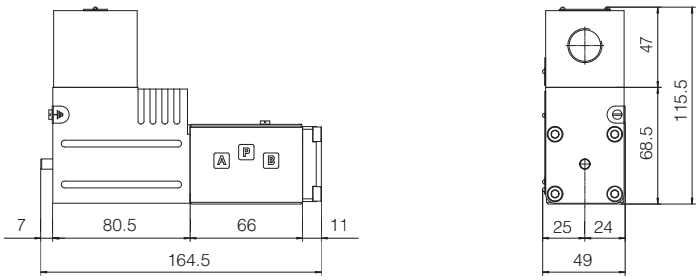
DHA-06 /A



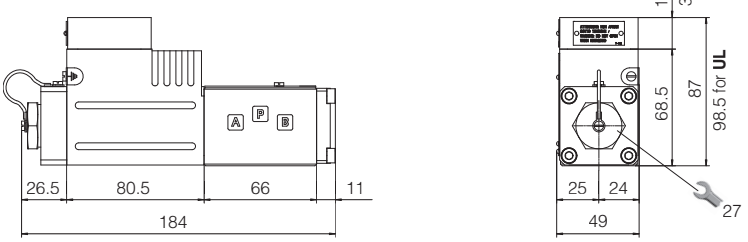
DHA-07



DHA-06 /O

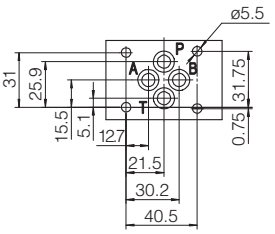


DHA-06 /WP



ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5x30 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

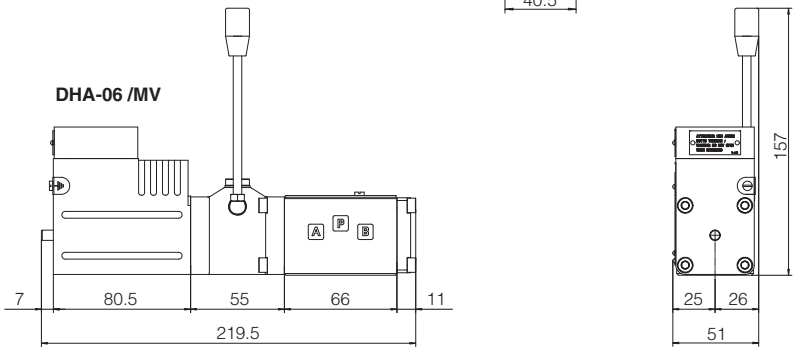
Valve's bottom view



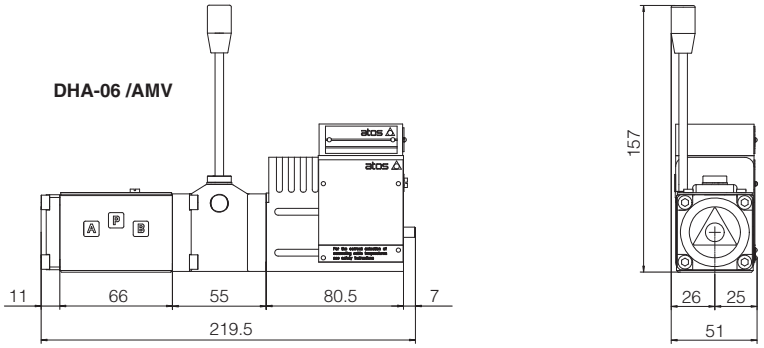
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

Mass [kg]	
DHA-06/MV	2,9
DHA-07/MV	4,55

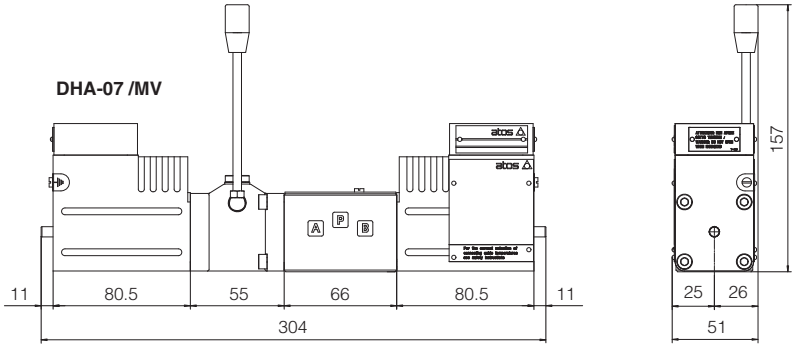
DHA-06 /MV



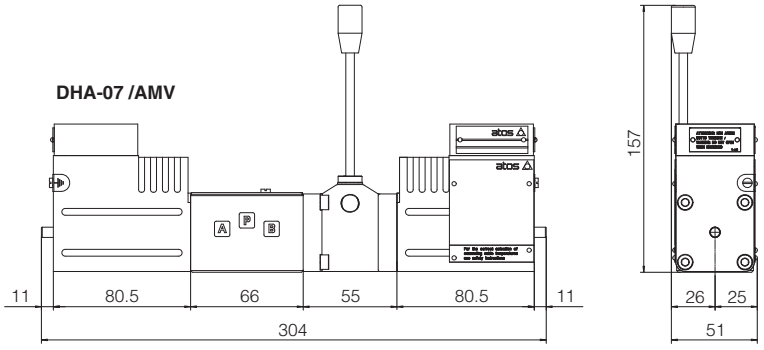
DHA-06 /AMV



DHA-07 /MV



DHA-07 /AMV

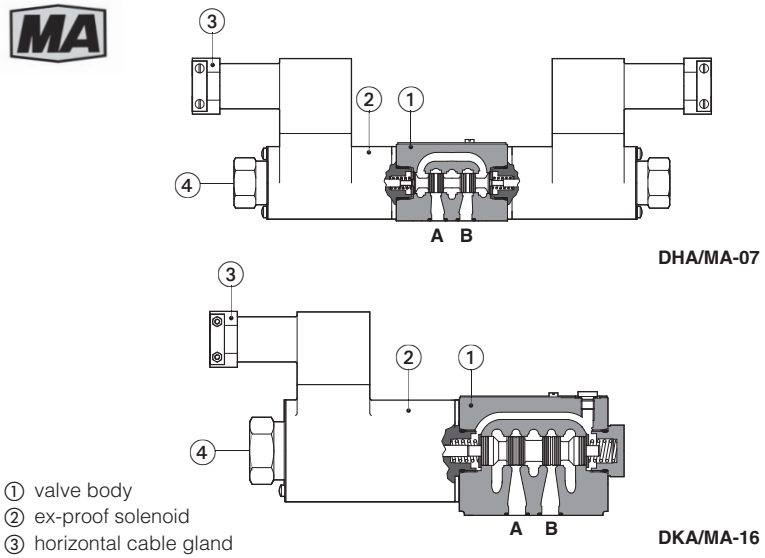


16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**EX900**	Operating and manintenance information for ex-proof on-off valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
X030	Summary of Atos ex-proof components certified to cULus	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof solenoid directional valves

On-off, direct, spool type - **MA certification**



① valve body
② ex-proof solenoid
③ horizontal cable gland
④ manual override

On-off directional valves equipped with explosion-proof solenoids certified according to **MA** Chinese mining certification, protection mode:

Ex d I Mb for surface, tunnel or mine plants

The solenoids are provided with cable glands (horizontally oriented) for cable entrance and internal terminal board for power supply coils connections.

The solenoid case classified **Ex d** is designed to contain the possible explosion which could be caused by the presence of the gas mixture inside the housing, thus avoiding dangerous propagation in the external environment.

They are also designed to limit the external temperature according to the certified class to avoid the self ignition of the explosive mixture present in the environment.

DHA/MA:	**DKA/MA**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **120 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHA	/	MA	-	0	63	1/2	/	*	24DC	*	*

DHA = spool type - direct, size 06
DKA = spool type - direct, size 10

MA = Ex-proof Ma Chinese mining certification

Valve size (ISO 4401)
0 = 06 for DHA
1 = 10 for DKA

Configuration, see section 2

Spool type, see section 2

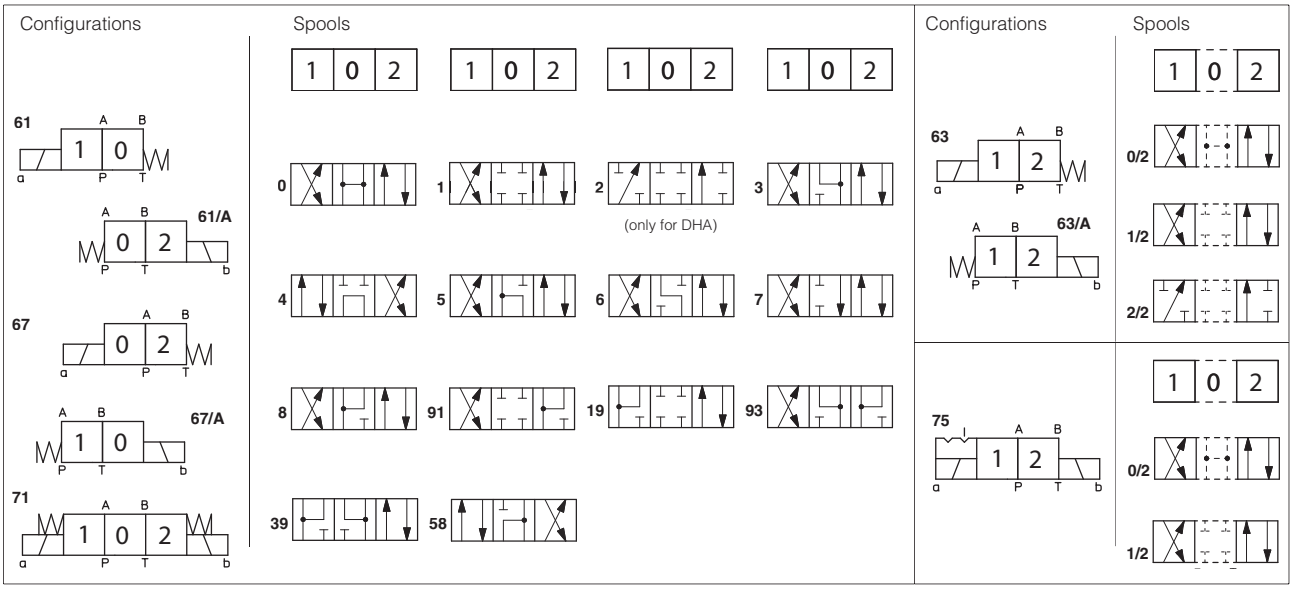
Option:
A = solenoid at side of port B (for single solenoid valves)

Voltage code, see section 5

Series number

Seals material, see sect. 6:
- = NBR
PE = FKM

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



DHA spools **1, 4**, **5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1.** They are properly shaped to reduce water-hammer shocks during the swiching.
DKA spool **1** is also available as **1/1.** It is properly shaped to reduce water-hammer shocks during the swiching.

3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure Ex-d

4 HYDRAULIC CHARACTERISTICS

Operating pressure	**DHA/MA**	P, A, B = **350 bar**	T = **210 bar**
	DKA/MA	P, A, B = **315 bar**	T = **210 bar**
Maximuim flow	**DHA/MA**	**80 l/min**	
	DKA/MA	**120 l/min**	

5 ELECTRICAL CHARACTERISTICS

SOLENOID TYPE	ON/OFF	
Voltage code VDC ±10%	**12DC, 24DC, 110DC**	
Power consumption	16,5 W (DHA)	18W (DKA)
Protection degree	IP 65 to DIN EN 60529	
Duty factor	100%	

6 SEALS AND HYDRAULIC FLUID

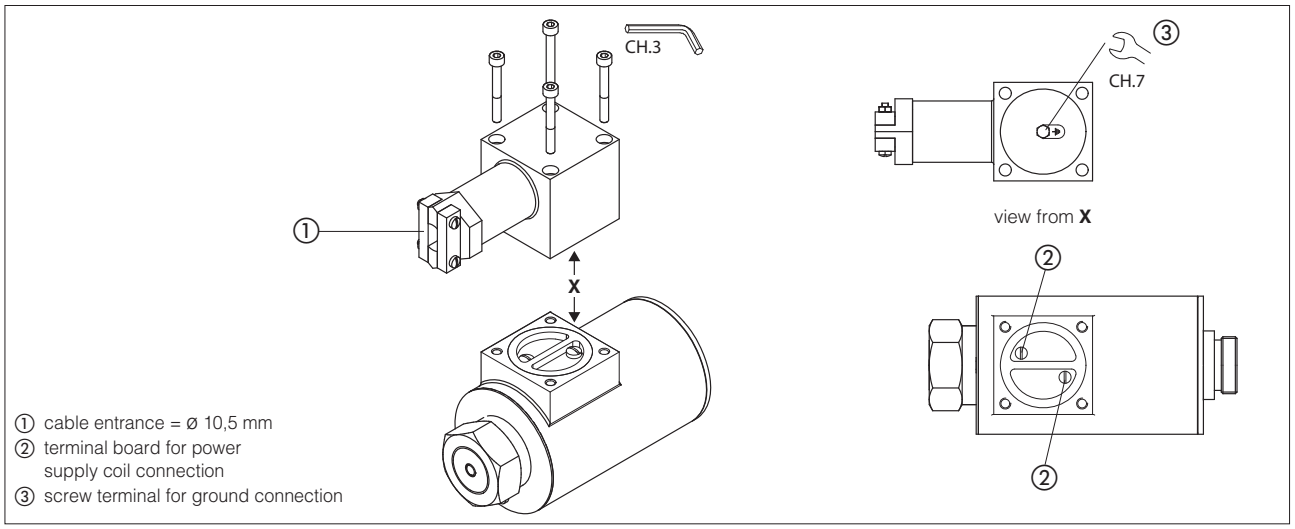
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

7 CERTIFICATION DATA

Valve type	DHA**/MA**	DKA**/MA**
Certification	MA mining	
Solenoid certified code	**DTBZ12 - 37 FYC**	**DTB29 - 90FYC**
Type examination certificate	CNEx 17.4187	CNEx 17.4190
Method of protection	Ex d I Mb	
Ambient temperature	≤ 135 °C	
Ambient temperature	-20 ÷ +40 °C	
Cable entrance:	cable entrance Ø =10.5mm	

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

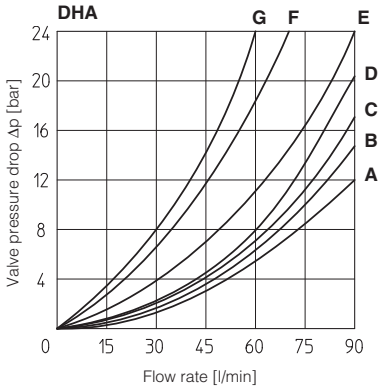
8 EX-PROOF SOLENOID WIRING



9 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

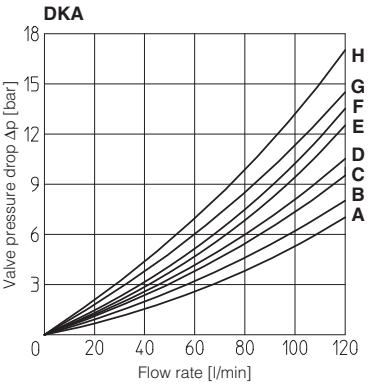
DHA

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1	A	A	C	C	D
1, 1/1	D	C	C	C	
3, 3/1	D	D	A	A	
4, 4/8, 5, 5/1, 58, 58/1 19, 91, 93, 39	F	F	G	C	E
1/2, 0/2	D	D	D	D	
6, 7	D	D	D	D	
8	A	A	E	E	
2	D	D			
2/2	F	F			



DKA

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T	B→A
0, 0/1, 0/2, 2/2	A	A	B	B		
1, 1/1, 1/3, 6, 8	A	A	D	C		
3, 3/1, 7	A	A	C	D		
4	B	B	B	B	F	
5	A	B	C	C	G	
1/2	B	C	C	B		
19	A	D	C			H



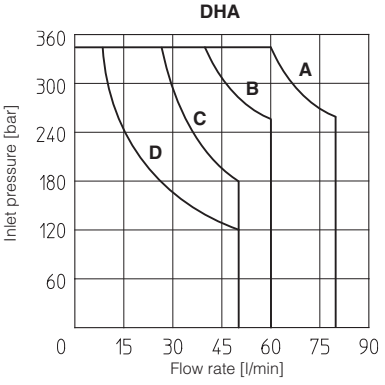
10 OPERATING LIMITS For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

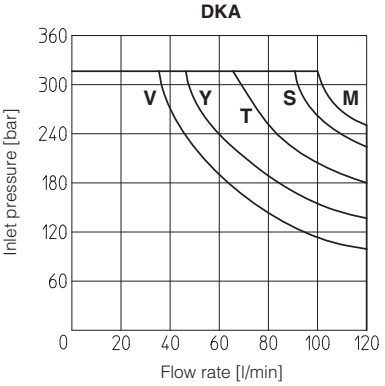
DHA

A = Spools 0, 0/1, 1, 1/2, 3, 8
B = Spools 0/2, 1/1, 6, 7
C = Spools 3/1, 4, 4/8, 5, 5/1, 19, 39, 58, 58/1, 09, 90, 91, 93, 94
D = Spools 2, 2/2

DKA

M = Spools 0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8
S = Spools 1/3, 6, 7
Y = Spools 4, 5
V = Spools 2/2
T = Spools 19

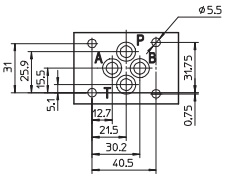




11 INSTALLATION DIMENSIONS FOR DHA/MA AND DKA/MA

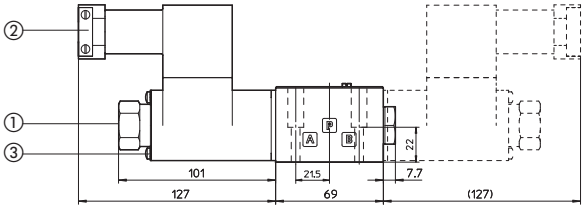
DHA/MA

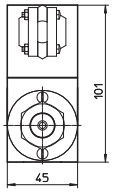
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5x30 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)



P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

DHA/MA-06
DHA/MA-07 (dotted line)



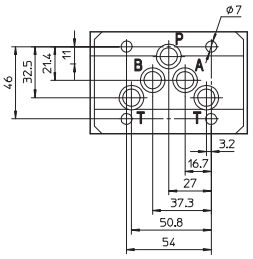


Mass of basic versions:
DHA/MA-06: 3,2 kg
DHA/MA-07: 4,9 kg

① manual override
② horizontal cable gland, cable entrance = ø 10,5 mm
③ screw terminal for additional equipotential grounding

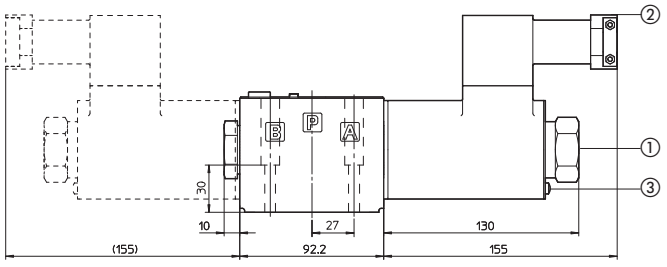
DKA/MA

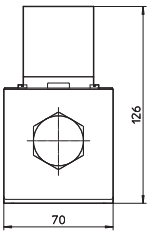
ISO 4401: 2005
Mounting surface according to 4401-05-05-0-05
(without X port, Y port optional)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050 and 1 OR 108
Ports P,A,B,T: Ø = 11.5 mm (max)
Ports Y: Ø = 5 mm



P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

DKA/MA-16
DKA/MA-07 (dotted line)





Mass of basic versions:
DKA/MA-16: 5,7 kg
DKA/MA-17: 8,7 kg

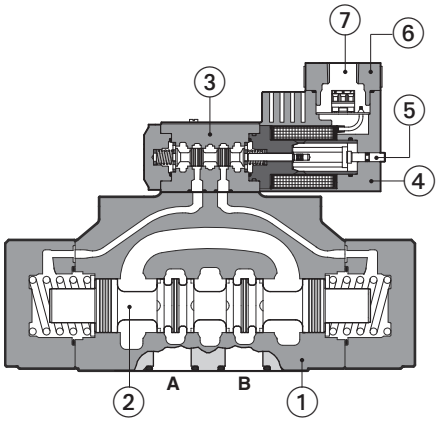
① manual override
② horizontal cable gland, cable entrance = ø 10,5 mm
③ screw terminal for additional equipotential grounding

12 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**EX900**	Operating and manintenance information for ex-proof on-off valves
X040	Summary of Atos ex-proof components certified to MA	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof solenoid directional valves

on-off, piloted - **ATEX, IECEx, EAC, PESO** or **cULus**



DPHA-461*

① main body
② main spool
③ pilot valve
④ ex-proof solenoid
⑤ manual override
⑥ threaded connection for cable gland
⑦ internal terminal board fr cable connection

DPHA

On-off spool type, piloted directional valves equipped with ex-proof solenoids certified for safe operation in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **10 ÷ 32** - ISO 4401
Max flow: **160 ÷ 1000 l/min**
Max pressure: **350 bar**

1 **MODEL CODE**

DPHA	/	*	-	2	63	1/2	/	M	/	*	24DC	*	/	*

DPHA: Ex-proof directional valve, piloted

Certification type:
Multicertification ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / II 2D **(1)**
M = Group I M2 (mining)
North American certification
UL = cULus

Valve size (ISO 4401)
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration, see section 2

Spool type, see section 2

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (3)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (4):
A = solenoid at side of port B (for single solenoid valves)
O = horizontal cable entrance **(3)**
/D = Internal drain
/E = external pilot pressure
/H = adjustable chokes (meter-out to the pilot chambers of the main valve)
/H9 = adjustable chokes (meter-in to the pilot chambers of the main valve)
L1, L2, L3 = calibrated restrictors in A and B ports of pilot valve
/L9 = (only for DPHA-2 and DPHA-4) plug with calibrated restrictor on port P of pilot valve
/R = pilot pressure generator (not for DPHA-1)
/S = main spool stroke adjustment (not for DPHA-1)
WP = ⚠ manual override protected by metallic cap

Voltage code, see section 7

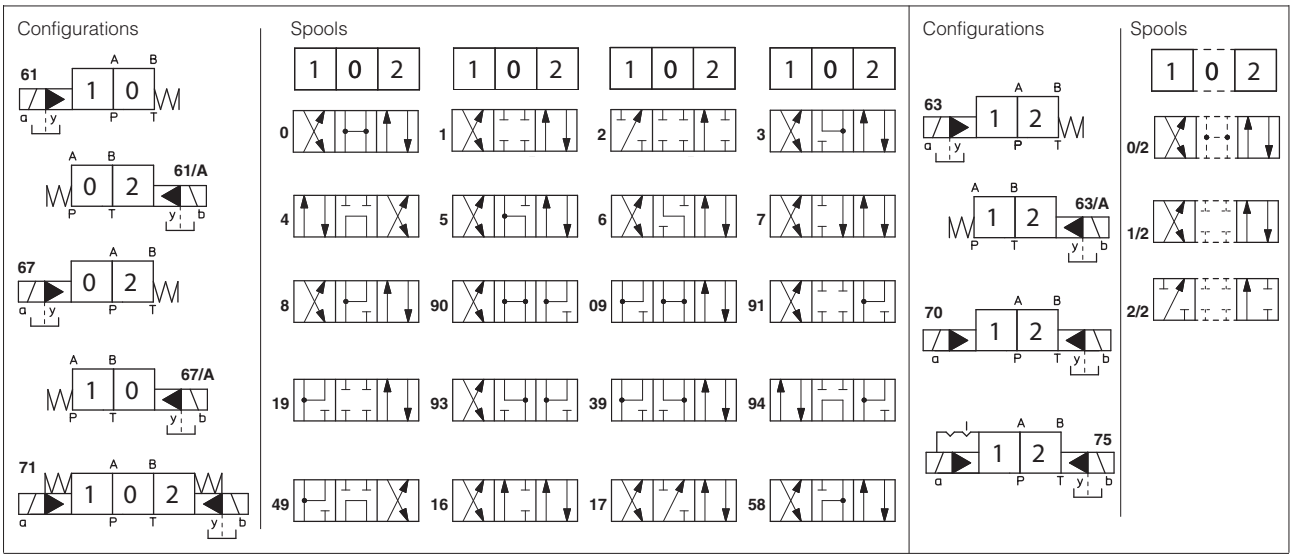
Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR **(3)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com **(2)** Approved only for the Italian market
(3) Not for multicertification **M** group I (mining) **(4)** For possible combined options, see 10

⚠ For valves with external drain (option /D), the pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar.

2 CONFIGURATIONS AND SPOOLS



2.1 Standard spools availability

- DPHA-1 are available only with spools **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- DPHA-2 and DPHA-4 are available with all spools shown in the above table
- DPHA-6 are available only with spools **0, 1, 1/2, 2, 3, 4, 5, 58, 6, 7, 8, 19, 91**

2.2 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5, 58, 6** and **7** are also available as **1/1, 4/8, 5/1, 58/1, 6/1** and **7/1** that are properly shaped to reduce water-hammer shocks during the switching (to use with option /L*).

2.3 Special spool availability

Valve size	standard spools							
	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPHA-1	•	•		•				
DPHA-2, DPHA-4	•	•	•	•	•	•	•	•
DPHA-6		•	•	•				

3 DEVICES FOR MAIN SPOOL SWITCHING CONTROL

Folowing options are suggested to reduce the hydraulic shocks at the valve operation

/H = Adjustable chokes (meter-out to the pilot chambers of the main valve).

/H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve).

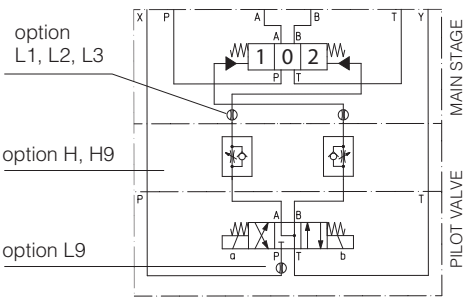
/L1, /L2, /L3 = calibrated restrictors on A and B ports of the pilot valve:

L1 = 0,8 mm, **L2** = 1 mm, **L3** = 1,25 mm

/L9 (only for DPHA-2 and DPHA-4) plug with calibrated restictor in P port of pilot valve see section 16

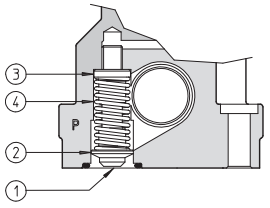
Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

FUNCTIONAL SCHEME (config. 71)
example of switching control options



4 PILOT PRESSURE GENERATOR (OPTION /R)

The device **/R** generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0, 0/1, 4, 4/8, 5, 58, 09, 90, 94, 49.** The device **/R** has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.

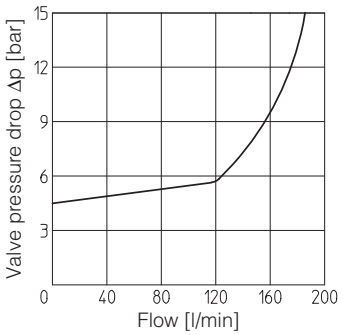


① Flapper-guide
② Flapper
③ Spring stop-washer
④ Spring

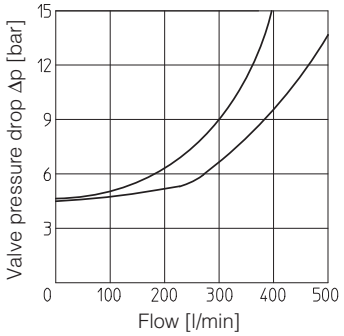
Ordering code of spare pilot pressure generator

R/DP	-	*
Pilot pressure generator		Size: **2** for DPHA-2 **4** for DPHA-4 **6** for DPHA-6 Not available for DPHA-1

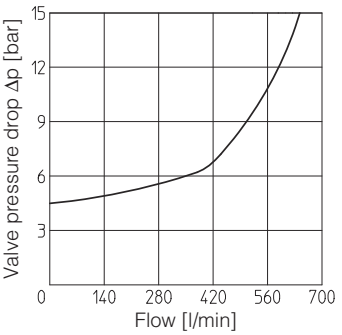
DPHA-2



DPHA-4



DPHA-6



5 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Operating pressure	P, A, B, X = **350 bar** T = **250 bar** with external drain (standard) T and Y = **210 bar** with internal drain (option /D) Minimum pilot pressure for correct operation is = **8 bar**
Rated flow	See diagrams Q/Δp at section 14
Maximum flow	DPHA-1: **160 l/min;** DPHA-2: **300 l/min;** DPHA-4: **700 l/min;** DPHA-6: **1000 l/min** see Q/Δp diagrams at section 14 and operating limits at section 15

7 ELECTRICAL CHARACTERISTICS

Valve type		DPHA	DPHA**/M**	DPHA**/UL**
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W		12W
Coil insulation		class H		
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor		100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

9 CERTIFICATION DATA

Valve type	DPHA		DPHA**/M**	DPHA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American cULus **cULus**	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0: EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

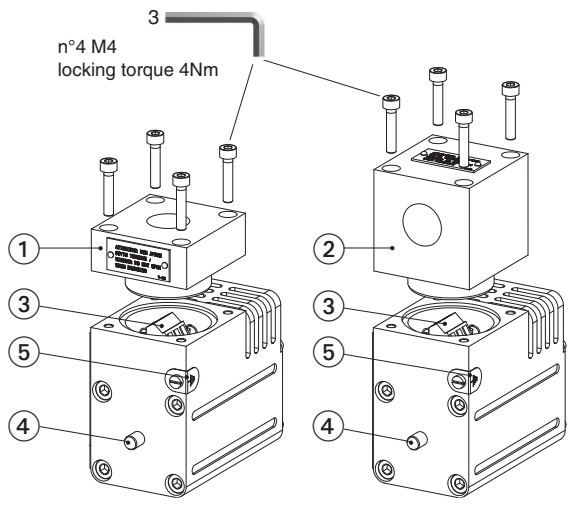
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

10 OPTIONS

A = Solenoid at side of port B of the main stage (for single solenoid valves)
O = Horizontal cable entrance, to be selected in case of limited vertical space
/D = Internal drain
/E = External pilot pressure
/H = Adjustable chokes (meter-out to the pilot chambers of the main valve)
/H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve)
L1, L2, L3 = Calibrated restrictors in A and B ports of pilot valve
/L9 = (only for DPHA-2 and DPHA-4) plug with calibrated restrictor on port P of pilot valve
/R = Pilot pressure generator (not for DPHA-1)
/S = Main spool stroke adjustment (not for DPHA-1)
WP = Manual override protected by metallic cap

11 EX PROOF SOLENOIDS WIRING

Multicertification



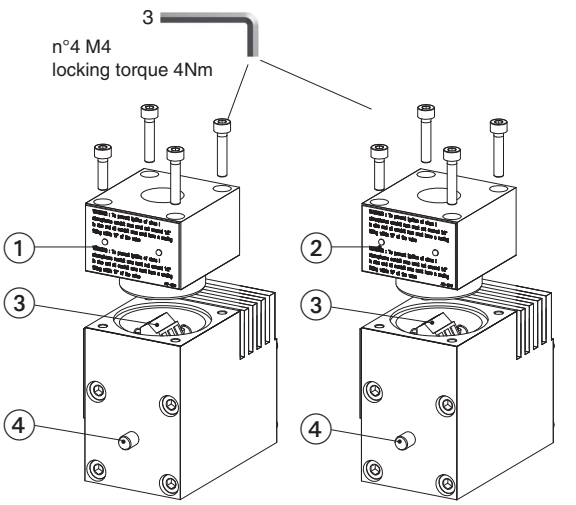
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

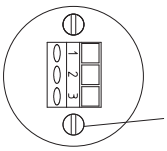
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to coil polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 12 note 1

alternative GND screw terminal connected to solenoid housing

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus certification

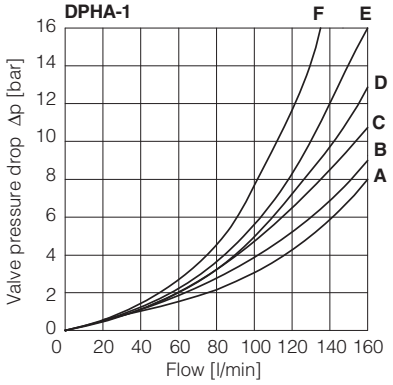
Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

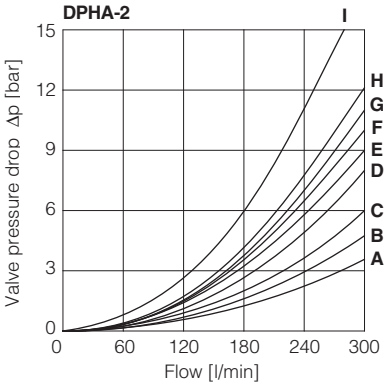
13 CABLE GLANDS only for Multicertification

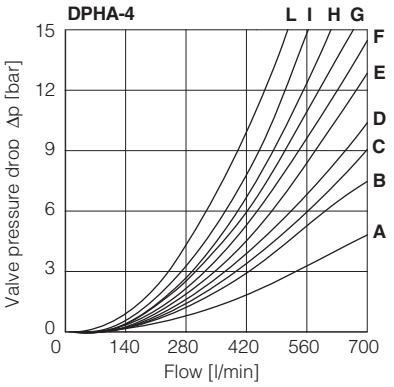
Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

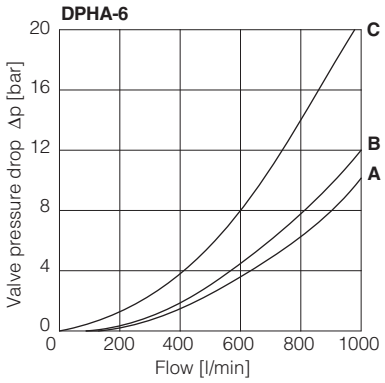
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C









DPHA-1

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	C	-
0	D	E	C	C	E
1	A	B	D	C	-
3, 6, 7	A	B	C	C	-
4, 4/8	B	C	D	D	-
5, 58	A	E	C	C	F

DPHA-6

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0	A	A	B	B	B
1	A	A	A	B	-
3	A	-	A	B	-
4	A	A	C	C	C

DPHA-2

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1, 3, 6, 7, 8	A	A	D	A	-
1/1, 1/2, 7/1	B	B	D	E	-
0	A	A	D	E	C
0/1	A	A	D	-	-
2	A	A	-	-	-
2/2	B	B	-	-	-
3/1	A	A	D	D	-
4	C	C	H	I	F
4/8	C	C	G	I	F
5	A	B	F	H	G
5/1	A	B	D	F	-
6/1	B	B	C	E	-
09	A	-	-	G	-
16	A	C	D	F	-
17	C	A	E	F	-
19	C	-	-	G	-
39	C	-	-	H	-
49	-	D	-	-	-
58	B	A	F	H	H
58/1	B	A	D	F	-
90	A	A	E	-	D
91	C	C	E	-	-
93	-	C	D	-	-
94	D	-	-	-	-

DPHA-4

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
1	B	B	B	D	-
1/1	D	E	E	F	-
1/2	E	D	B	C	-
0	D	C	D	E	F
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-
0/2	D	D	D	E	-
2	B	B	-	-	-
2/2	E	D	-	-	-
3	B	B	D	F	-
4	C	C	H	L	L
5	A	D	D	D	H
6/1	D	E	D	F	-
7/1	D	E	F	F	-
8	D	D	E	F	-
09	D	-	-	F	F
16	C	D	E	F	-
17	E	D	E	F	-
19	F	-	-	E	-
39	G	F	-	F	-
58	E	A	B	F	H
58/1	E	D	D	F	-
90	D	D	D	-	F
91	F	F	D		
93	-	G	D	-	-

15 OPERATING LIMITS For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPHA-1

Spool type	Inlet pressure [bar]			
	70	160	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7	160	160	160	145
4, 4/8	160	160	135	100
5, 58	160	160	145	110
0/1, 0/2, 1/2	160	160	145	135

DPHA-2

Spool type	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7, 8	300	300	300	300
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1, 0/2, 1/2	300	250	210	180
16, 17, 56, *9, 9*	300	300	270	200

DPHA-4

Spool type	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 6, 7, 8	700	700	700	600
2, 4, 4/8	500	500	450	400
5, 0/1, 0/2, 1/2	600	520	400	300
0, 3	700	700	600	540
16, 17, 58, *9, 9*	500	500	500	450

DPHA-6

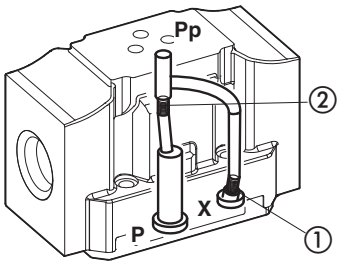
Spool type	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 3, 6, 7, 8	1000	950	850	700
0	950	900	800	650
2, 4, 4/8, 5	850	800	700	450
0/1, 58, 19, 91	950	850	650	450

16 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

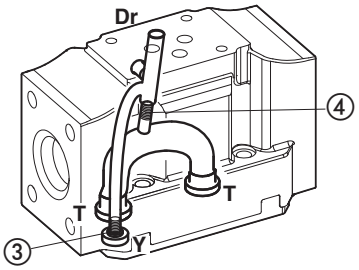
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPHA-1

Pilot channels



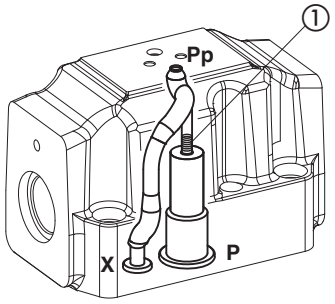
Drain channels



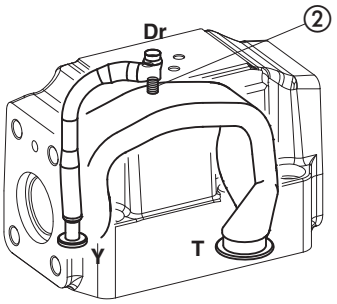
Internal piloting: blinded plug SP-X300F ① in X;
plug SP-X310F ② in Pp;
External piloting: blinded plug SP-X300F ② in Pp;
plug SP-X310F ① in X;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPHA-2

Pilot channels

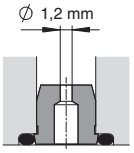


Drain channels



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

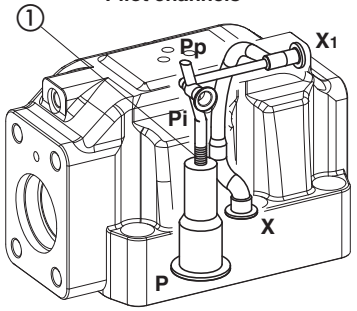
Option L9
This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve



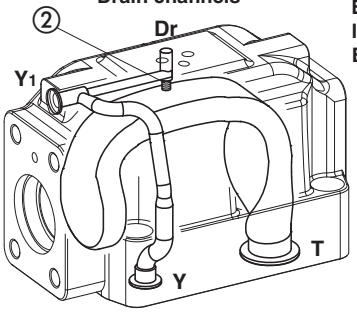
PLUG-12A

DPHA-4

Pilot channels

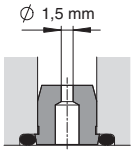


Drain channels



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

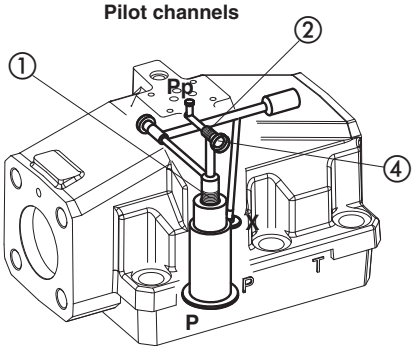
Option L9
This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve



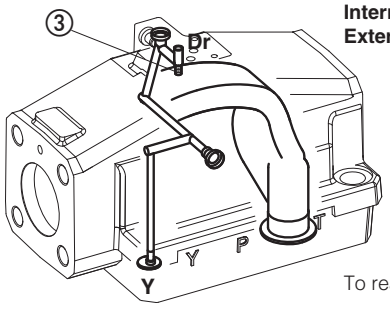
PLUG-15A

DPHA-6

Pilot channels



Drain channels



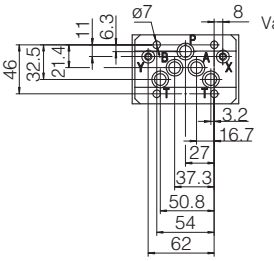
Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orifice ②, remove plug ④ = G 1/8”

17 INSTALLATION DIMENSIONS [mm] - Multicertified and UL

DPHA-1*

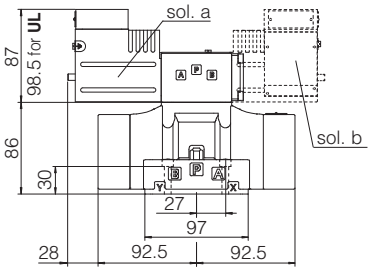
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A,B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;
Seals: 5 OR 2050, 2 OR 108

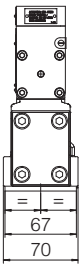


P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

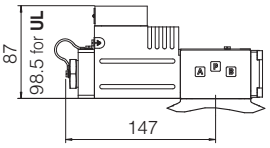
Mass [kg]	
DPHA-16	8,0
DPHA-17	9,5
Option /WP	+0,25
Option /O	+0,35
Option /H, /H9	+1,0

DPHA-16
DPHA-17 (dotted line)

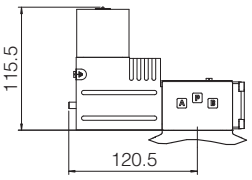




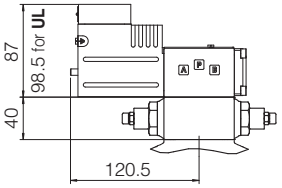
Option /WP



Option /O

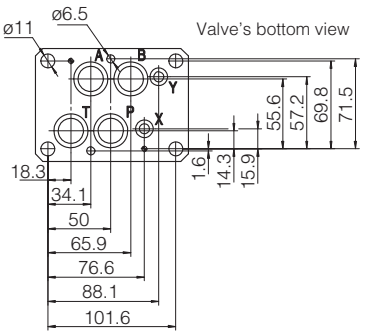


Option /H; /H9



DPHA-2*

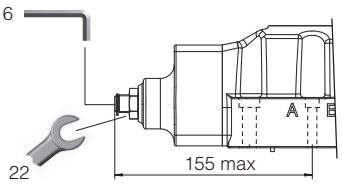
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 130, 2 OR 2043



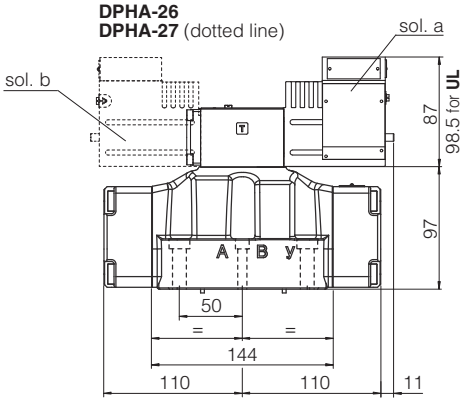
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

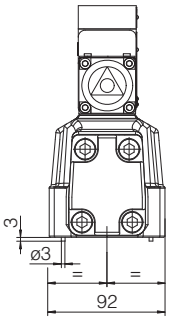
Mass [kg]	
DPHA-26	11
DPHA-27	12,5
Option /WP	+0,25
Option /O	+0,35
Option /S	+1,0
Option /H, /H9	+1,0

Option /S

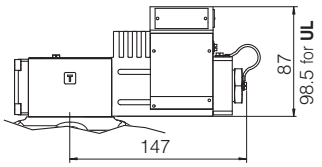


DPHA-26
DPHA-27 (dotted line)

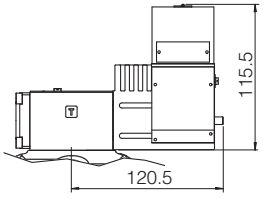




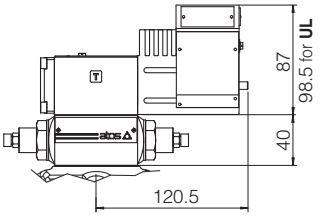
Option /WP



Option /O



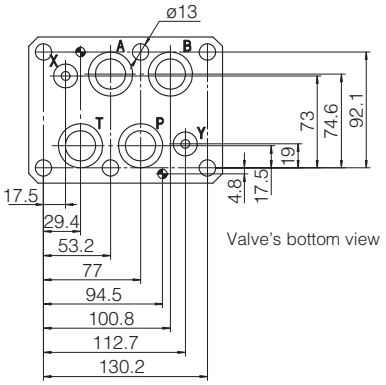
Option /H; /H9



DPHA-4*

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-08-08-0-05
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Seals: 4 OR 4112; 2 OR 3056
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;

Mass [kg]	
DPHA-46	18,5
DPHA-47	20,0
Option /WP	+0,25
Option /O	+0,35
Option /S	+1,5
Option /H, /H9	+1,0

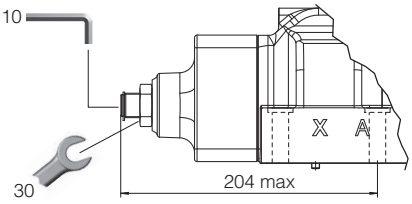


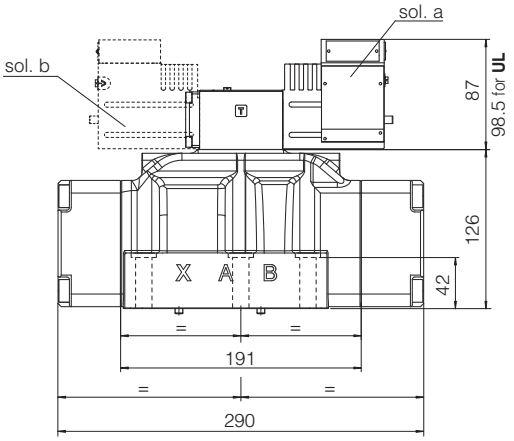
Valve's bottom view

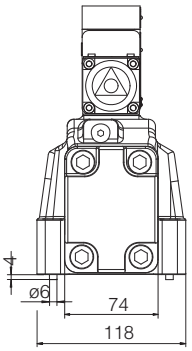
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

DPHA-46
DPHA-47 (dotted line)

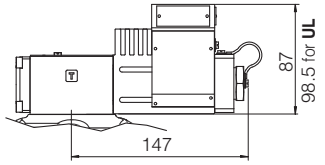
Option /S



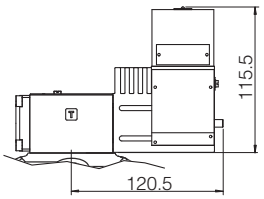




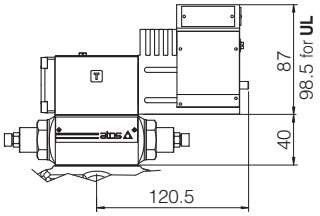
Option /WP



Option /O



Option /H; /H9



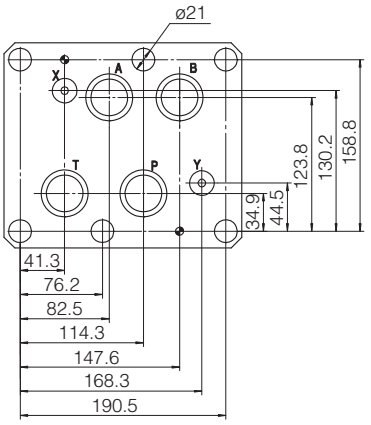
DPHA-6*

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

Fastening bolts:
6 socket head screws M20x80 class 12.9
Tightening torque = 600 Nm
Diameter of ports A, B, P, T: Ø = 34 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 144, 2 OR 3056

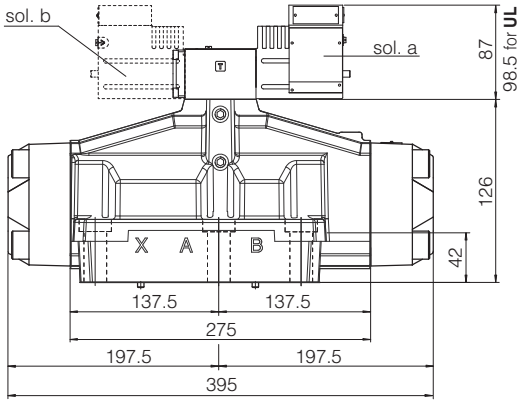
Mass [kg]	
DPHA-66	45,0
DPHA-67	46,5
Option /WP	+0,25
Option /O	+0,35
Option /S	+3,5
Option /H, /H9	+1,0

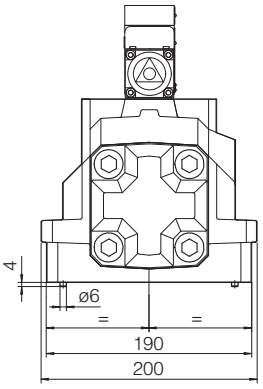
Valve's bottom view



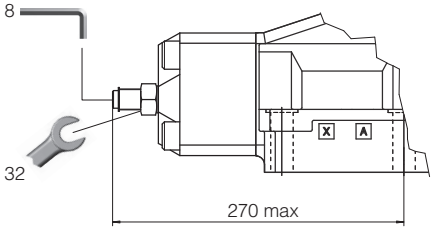
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

DPHA-66
DPHA-67 (dotted line)

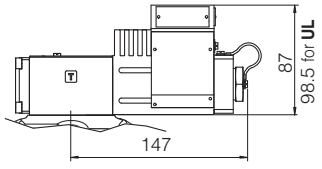




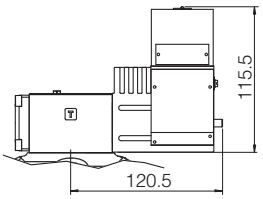
Option /S



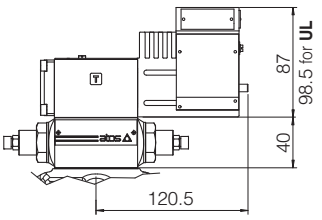
Option /WP



Option /O



Option /H; /H9

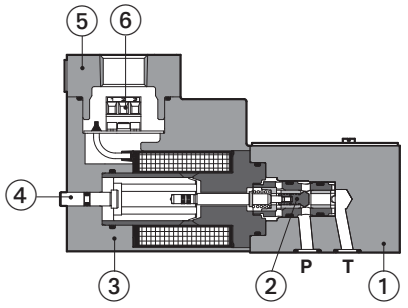


18 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
EX900	Operating and manintenance information for ex-proof on-off valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof solenoid directional valves

on-off, direct, poppet type leak free - **ATEX, IECEx, EAC, PESO** or **cULus**



DLAH-2A

① valve body
② poppet
③ ex-proof solenoid
④ manual override
⑤ threaded connections for cable gland
⑥ internal terminal board for cable connection

DLAH, DLAHM, CART LAH, CART LAHM

On-off oppet type, directional valves equipped with ex-proof solenoids certified for safe operation in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

They are **SIL** compliance with IEC 61508 (TÜV certified)

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

DLAH subplate, **CART LAH** screw-in
Size: **06** - ISO 4401 (only for DLAH)
Max flow: **12 l/min**
Max pressure: **350 bar**

DLAHM subplate, **CART LAHM** screw-in
Size: **06** - ISO 4401 (only for DLAHM)
Max flow: **30 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DLAH	/	*	-	2	A	/	M	/	*	24DC	/	*	/	*

DLAH
Ex-proof solenoid directional valves, poppet type

Subplate mounting
DLAH = max flow 12 l/min
DLAHM = max flow 30 l/min

Screw-in mounting
CART LAH = max flow 12 l/min
CART LAHM = max flow 30 l/min

Certification type:
Multicertification ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / II 2D **(1)**
M = Group I M2 (mining)

North American Certification:
UL = cULus

2 = two way (only for DLAH and CART LAH)
3 = three way

Configuration, see section 2
A **C**

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
O = horizontal cable entrance **(2)**
R = with check valve on port P (only for DLAH)
WP = ⚠ manual override protected by metallic cap

Voltage code, see section 5

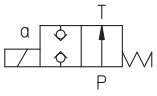
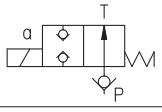
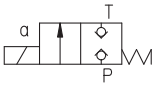
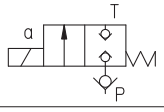
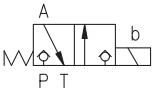
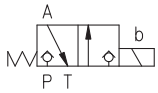
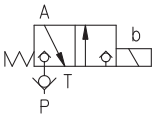
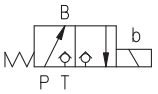
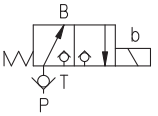
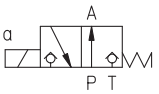
Series number

Seals material, see section 6:
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** For possible combined options, see 12.1 **(4)** Approved only for the Italian market

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

DLAH-2A **CART LAH-2A**	**DLAH-2A/R**	**DLAH-2C** **CART LAH-2C**	**DLAH-2C/R**	**DLAHM-3A** **CART LAHM-3A**
				
DLAH-3A **CART LAH-3A**	**DLAH-3A/R**	**DLAH-3C** **CART LAH-3C**	**DLAH-3C/R**	**DLAHM-3C** **CART LAHM-3C**
				

3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Operating pressure	DLAH, CART LAH, ports P,A,B: **350** bar; DLAHM, CART LAHM ports P,A: **315** bar; Port T **210** bar
Rated flow	See diagrams Q/Δp at section 13
Maximum flow	DLAH, CART LAH: **12 l/min**, DLAHM, CART LAHM: **30 l/min**, see operating limits at section 14

5 ELECTRICAL CHARACTERISTICS

Valve type		DLAH, DLAHM CART LAH, LAHM	DLAH**/M**, DLAHM**/M** CART LAH**/M**, LAHM**/M**	DLAH**/UL**, DLAHM**/UL** CART LAH**/UL**, LAHM**/UL**
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W		12W
Coil insulation		class H		
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor		100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature.

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type	DLAH, DLAHM CART LAH, LAHM		DLAH**/M**, DLAHM**/M** CART LAH**/M**, LAHM**/M**	DLAH**/UL**, DLAHM**/UL** CART LAH**/UL**, LAHM**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American cULus **cULus**	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

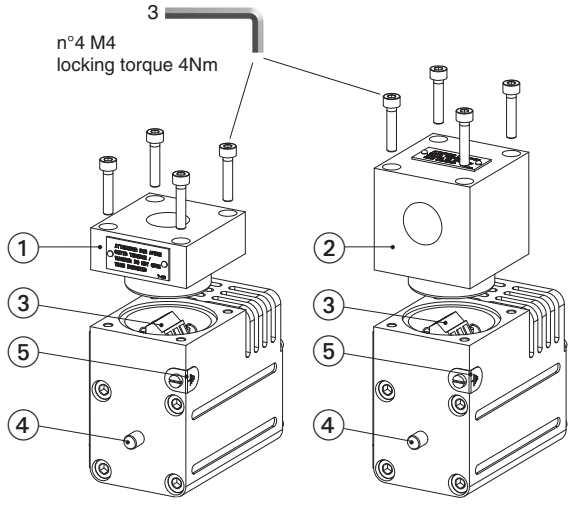
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 SIL compliance with IEC 61508: 2010 - only subplate version DLAH and DLAHM

DLAH and DLAHM (multicertified for surface and mining) meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

9 EX PROOF SOLENOIDS WIRING

Multicertification



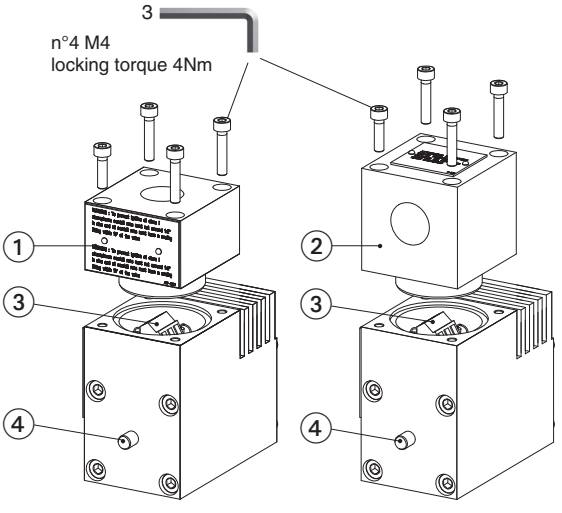
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

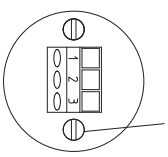
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to coil polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section [10] note 1

alternative GND screw terminal connected to solenoid housing

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

11 CABLE GLANDS only for Multicertification

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 OPTIONS

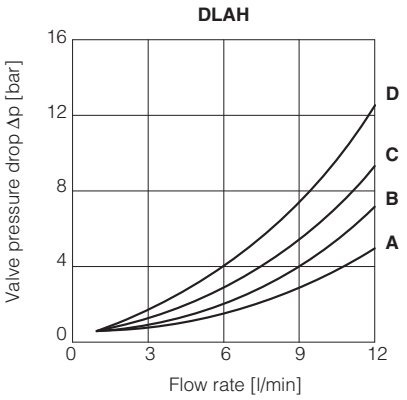
O = Horizontal cable entrance, to be selected in case of limited vertical space
R = Only for DLAH: integral check valve for free reverse flow
The DLAH-***/R** are provided with integral check valve for free reverse flow A→B
WP = Manual override protect by metallic cap

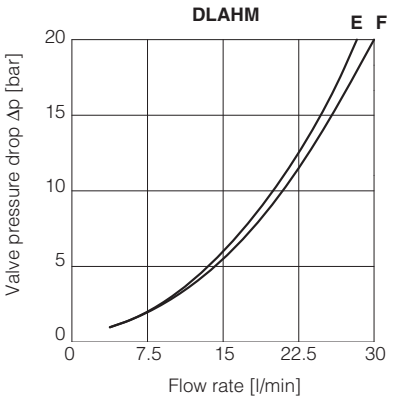
12.1 Possible combined options: /OP, /OR, /PR, /OPR

13 Q/Δp DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

Flow direction / Valve type	P → A (1) (P → B)	A → T (B → T)
DLAH-2A CART LAH-2A	B	–
DLAH-2C CART LAH-2C	C	–
DLAH-3A CART LAH-3A	D	C
DLAH-3C CART LAH-3C	C	A
DLAHM-3A CART LAHM-3A	F	E
DLAHM-3C CART LAHM-3C	F	E

(1) For two-way valves, pressure drop refers to P→T





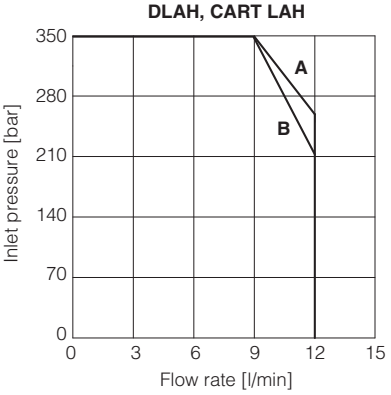
14 OPERATING LIMITS (based on mineral oil ISO VG 46 at 50°C)

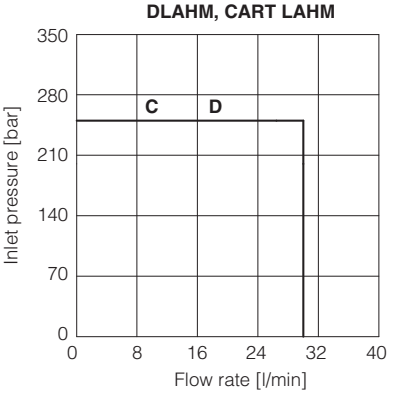
DLAH, CART LAH

A =CART LAH-3A, DLAH-3A;
B =CART LAH-2A, DLAH-2A,
CART LAH-3C, DLAH-3C

DLAHM, CART LAHM

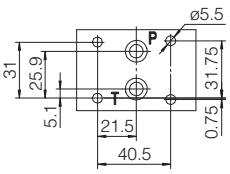
C =CART LAHM-3A, DLAHM-3A;
D =CART LAHM-3C, DLAHM-3C





15 INSTALLATION DIMENSIONS FOR SUBPLATE VERSION [mm] - Multicertified and UL

DLAH-2*

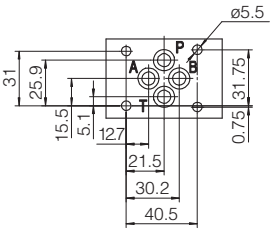


ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
without A and B ports
Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 2 OR 108
Ports P, T: Ø = 7,5 mm (max)

P = PRESSURE PORT
T = USE PORT

Mass [kg]	
DLAH-2*	2,65
DLAH-3*	2,65
Option /O	+0,35
Option /WP	+0,25

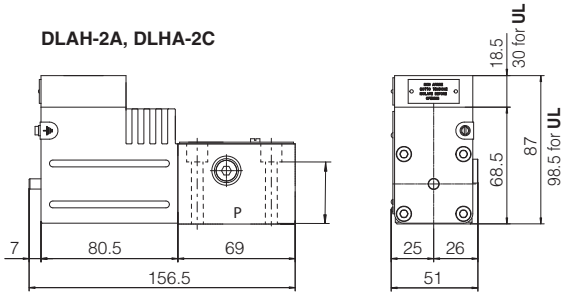
DLAH-3*



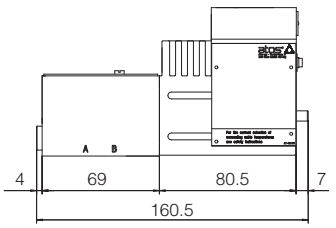
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5X50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

P = PRESSURE PORT
A = USE PORT (not used for DLAH-3C version)
B = USE PORT (not used for DLAH-3A version)
T = TANK PORT

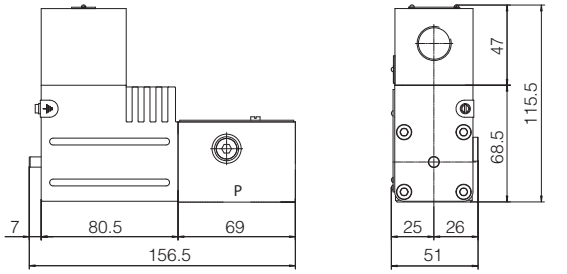
DLAH-2A, DLHA-2C



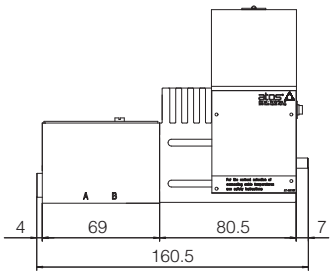
DLAH-3A ,DLAH-3C



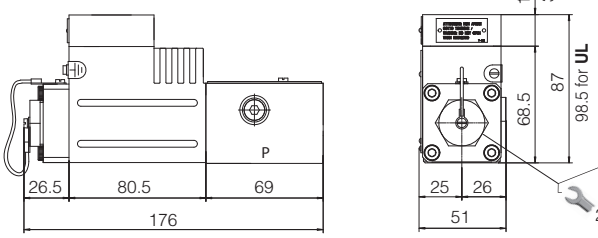
DLAH-2A /O, DLHA-2C /O



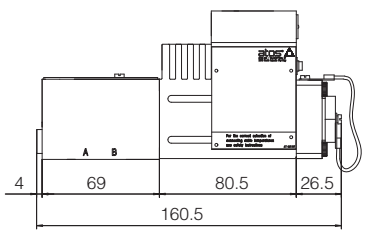
DLAH-3A /O ,DLAH-3C /O



DLAH-2A /WP, DLHA-2C /WP

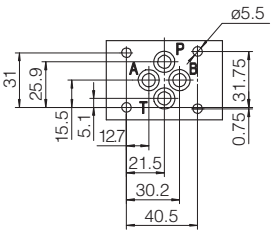


DLAH-3A /WP, DLAH-3C



DLAHM-3*

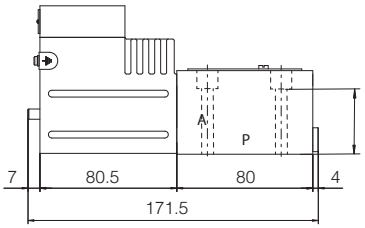
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5X50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

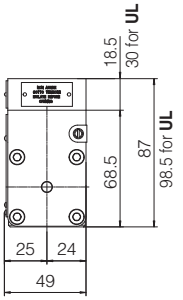


Mass [kg]	
DLAHM-3*	2,85
Option /O	+0,35
Option /WP	+0,25

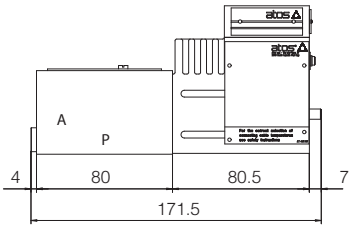
P = PRESSURE PORT
A = USE PORT
B = not used
T = TANK PORT

DLAHM-3C

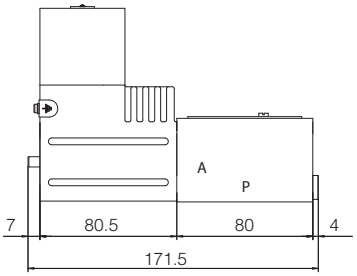


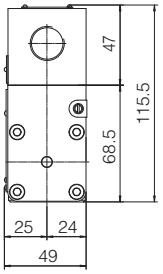


DLAHM-3A

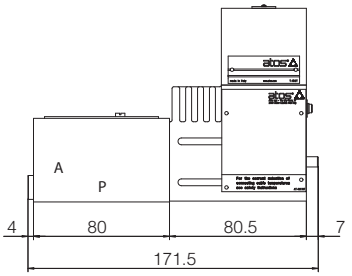


DLAHM-3C /O

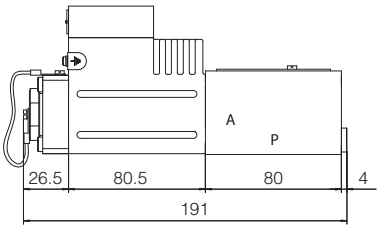


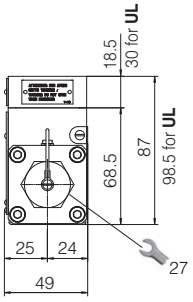


DLAHM-3A /O

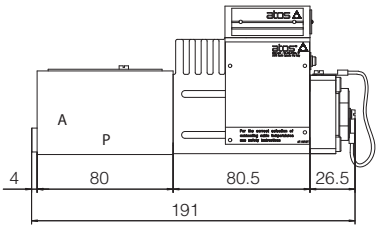


DLAHM-3C /WP



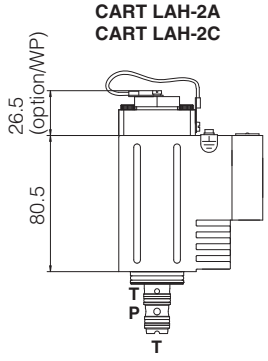


DLAHM-3A /WP

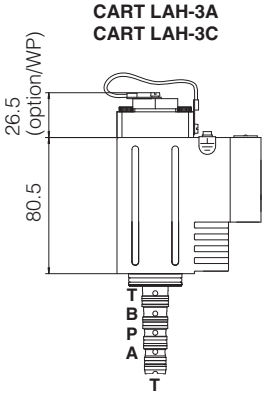


16 INSTALLATION DIMENSIONS FOR SCREW-IN VERSION [mm] - Multicertified and UL

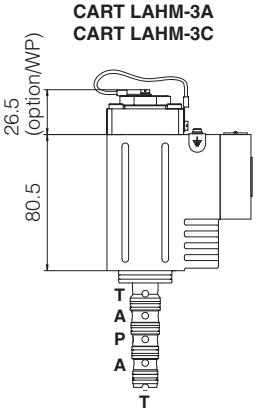
CART LAH-2A
CART LAH-2C



CART LAH-3A
CART LAH-3C



CART LAHM-3A
CART LAHM-3C

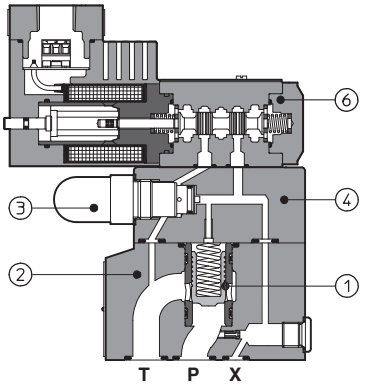


17 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
EX900	Operating and manintenance information for ex-proof on-off valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves
P006	Mounting surfaces and cavities for cartridge valves

Ex-proof pressure relief valves

piloted, subplate or in line mounting - **ATEX, IECEx, EAC, PESO** or **cULus**



① main poppet
② valve main body
③ mechanical pressure limiter
④ cover
⑤ ex proof pilot valve

AGAM-10/10/-AO**

AGAM, ARAM

Ex-proof pressure relief valves equipped with solenoid pilot valve for venting or multiple pressure selection, certified for safe operation in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

AGAM: pressure relief, subplate mounting
Size: **10, 20, 32** - ISO 6264
Max flow: **200, 400, 600 l/min**

ARAM: pressure relief, threaded connections
Size: **G 3/4"** and **G 1 1/4"**
Max flow: **350** and **500 l/min**

Max pressure: **350 bar**

1 **MODEL CODE**

AGAM	-	20	/	20	/	210/100/100	/	M	-	AO	/	*	/	24DC	*	/	*

AGAM
Ex-proof pressure relief valves, piloted
AGAM
subplate mounting
ARAM
threated connections

Valve size:
10 = AGAM (ISO 6264)
20 = AGAM (ISO 6264)
32 = AGAM (ISO 6264)
20 = ARAM G 3/4"
32 = ARAM G 1 1/4"

Configuration, see section 2 :

10	**20**	**22**
11	**21**	**32**

Max regulated pressure
of first (second / third) setting, see section 4 :

50 = 50 bar	**100** = 100 bar
210 = 210 bar	**350** = 350 bar

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Certification type:
AO = Multicertification for Group II 2G / II 2D **(3)**
AO/M = Multicertification for Group I M2 (mining)
AO/UL = cULus North American certification

Options (2):
E = external pilot
O = horizontal cable entrance **(1)**
V = regulating handweel for pressure adjustment
WP = ⚠ manual override protected by metallic cap
Y = external drain

Voltage code, see section 5

Series number

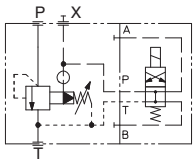
Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for multicertification **M** group I (mining) **(2)** For possible combined options, see 11.1 **(3)** The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(4) Approved only for the Italian market

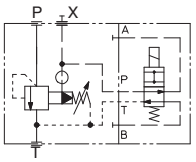
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS

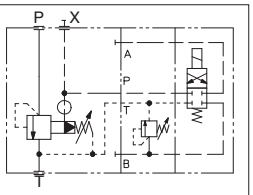
AGAM-/10**
ARAM-/10**
one setting pressure
+ venting with
de-energized solenoid



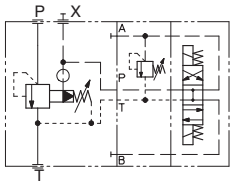
ARAM-/11**
AGAM-/11**
one setting pressure
+ venting with
energized solenoid



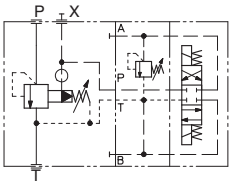
AGAM-/22**
ARAM-/22**
two setting pressure
without venting



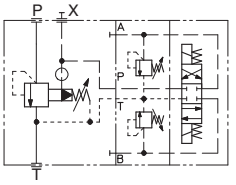
AGAM-/20**
ARAM-/20**
two setting pressure
+ venting with
de-energized solenoid



AGAM-/21**
ARAM-/21**
two setting pressure
+ venting with
energized solenoid



AGAM-/32**
ARAM-/32**
three setting pressure
without venting



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation -salt spray test (EN ISO9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Valve size		**10**	**20**	**32**
Max operating pressure	[bar]	port P = **350** port T, Y = **210**		
Max regulated pressure	[bar]	**50**	**100** **210**	**350**
Pressure range	[bar]	4÷50;	6÷100; 7÷210;	8÷350
Max flow **AGAM (1)**	[l/min]	200	400	600
Max flow **ARAM (1)**	[l/min]	-	350	500

(1) see Q/Δp diagrams at section 12 and 13

5 ELECTRICAL CHARACTERISTICS

Valve type		AGAM-*/**AO** ARAM-*/**AO**	AGAM-*/**AO/M** ARAM-*/**AO/M**	AGAM-*/**AO/UL** ARAM-*/**AO/UL**
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W		12W
Coil insulation		class H		
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor		100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

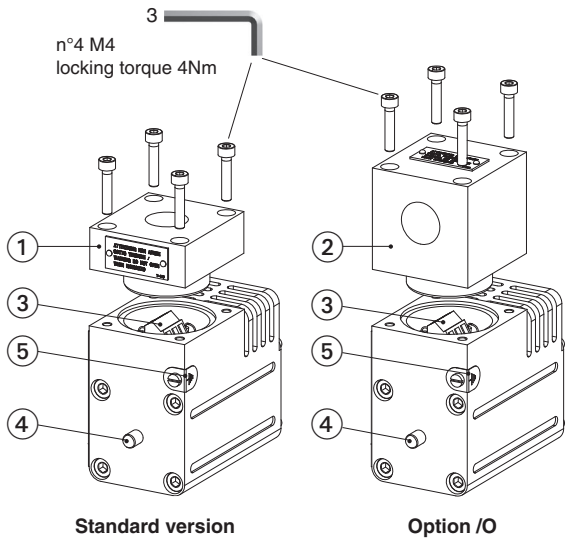
Valve type	AGAM-*/**AO** ARAM-*/**AO**		AGAM-*/**AO/M** ARAM-*/**AO/M**	AGAM-*/**AO/UL** ARAM-*/**AO/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American cULus **cULus**	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX PROOF SOLENOIDS WIRING

Multicertification



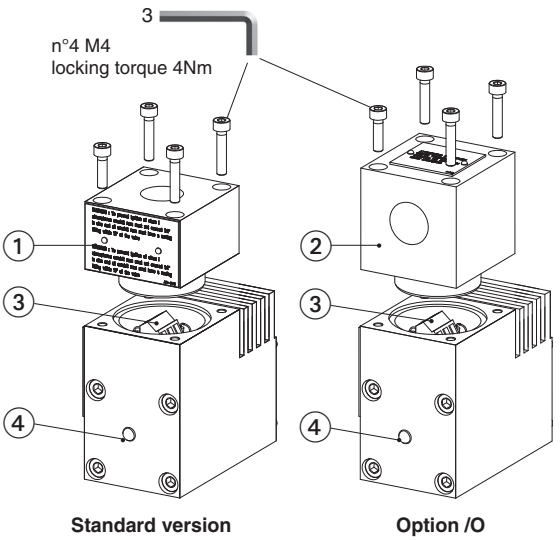
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

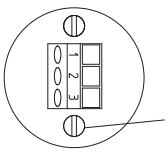
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override



⚠ **Pay attention to coil polarity**

1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section [9] note 1

alternative GND screw terminal connected to solenoid housing

9 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

10 **CABLE GLANDS only for Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 **OPTIONS**

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").

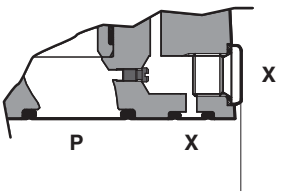
O = Horizontal cable entrance, to be selected in case of limited vertical space

V = Regulating handweel for pressure adjustment

WP = Manual override protect by metallic cap

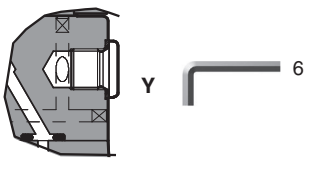
Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.

E option



Blinded plug SP-X100A

Y option

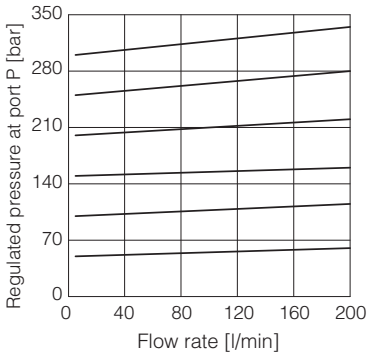


11.1 Possible combined options:

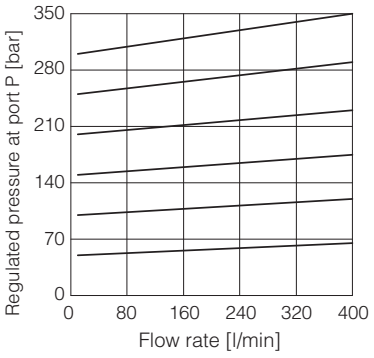
/EO, /EV, /EY, /EW, /EWP, /EOV, /EOY, /EVY
/EOWP, /EWPY, /EOVY, /EOVWP, /EVWPY, /EOVWPY
/OV, /OY, /OWP, /OVY, /OVWP, /OWPY, /OVWPY,
/VY, /VWP, /VWPY
/WPY

12 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

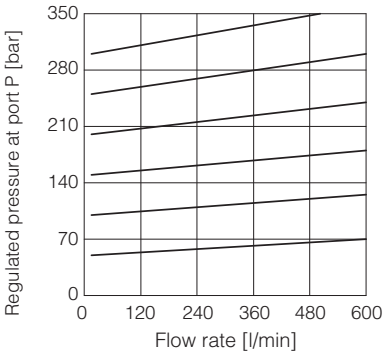
AGAM-10



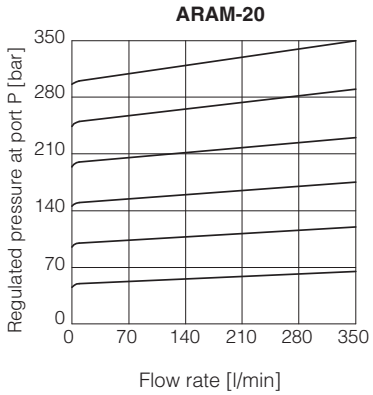
AGAM-20



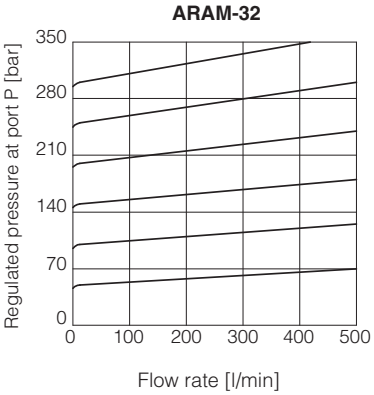
AGAM-32



ARAM-20

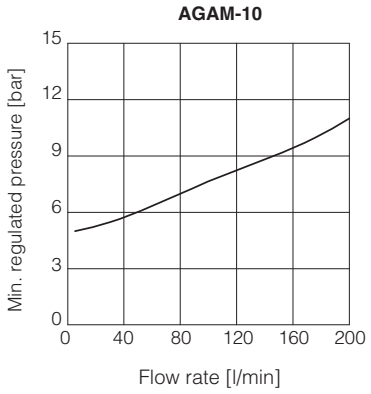


ARAM-32

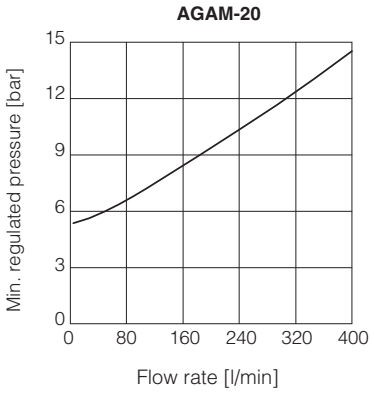


13 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

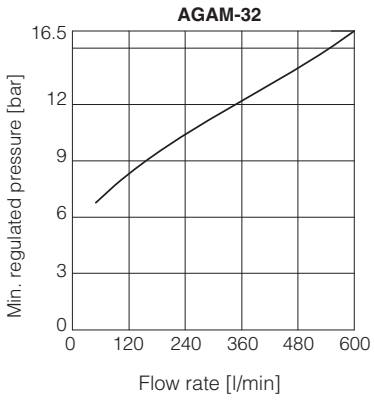
AGAM-10



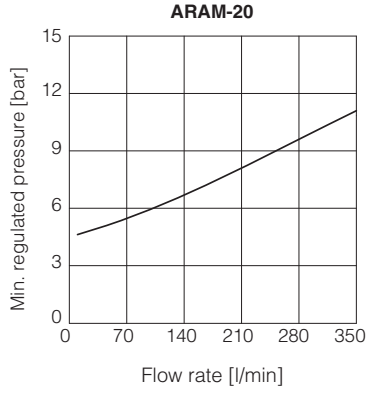
AGAM-20



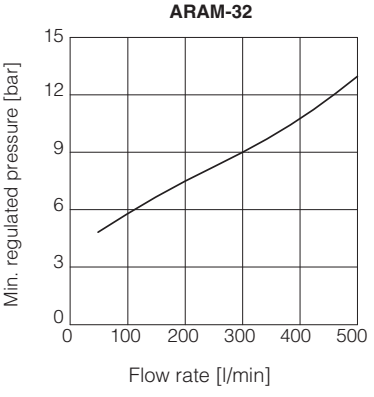
AGAM-32



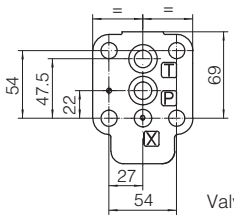
ARAM-20



ARAM-32



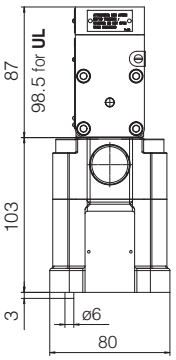
AGAM-10



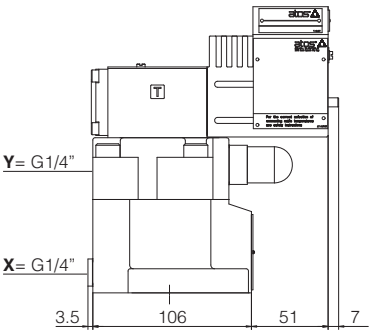
Valve's bottom view

ISO 6264: 2007 (see table P005)
Mounting surface: 6264-06-09-1-97
Fastening bolts:
4 socket head screws M12x35 class 12.9
Tightening torque = 125 Nm
Seals: 2 OR 123; 1 OR 109/70
Ports P, T: Ø = 14,5 mm
Ports X: Ø = 3,2 mm

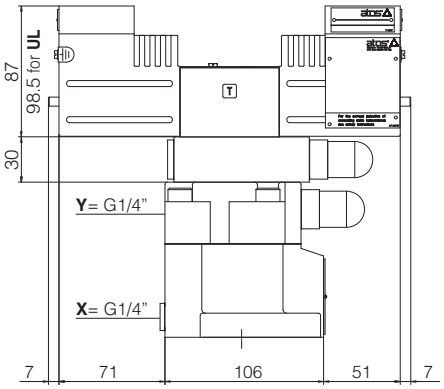
Mass [kg]	
AGAM-10/10 10/11	6,45
AGAM-10/20 10/21	7,55
AGAM-10/22 10/32	7,25 9
option /V	-
option /O	+0,35
option /WP	+0,25



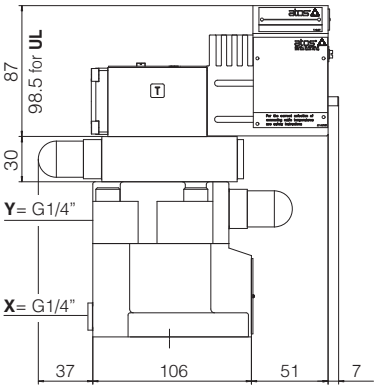
AGAM-10/10/-AO**
AGAM-10/11/-AO**



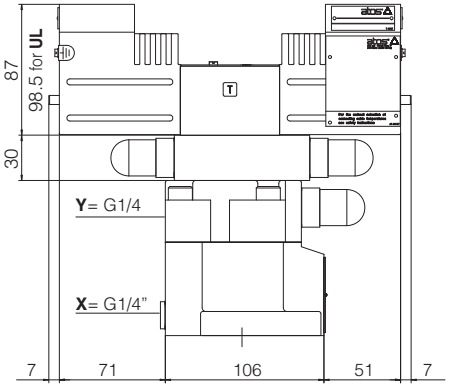
AGAM-10/20/-AO**
AGAM-10/21/-AO**



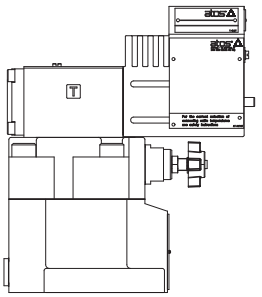
AGAM-10/22/-AO**



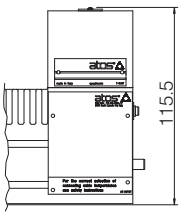
AGAM-10/32/-AO**



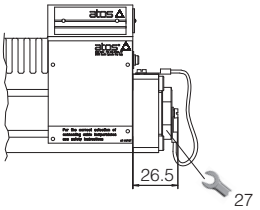
Option /V



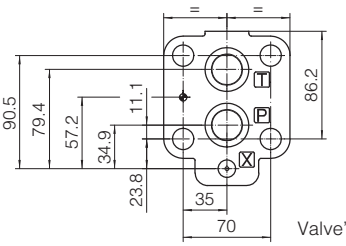
Option /O



Option /WP



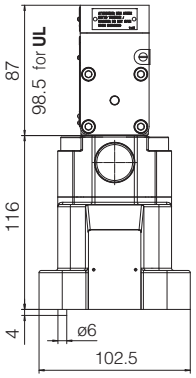
AGAM-20



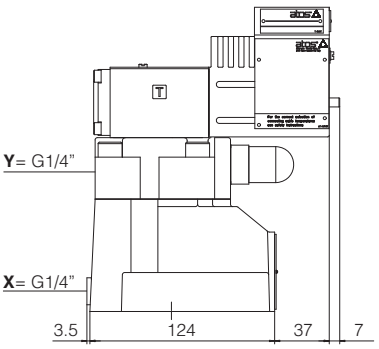
Valve's bottom view

ISO 6264: 2007 (see table P005)
Mounting surface: 6264-08-11-1-97
Fastening bolts:
4 socket head screws M16x50 class 12.9
Tightening torque = 300 Nm
Seals: 2 OR 4112; 1 OR 109/70
Ports P, T: Ø = 24 mm
Ports X: Ø = 3,2 mm

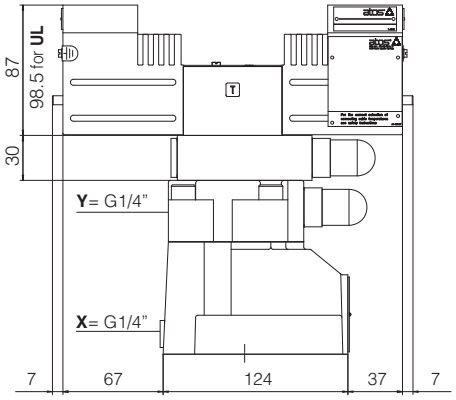
Mass [kg]	
AGAM-20/10 20/11	7,65
AGAM-20/20 20/21	8,75
AGAM-20/22 20/32	8,45 10,2
Option /V	-
Option /O	+0,35
Option /WP	+0,25



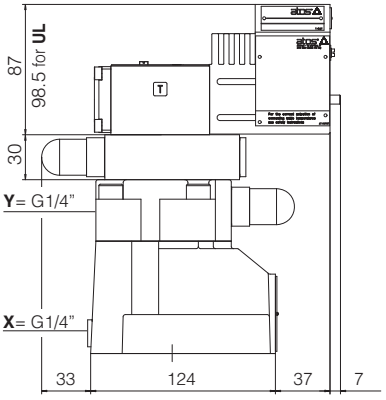
AGAM-20/10/-AO**
AGAM-20/11/-AO**



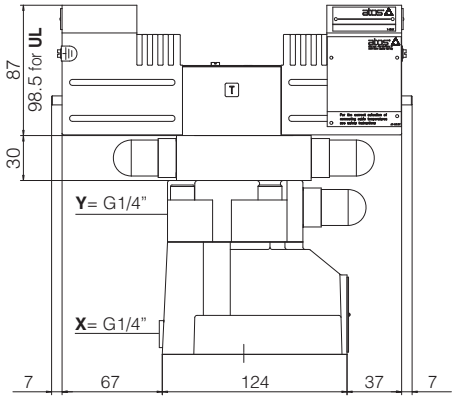
AGAM-20/20/-AO**
AGAM-20/21/-AO**



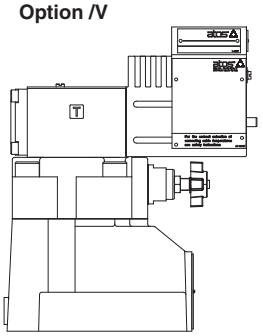
AGAM-20/22/-AO**



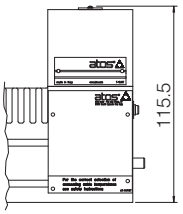
AGAM-20/32/-AO**



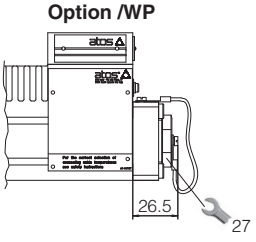
Option /V



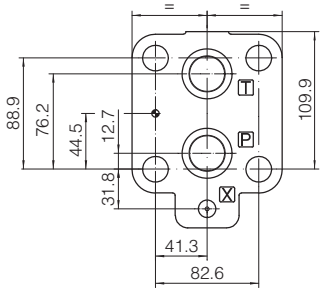
Option /O



Option /WP



AGAM-32

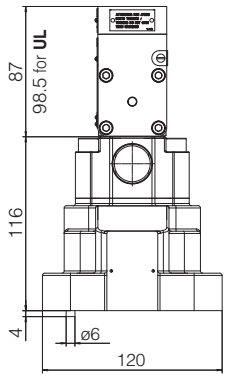


Valve's bottom view

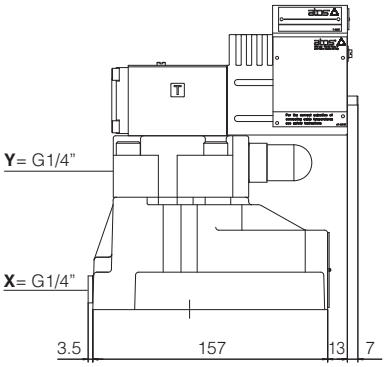
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)
Fastening bolts:
4 socket head screws M20x60 class 12.9
Tightening torque = 600 Nm
Seals: 2 OR 4131; 1 OR 109/70
Ports P, T: Ø = 28,5 mm
Ports X: Ø = 3,2 mm

X = port connection for external pilot
Y = port connection for external drain

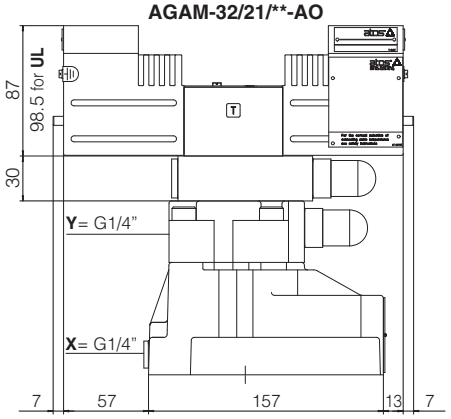
Mass [kg]	
AGAM-32/10 32/11	9,05
AGAM-32/20 32/21	10,05
AGAM-32/22 32/32	9,85 11,6
Option /V	-
Option /O	+0,35
Option /WP	+0,25



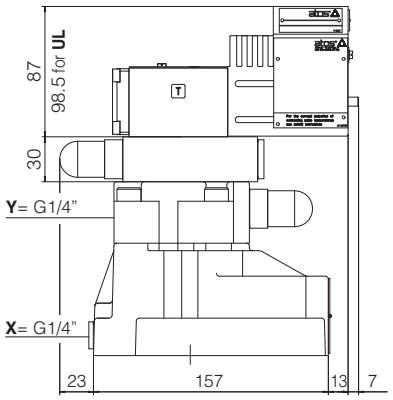
AGAM-32/10/-AO**
AGAM-32/11/-AO**



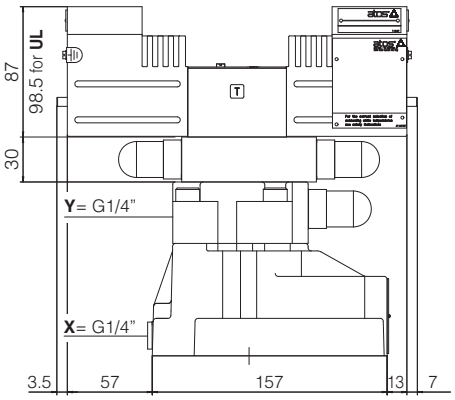
AGAM-32/20/-AO**
AGAM-32/21/-AO**



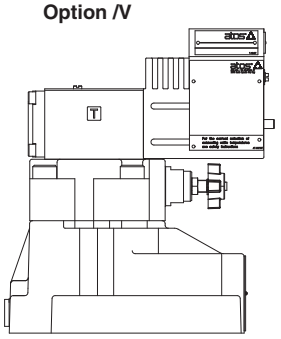
AGAM-32/22/-AO**



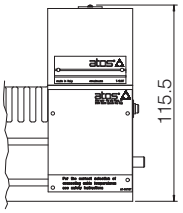
AGAM-32/32/-AO**



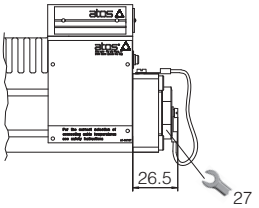
Option /V



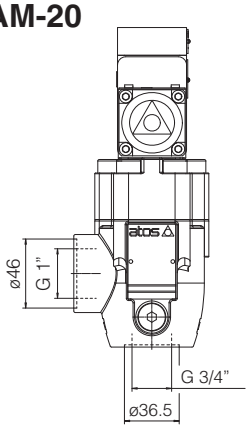
Option /O

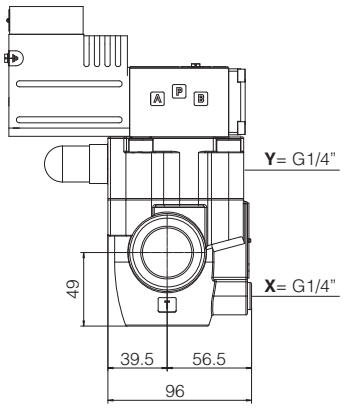


Option /WP



ARAM-20

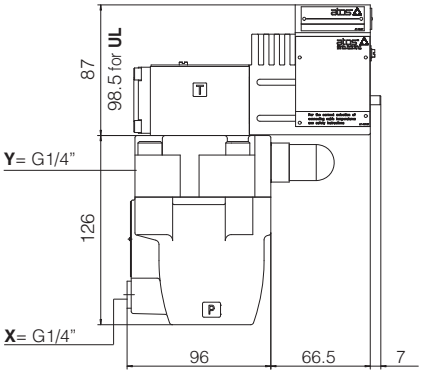




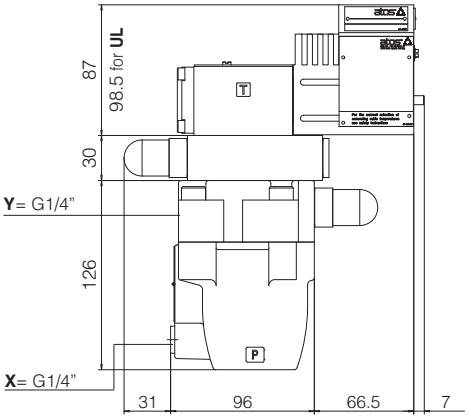
Mass [kg]	
ARAM-20/10 20/11	6,75
ARAM-20/20 20/21	8,45
ARAM-20/22 20/32	8,15 10,1
Option /V	-
Option /O	+0,35
Option /WP	+0,25

X = port connection for external pilot
Y = port connection for external drain

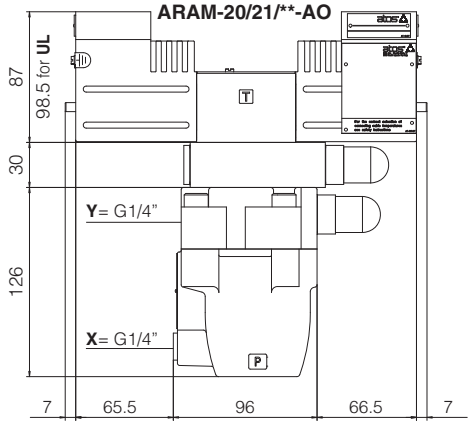
ARAM-20/10/-AO**
ARAM-20/11/-AO**



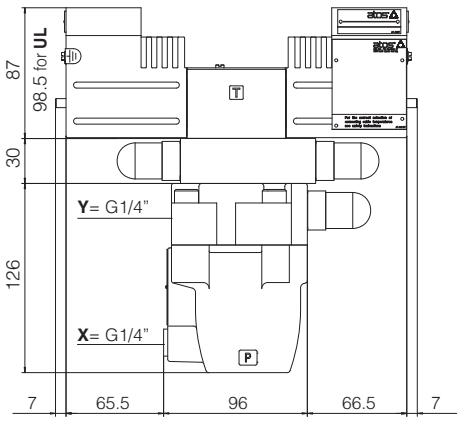
ARAM-20/22/-AO**



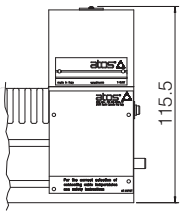
ARAM-20/20/-AO**
ARAM-20/21/-AO**



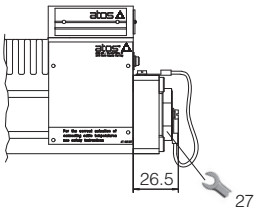
ARAM-20/32/-AO**



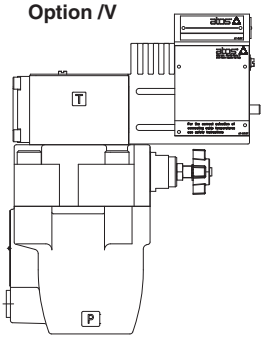
Option /O



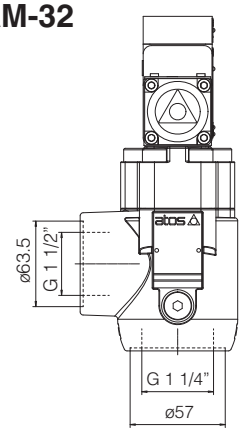
Option /WP

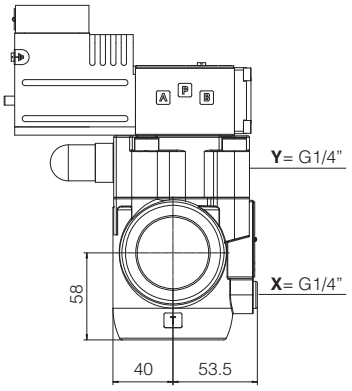


Option /V



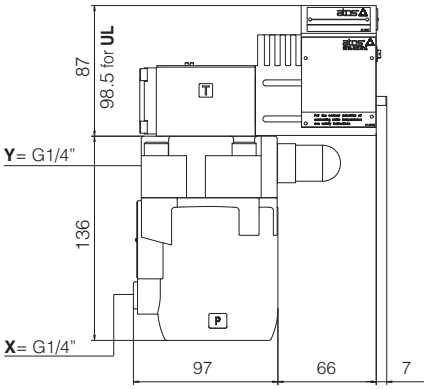
ARAM-32



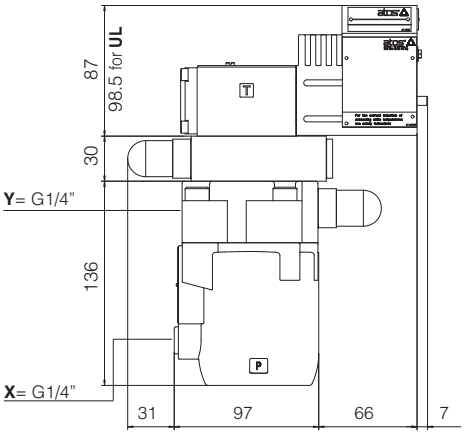


Mass [kg]	
ARAM-32/10 32/11	7,05
ARAM-32/20 32/21	9,05
ARAM-32/22 32/32	8,55 10,7
Option /V	-
Option /O	+0,35
Option /WP	+0,25

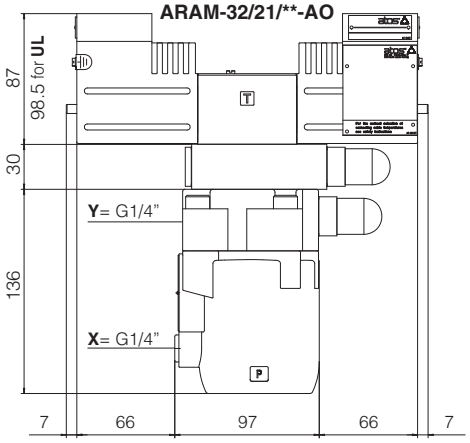
ARAM-32/10/-AO**
ARAM-32/11/-AO**



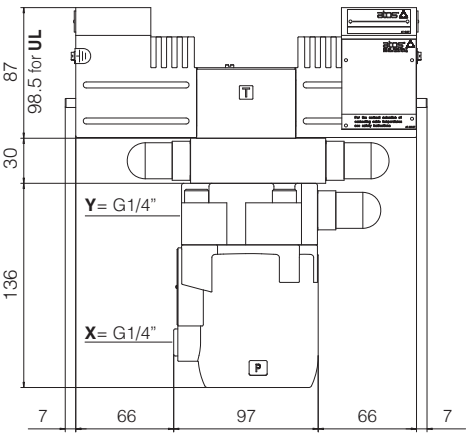
ARAM-32/22/-AO**



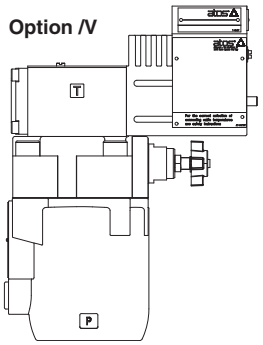
ARAM-32/20/-AO**
ARAM-32/21/-AO**



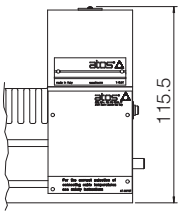
ARAM-32/32/-AO**



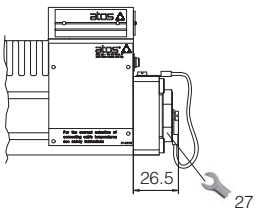
Option /V



Option /O



Option /WP

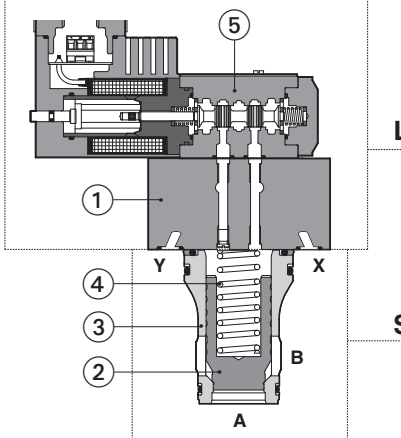


16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**EX900**	Operating and manintenance information for ex-proof on-off valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
X030	Summary of Atos ex-proof components certified to cULus	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof ISO cartridges

directional control - **ATEX, IECEx, EAC, PESO** or **cULus**



LIDEW1-4/*-AO

SC LI-4043*

① Functional cover
② Poppet
③ Sleeve
④ Spring
⑤ Ex proof pilot valve

LIDEW, LIDBH

Directional ISO cartridgs equipped with ex-proof solenoid pilot valve, certified for safe operation in hazardous environments, with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

LIDEW: directional control with ex-proof solenoid valve for pilot selection

LIDBH: directional control with ex-proof solenoid valve and shuttle valve for pilot selection

Size: **16** ÷ **63** - ISO 7368
Flow: **240** ÷ **4000 l/min** at Δp 5 bar
Max pressure: **350 bar**

1 **MODEL CODE OF COVERS** - to be coupled with cartridge in section **5**

LI	D	EW	1	-	1	/	M	-	AO	/	*	24DC	*	/	*	*

Cover according to ISO 7368

D = directional function

EW = with pilot solenoid valve
BH = as EW plus shuttle valve for pilot selection

Cover configuration see section **2** :
LIDEW: **-**, **1**, **2**, **4**, **5**, **6**
LIDBH: **1A**, **1C**, **2A**, **2C**

Valve size (ISO 7368):
1 = 16 **3** = 32 **5** = 50
2 = 25 **4** = 40 **6** = 63

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (1)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Certification type:
AO = Multicertifications for Group II 2G / II 2D **(2)**
AO/M = Multicertifications for Group I M2, ATEX (mining)
AO/UL = cULus North American certification

Series number

Voltage code - see section **9**

Options (4):
B = cartridge piloted via port "B" of solenoid pilot valve
E = external attachments X (1/4" GAS) and underneath port X supplied plugged (only for sizes 40...63)
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap

Seals material, see section **10** :
- = NBR
PE = FKM
BT = HNBR **(3)**

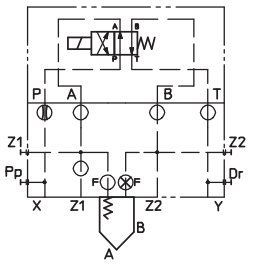
Optional different setting of the calibrated plugs in the pilot channels see section **3**

(1) Approved only for the Italian market **(2)** The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(3) Not for multicertification **M** group I (mining) **(4)** For possible combined options, see 3.1

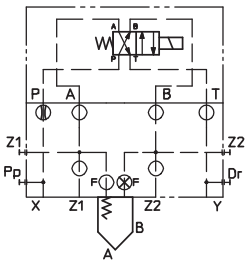
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 VALVES CONFIGURATIONS AND HYDRAULIC SYMBOLS

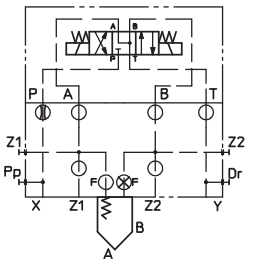
LIDEW



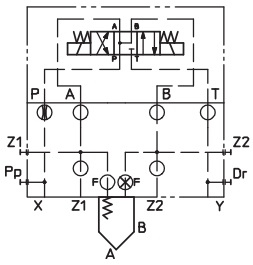
LIDEW1-*



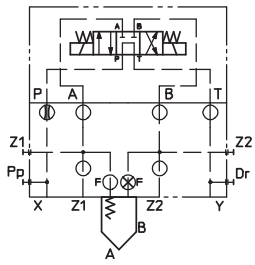
LIDEW2-*



LIDEW4-*

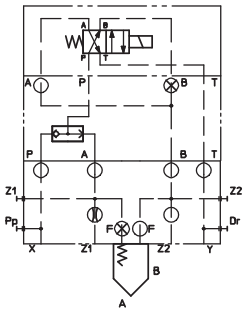


LIDEW5-*

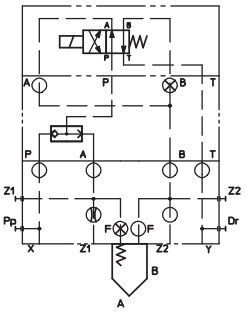


LIDEW6-*

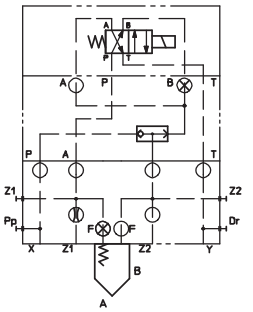
LIDBH



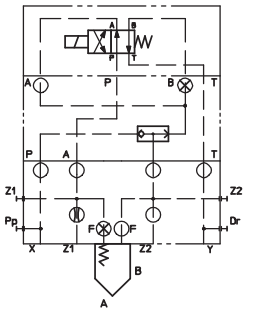
LIDBH1A-*



LIDBH1C-*



LIDBH2A-*



LIDBH2C-*

3 OPTIONS

For LIDEW*, LIDBH* covers (sizes 40…63):

/E = with external attachments Pp and underneath port X supplied plugged;

For all the models:

/B = cartridge piloted via port "B" of solenoid pilot valve;

/F = prearranged for coupling to an intermediate element with poppet position detector for safety function. See tab. EY120.

/WP = prolonged manual override protected by rubber cap for solenoid pilot valve. See table K150.

******* = Calibrated plugs different from standard ones reported in section 4. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

3.1 Possible combined options:

All combinations are available

LIDEW2	-	1	/*	-	AO	24DC	**

P
Channel where the orifice has to be provided: **P** = channel X, port P **Z1** = channel Z1 **F** = channel F **Z2** = channel Z2

06
Size of the throttling hole in teths of millimeters: **05** = 0,5 mm **10** = 1 mm **17** = 1,7 mm **06** = 0,6 mm **12** = 1,2 mm **20** = 2 mm **08** = 0,8 mm **15** = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Port \ Cover	LIDEW*-1 LIDBH*-1	LIDEW*-2 LIDBH*-2	LIDEW*-3 LIDBH*-3	LIDEW*-4 LIDBH*-4	LIDEW*-5 LIDBH*-5	LIDEW*-6 LIDBH*-6
Z1 (only for LIDBH*-*)	M4 12A	M4 12A	M6 15A	M6 17A	M6 20A	M6 20A
P	M6 12A	M6 12A	M6 15A	M6 17A	M6 20A	M6 20A

M4 ÷ M8 = screw size; **12A ÷ 20A** = calibrated orifices diameter in tenths of mm; **A** = short calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES, to be coupled with covers in section 1

SC LI	-	16	43	1	40	/*

SC LI – Cartridge valve

16 – **Size** (ISO 7368): **16 25 32 40 50 63**

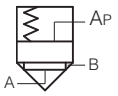
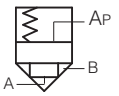
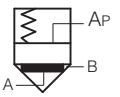
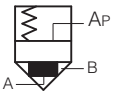
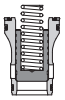
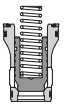
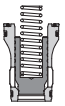
43 – **Type of poppet**, see section 6 for maximum flow
32, 33
42 = as 32 but with dumping nose
43 = as 33 but with dumping nose

1 – **Spring cracking pressure**:
1 = 0,3 bar for poppet 32, 42;
1 = 0,6 bar for poppet 33, 43;
2 = 1,5 bar for poppet 32, 42;
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

40 – **High flow:**
40 = all sizes

/* – Seals material:
- = NBR
PE = FKM
BT = HNBR

6 TYPE OF POPPET

Type of poppet		**32**	**33**	**42**	**43**
Functional sketch (Hydraulic symbol)					
Operating pressure		**420 bar max** (only SCLI cartridge)			
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 9	Size **16**	270	270	240	240
	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
Typical section					
Area ratio A:Ap		**1:1,1**	**1:1,5**	**1:1,1**	**1:1,5**
Cracking pressure A→B	Spring **1**	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	3 bar	3 bar	3 bar
	6	5,5 bar	5,5 bar	5,5 bar	5,5 bar
Cracking pressure B→A	Spring **1**	3 bar	1,2 bar	3 bar	1,2 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	6 bar	32,5 bar	6 bar
	6	54,5 bar	11 bar	54,5 bar	11 bar

7 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS

Functional cover operating pressure	port A, B, X, Z1, Z2 = **350**; port Y = **210**
Rated flow	see section 6

9 ELECTRICAL CHARACTERISTICS

Valve type		LIDEW*/**AO** LIDBH*/**AO**	LIDEW*/**AO/M** LIDBH*/**AO/M**	LIDEW*/**AO/UL** LIDBH*/**AO/UL**
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W		12W
Coil insulation		class H		
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor		100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 EX-PROOF SOLENOIDS CERTIFICATION DATA

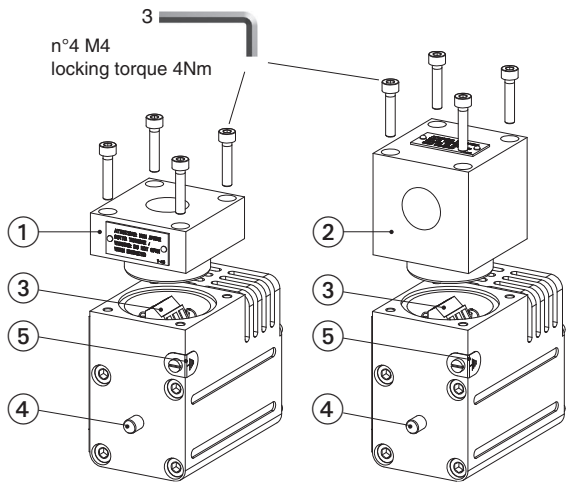
Valve type	LIDEW*/**AO** LIDBH*/**AO**		LIDEW*/**AO/M** LIDBH*/**AO/M**	LIDEW*/**AO/UL** LIDBH*/**AO/UL**	
Certifications	**ATEX IECEx EAC PESO** Multicertification Group II		**ATEX IECEx** Multicertification Group I	**cULus** North American cULus	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	2017324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

12 EX PROOF SOLENOIDS WIRING

Multicertification



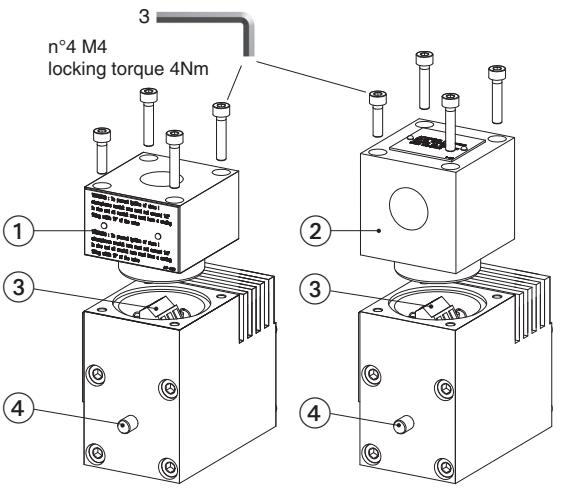
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

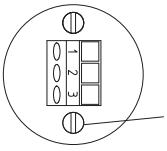
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ Pay attention to coil polarity



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 13 note 1

alternative GND screw terminal connected to solenoid housing

13 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

13.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

14 CABLE GLANDS only for Multicertification

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

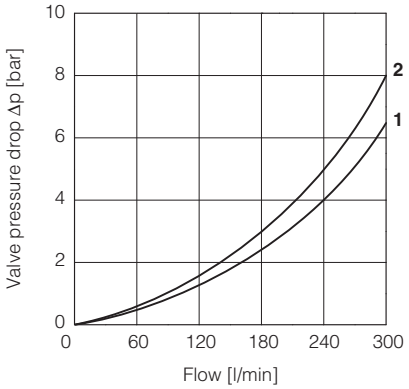
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

15 **Q/Δp DIAGRAMS** based on mineral oil ISO VG 46 at 50 °C

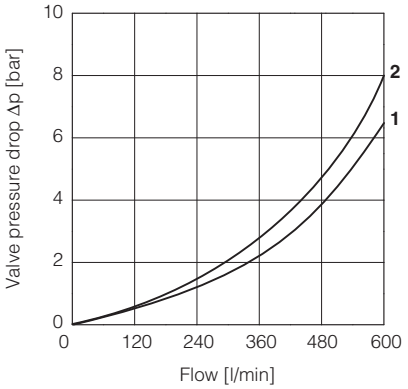
SC LI High flow - series 40

1 = poppet type 32 and 33 **2** = poppet type 42 and 43

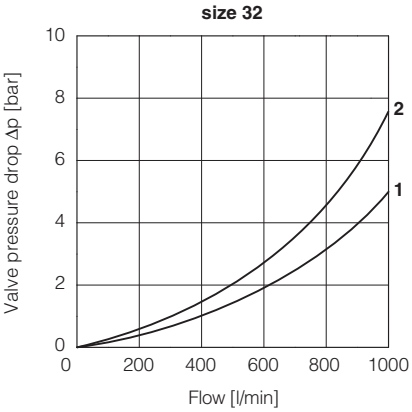
size 16



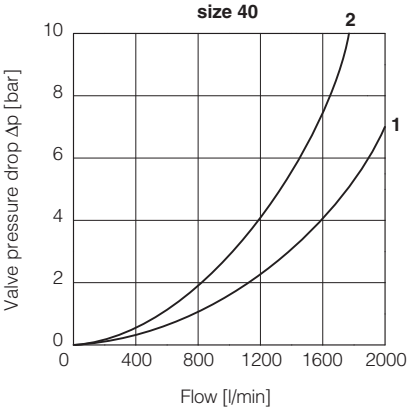
size 25



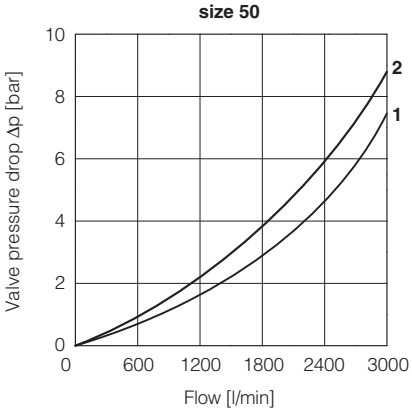
size 32



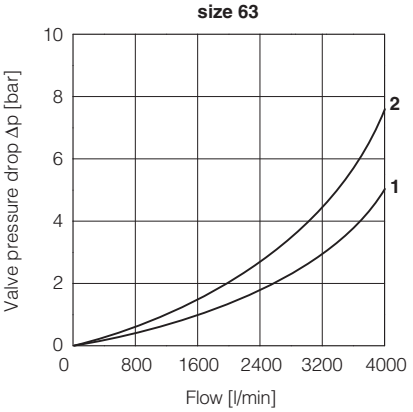
size 40



size 50

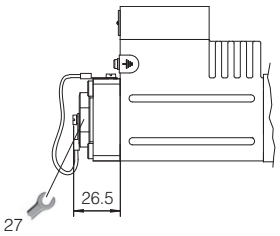


size 63



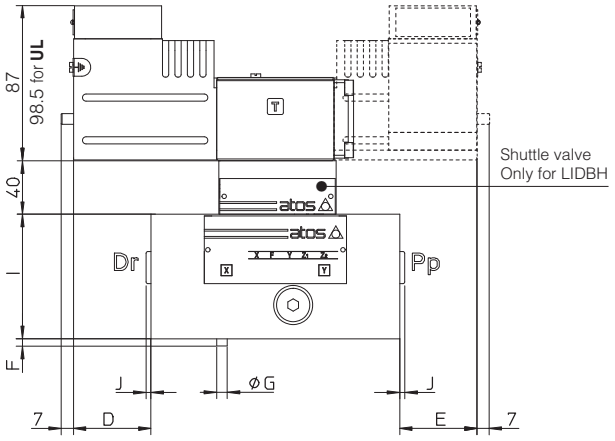
16 COVER INSTALLATION DIMENSIONS [mm] - Multicertified and UL - for cartridge cavity dimensions see tech table P006

Option /WP

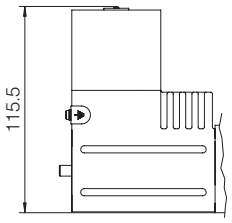


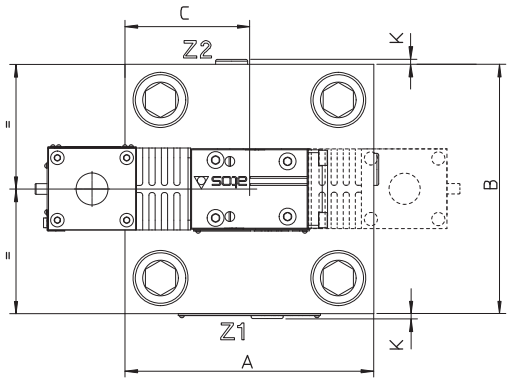
Size 16 ÷ 63

Drawing of size 50
dotted line: example of double solenoid version



Option /O





Notes referred to the below table:

(1) LIDEW1* - LIDBH*A: solenoid at side of port Y of cover
LIDEW2* - LIDBH*C: solenoid at side of port X of cover

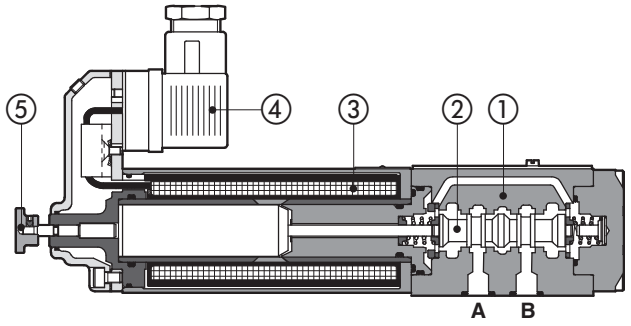
Size (1)	A	B	C	D max	E max	F	G	I	J	K	Ports Pp-Dr	Ports Z_1-Z_2	Seals	Fastening bolts (3)	Tightening torque [Nm]	Mass [Kg]
16	70	65	41	80	92	4	3	40	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	3,95 ÷ 5,7
25	85	85	42,5	78	78	6	5	40	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	4,35 ÷ 6,1
32	100	100	50	71	71	6	5	50	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	4,85 ÷ 6,7
40	125	125	62,5	58	58	6	5	60	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7,75 ÷ 9,6
50	140	140	70	51	51	4	6	70	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,85 ÷ 12,7
63	180	180	90	31	31	4	6	80	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	18,65 ÷ 20,4

17 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**EX900**	Operating and manintenance information for ex-proof on-off valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
X030	Summary of Atos ex-proof components certified to cULus	**P006**	Mounting surfaces and cavities for cartridge valves

Intrinsically safe solenoid directional valves

on-off spool type, direct - **ATEX** or **IECEx**



DHW-0611/WP/6

① valve body
② valve spool
③ intrinsically safe solenoid
④ electrical connector
⑤ manual override

DHW

On-off, spool type, directional valves equipped with intrinsically safe solenoids certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:
- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

DHW are **SIL** compliance with IEC 61508

See section 7 for certification data

The valves must be electrically powered through specific "safety barriers" limiting the max current to the solenoid, see section 13

Size: **06**
Max flow: up to **25 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHW	/	*	-	0	71	3H	/	*	/	6	*	/	*

Intrinsically safe valve, spool type, direct

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Valve size (ISO 4401):
0 = size 06

Configuration, see section 2 :

Spool type, see section 2 :

Options (2):
A = solenoid at side of port B
WP = prolunged manual override

Connector type
6 = DIN 43650 (standard)

Series number

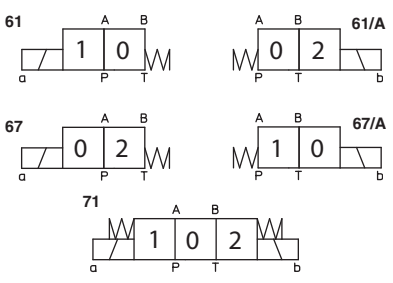
Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

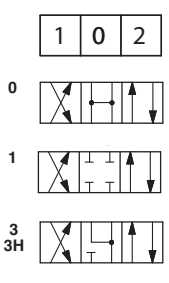
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATION and SPOOLS (representation according to ISO 1219-1)

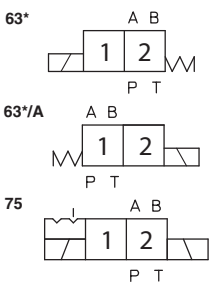
Configuration for DHW



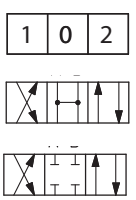
Spools for DHW



Configuration for DHW



Spools for DHW



Note: Spool type 3H is available only for configuration 71. It is similar to spool type 3 but with highetr flow capability A-B → T in central position, see section 10

3 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Intrinsically safe protection "Ex ia", see section 7 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Operating pressure	Ports P,A,B: **350** bar; Port T **160** bar
Rated flow	See Q/Δp diagrams at section 10
Maximum flow	**25 l/min**, see operating limits at section 11

5 ELECTRICAL CHARACTERISTICS - see also section 7

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type		DHW		DHW/**IE**			DHW/**M**			DHW/**IEM**		
Certification		**ATEX** (Group II)		**IECEx** (Group II)			**ATEX (mining)** (Group I)			**IECEx (mining)** (Group I)		
Solenoid code		**OW-18/6**		**OWI-18/6**			**OWM-18/6**			**OWIM-18/6**		
Type examination certificate **(1)**		CESI 02 ATEX 013		IECEx CES 12.0017			CESI 02 ATEX 013			IECEx CES 12.0017		
Method of protection		**Ex II 1G Ex ia**					**Ex I M2**		**Ex ia I Mb**		**Ex ib I Mb**	
		IIA T5 Ga	**IIB T6 Ga**	**IIC T6 Ga**								
Electrical characteristics (max values)	Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
	Ii [mA]	396	250	130	360	360	396	250	130	360	360	2200
	Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
	Ci , Li	≅ 0	≅ 0				≅ 0					
Temperature class		**T5**	**T6**				–					
Surface temperature (ambient temp. +60°C)		≤ 100°C	≤ 85°C				≤ 150°C					
Ambient temperature		-20 ÷ +60°C -40 ÷ +60°C **(2)**					-20 ÷ +60°C					
Applicable standards		EN 60079-0 EN 60079-11 EN 60079-26		IEC 60079-0 IEC 60079-11 IEC 60079-26								

(1) The type examinator certificates can be downloaded from www.atos.com **(2)** Only for **/BT** option

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

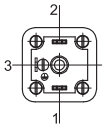
8 SIL compliance with IEC 61508: 2010

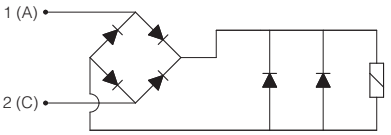
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

9 EX PROOF SOLENOIDS WIRING

Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

DIN 43650



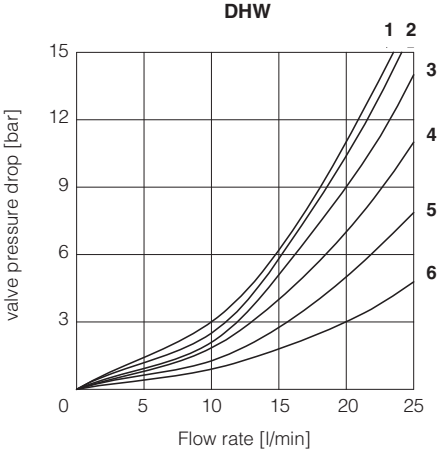


10 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C

DHW

spool type / Flow direction	0	0/2	1/2	1	3	3H
P→A / P→B	4	5	5	3	3	3
A→T / B→T	6	2	1	2	4	5
A - B→T						4

DHW

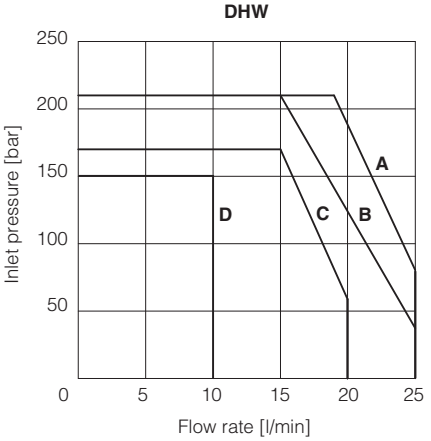


11 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams refer to warm solenoids and power supply provided by the Atos barrier type **Y-BXNE-412**.
For DHW valves the curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T).
In case of asymmetric flow the operating limits must be reduced.

DHW type	0	0/2	1/2	1	3	3H
Diagram	B	B	C	C	A	D

DHW



12 INTERNAL LEAKAGES

DHW internal leakages based on mineral oil ISO VG 46 at 50°C
18 cm³/min with P=100 bar - fluid viscosity = 43 cSt at 40 °C
30 cm³/min with P=140 bar - fluid viscosity = 22 cSt at 45 °C

13 INTRINSICALLY SAFE BARRIERS - see tech. table **GX010**

Intrinsically safe valves must be powered through safety barriers certified according to Ex-ie protection mode, limiting the energy to the solenoid.

To select the proper intrinsically safe barriers following data must be considered:
1) Vmax and Imax of the solenoid as specified in section 7 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 4 .

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

MODEL CODE OF I.S. BARRIER

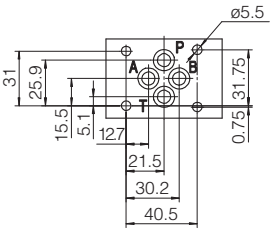
Y-BXNE 412 00	*

Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

14 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

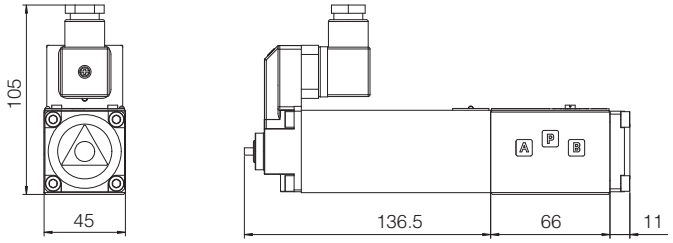
Valve's bottom view



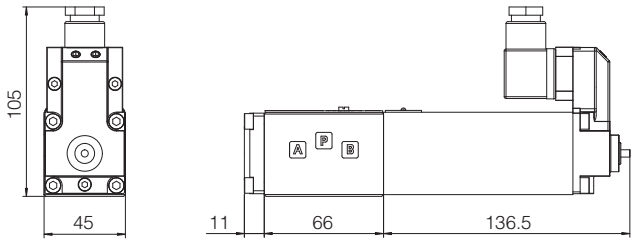
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

Mass [kg]	
DHW-06	2,4
DHW-06*/A	2,4
DHW-07*	4

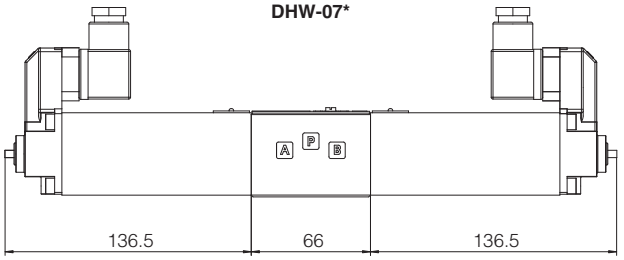
DHW-06



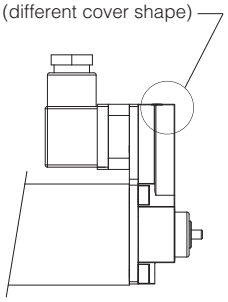
DHW-06*/A



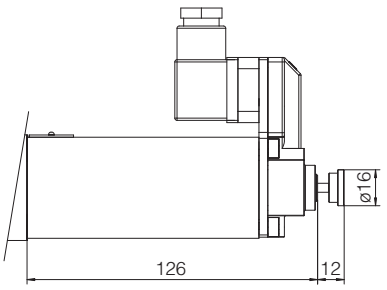
DHW-07*



DHW/M
(different cover shape)



Option **/WP**



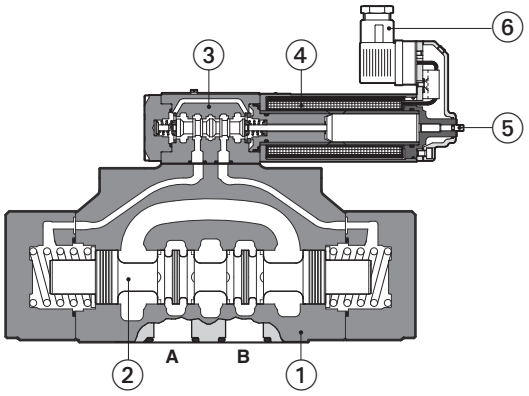
Note: the connector is supplied with the valve

15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P005	Mounting surfaces for electrohydraulic valves

Intrinsically safe solenoid directional valves

on-off spool type, piloted - **ATEX** or **IECEx**



DPHW-461*

① main body
② main spool
③ pilot valve
④ intrinsically safe solenoid
⑤ manual override
⑥ electrical connector

DPHW

On-off spool type, piloted directional valves equipped with intrinsically safe solenoids certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:
- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

See section 7 for certification data

The valves must be electrically powered through specific “safety barriers” limiting the max current to the solenoid, see section 12

Size: **10, 16** and **25**
Max flow: up to **160, 300** and **700 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPHW	/	*	-	2	61	1	/	*	/	6	*	/	*

Intrinsically safe directional valve, piloted

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Valve size (ISO 4401):
1 = 10 **2** = 16 **4** = 25

Configuration, see section 2

Spool type, see section 2

Options (2):
A = solenoid at side of port B (for single solenoid valves)
WP = ⚠ manual override protected by metallic cap
D = Internal drain
E = external pilot pressure
H = adjustable chokes (meter-out to the pilot chambers of the main valve)
L9 = (only for DPHW-2 and DPHW-4) plug with calibrated restrictor on port P of pilot valve

Series number

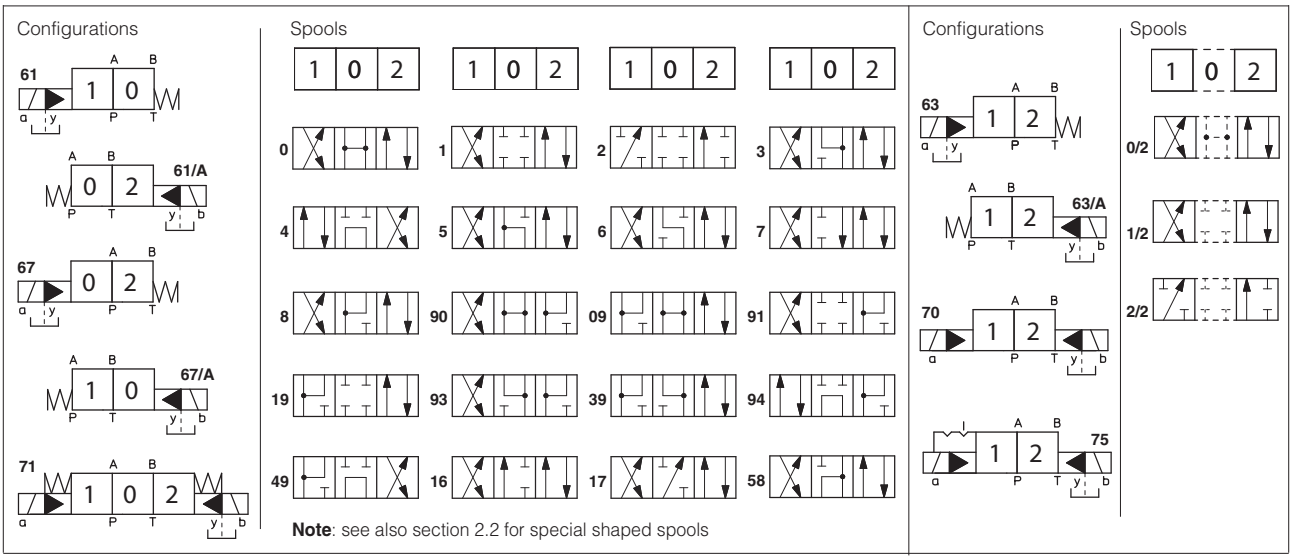
Connector type
6 = DIN 43650 (standard)

Seals material, see section 7:
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



2.1 Standard spools availability

- DPHW-1 are available only with spools **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- DPHW-2 and DPHW-4 are available with all spools shown in the above table

2.2 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5, 58, 6** and **7** are also available as **1/1, 4/8, 5/1, 58/1, 6/1** and **7/1** that are properly shaped to reduce water-hammer shocks during the switching.

2.3 Special spool availability

Valve size	standard spools							
	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPHW-1	•	•		•				
DPHW-2, DPHW-4	•	•	•	•	•	•	•	•

3 DEVICES FOR MAIN SPOOL SWITCHING CONTROL

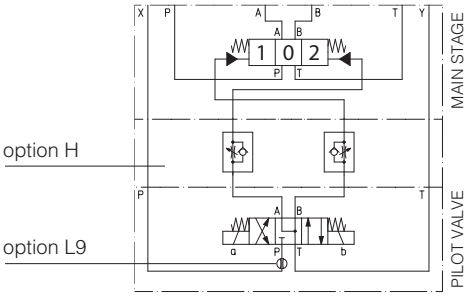
Folowing options are suggested to reduce the hydraulic shocks at the valve operation

/H = Adjustable chokes (meter-out to the pilot chambers of the main valve).

/L9 (only for DPHW-2 and DPHW-4) plug with calibrated restictor in P port of pilot valve

Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

FUNCTIONAL SCHEME (config. 71)
example of switching control options



4 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Intrinsically safe protection "Ex ia", see section 8 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS

Operating pressure	P, A, B, X = **350 bar** T = **250 bar** with external drain (standard) T and Y = **160 bar** with internal drain (option /D) Minimum pilot pressure for correct operation is = **8 bar**
Rated flow	See diagrams Q/Δp at section 10
Maximum flow	DPHW-1: **160 l/min;** DPHW-2: **300 l/min;** DPHW-4: **700 l/min;** see Q/Δp diagrams at section 10 and operating limits at section 11

6 ELECTRICAL CHARACTERISTICS - see also section 8

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

8 CERTIFICATION DATA

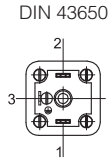
Valve type		DPHW		DPHW/**IE**			DPHW/**M**			DPHW/**IEM**		
Certification		**ATEX** (Group II)		**IECEx** (Group II)			**ATEX (mining)** (Group I)			**IECEx (mining)** (Group I)		
Solenoid code		**OW-18/6**		**OWI-18/6**			**OWM-18/6**			**OWIM-18/6**		
Type examination certificate **(1)**		CESI 02 ATEX 013		IECEx CES 12.0017			CESI 02 ATEX 013			IECEx CES 12.0017		
Method of protection		**Ex II 1G Ex ia**					**Ex I M2 Ex ia I Mb Ex ib I Mb**					
		IIA T5 Ga	**IIB T6 Ga**	**IIC T6 Ga**								
Electrical characteristics (max values)	Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
	Ii [mA]	396	250	130	360	360	396	250	130	360	360	2200
	Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
	Ci , Li	≅ 0	≅ 0				≅ 0					
Temperature class		**T5**	**T6**				–					
Surface temperature (ambient temp. +60°C)		≤ 100°C	≤ 85°C				≤ 150°C					
Ambient temperature		-20 ÷ +60°C	-40 ÷ +60°C **(2)**				-20 ÷ +60°C					
Applicable standards		EN 60079-0 EN 60079-11 EN 60079-26		IEC 60079-0 IEC 60079-11 IEC 60079-26								

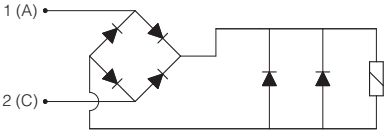
(1) The type examinator certificates can be downloaded from www.atos.com
(2) Only for **/BT** option

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

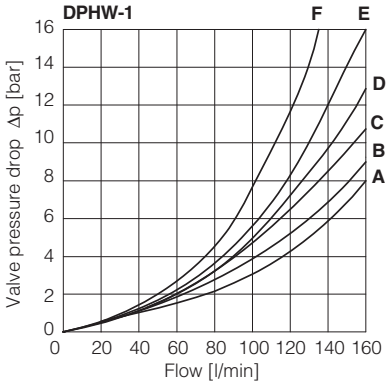
9 SOLENOIDS WIRING

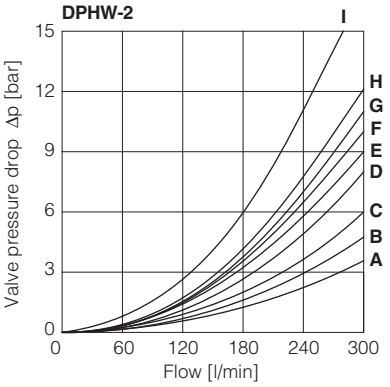
Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

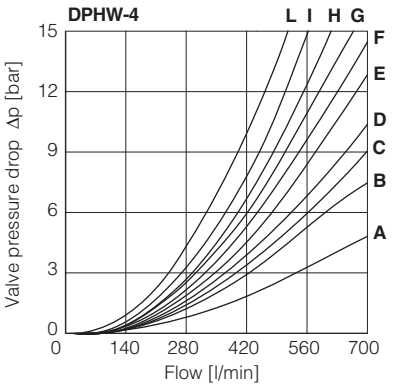




10 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C







DPHW-1

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	C	-
0	D	E	C	C	E
1	A	B	D	C	-
3, 6, 7	A	B	C	C	-
4, 4/8	B	C	D	D	-
5, 58	A	E	C	C	F

DPHW-2

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1, 3, 6, 7, 8	A	A	D	A	-
1/1, 1/2, 7/1	B	B	D	E	-
0	A	A	D	E	C
0/1	A	A	D	-	-
2	A	A	-	-	-
2/2	B	B	-	-	-
3/1	A	A	D	D	-
4	C	C	H	I	F
4/8	C	C	G	I	F
5	A	B	F	H	G
5/1	A	B	D	F	-
6/1	B	B	C	E	-
09	A	-	-	G	-
16	A	C	D	F	-
17	C	A	E	F	-
19	C	-	-	G	-
39	C	-	-	H	-
49	-	D	-	-	-
58	B	A	F	H	H
58/1	B	A	D	F	-
90	A	A	E	-	D
91	C	C	E	-	-
93	-	C	D	-	-
94	D	-	-	-	-

DPHW-4

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
1	B	B	B	D	-
1/1	D	E	E	F	-
1/2	E	D	B	C	-
0	D	C	D	E	F
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-
0/2	D	D	D	E	-
2	B	B	-	-	-
2/2	E	D	-	-	-
3	B	B	D	F	-
4	C	C	H	L	L
5	A	D	D	D	H
6/1	D	E	D	F	-
7/1	D	E	F	F	-
8	D	D	E	F	-
09	D	-	-	F	F
16	C	D	E	F	-
17	E	D	E	F	-
19	F	-	-	E	-
39	G	F	-	F	-
58	E	A	B	F	H
58/1	E	D	D	F	-
90	D	D	D	-	F
91	F	F	D		
93	-	G	D	-	-

11 OPERATING LIMITS

For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPHW-1

Spool type	Inlet pressure [bar]			
	70	160	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7	160	160	160	145
4, 4/8	160	160	135	100
5, 58	160	160	145	110
0/1, 0/2, 1/2	160	160	145	135

DPHW-4

Spool type	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 6, 7, 8	700	700	700	600
2, 4, 4/8	500	500	450	400
5, 0/1, 0/2, 1/2	600	520	400	300
0, 3	700	700	600	540
16, 17, 58, *9, 9*	500	500	500	450

DPHW-2

Spool type	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7, 8	300	300	300	300
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1, 0/2, 1/2	300	250	210	180
16, 17, 56, *9, 9*	300	300	270	200

12 INTRINSICALLY SAFE BARRIERS - see tech. table **GX010**

Intrinsically safe valves must be powered through safety barriers certified according to Ex-ie protection mode, limiting the energy to the solenoid.

To select the proper intrinsically safe barriers following data must be considered:
1) Vmax and Imax of the solenoid as specified in section 8 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 11

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

MODEL CODE OF I.S. BARRIER

Y-BXNE 412 00	*

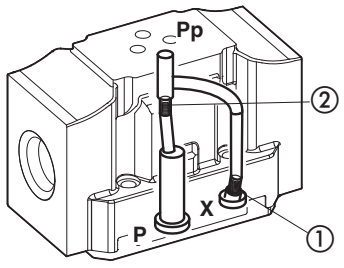
Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

13 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

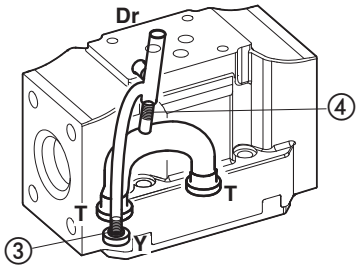
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPHW-1

Pilot channels



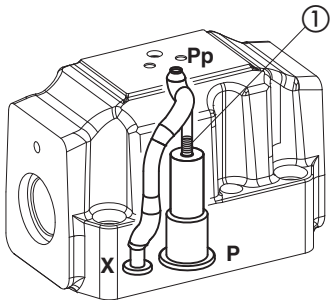
Drain channels



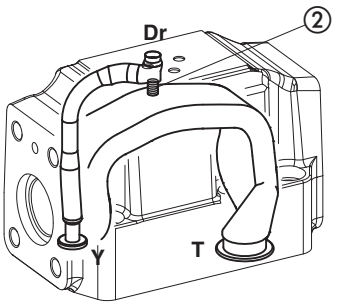
Internal piloting: blinded plug SP-X300F ① in X;
plug SP-X310F ② in Pp;
External piloting: blinded plug SP-X300F ② in Pp;
plug SP-X310F ① in X;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPHW-2

Pilot channels

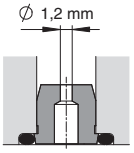


Drain channels



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

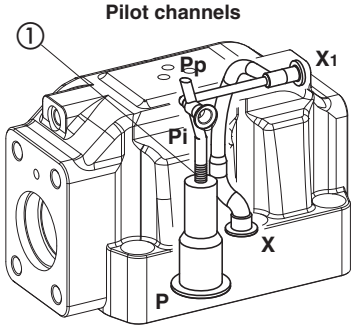
Option L9
This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve



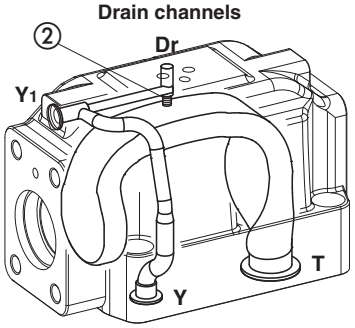
PLUG-12A

DPHW-4

Pilot channels

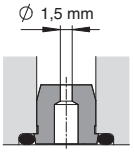


Drain channels



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

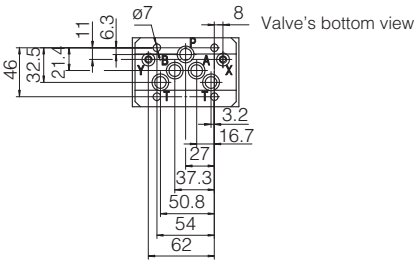
Option L9
This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve



PLUG-15A

DPHW-1*

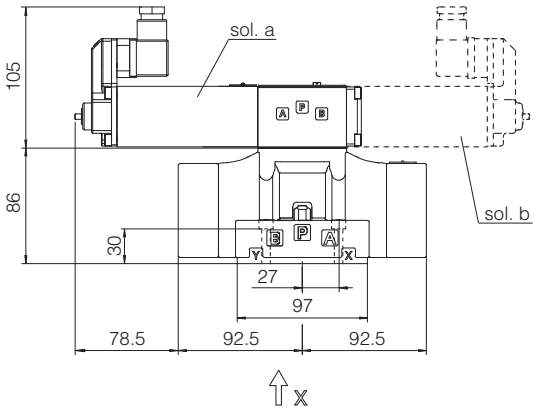
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-05-05-0-05
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A,B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;
Seals: 5 OR 2050, 2 OR 108

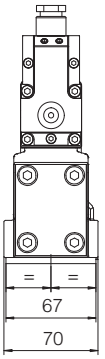


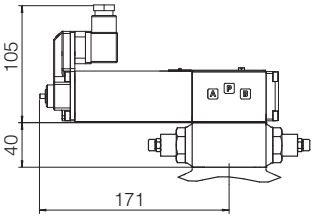
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

Mass [kg]	
DPHW-16	8,0
DPHW-17	9,5
Option /H	+1,0

DPHW-16
DPHW-17 (dotted line)

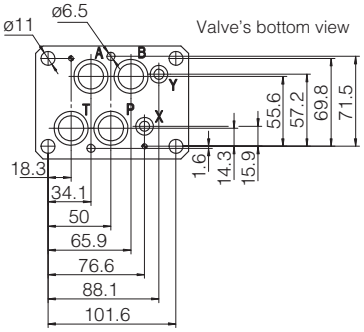






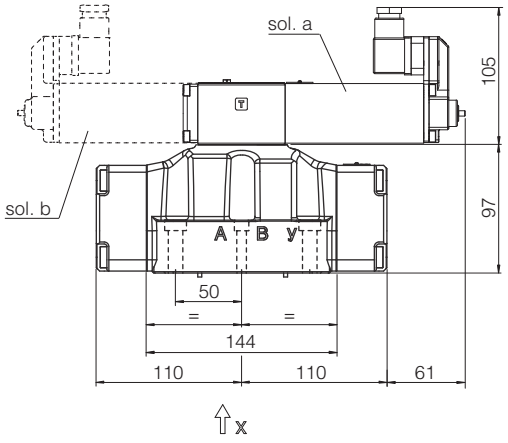
DPHW-2*

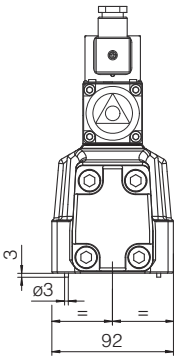
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-07-07-0-05
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 130, 2 OR 2043

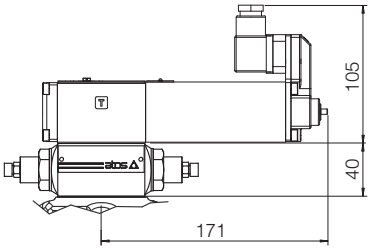


P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

Mass [kg]	
DPHW-26	11
DPHW-27	12,5
Option /H	+1,0

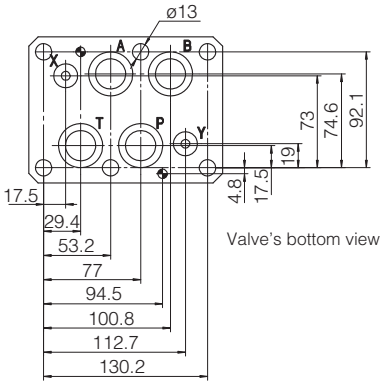






DPHW-4*

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-08-08-0-05
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Seals: 4 OR 4112; 2 OR 3056
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;

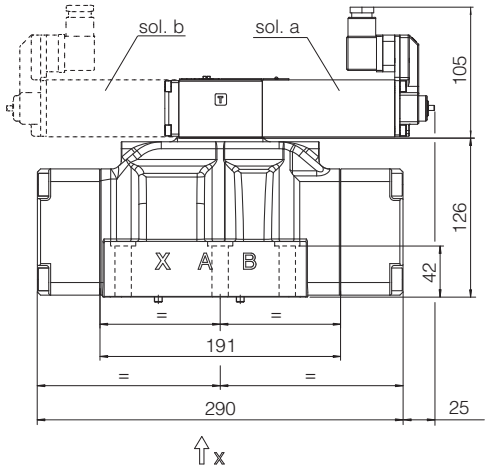


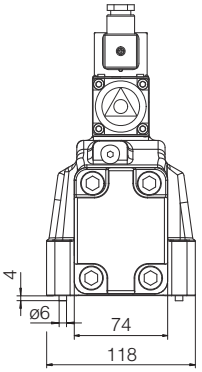
Valve's bottom view

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

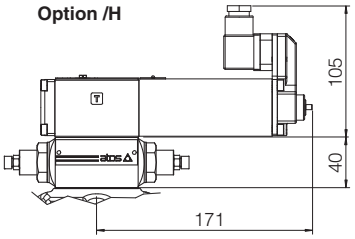
Mass [kg]	
DPHW-46	18,5
DPHW-47	20
Option /H	+1,0

DPHW-46
DPHW-47 (dotted line)



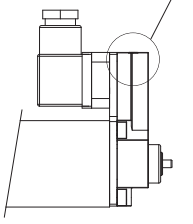


Option /H

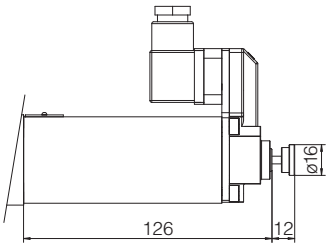


Options for all sizes of DPHW

Pilot of DPHW **/M** and **/IEM**
(different cover shape)



Pilot of DPHW **/WP**



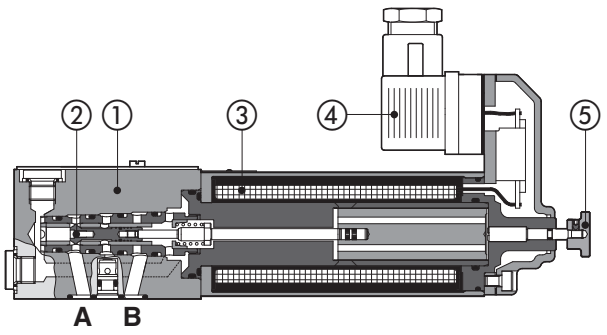
Note: the connector is supplied with the valve

15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P005	Mounting surfaces for electrohydraulic valves

Intrinsically safe solenoid directional valves

on-off poppet type, leak free, direct - **ATEX** or **IECEx**



DLWH-3A/6

① valve body
② poppet
③ intrinsically safe solenoid
④ electrical connector
⑤ manual override

DLWH

On-off poppet type, directional valves designed for application in hydraulic systems with leak-free requirements and equipped with intrinsically safe solenoids certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:
- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

See section 7 for certification data

The valves must be electrically powered through specific “safety barriers” limiting the max current to the solenoid, see section 12

Size: **06**
Max flow: up to **12 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DLWH	/	*	-	2A	/	*	/	6	*	/	*

DLWH: Intrinsically safe valve, poppet type, direct

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Configuration:
2A = 2 way, open in rest position
2C = 2 way, closed in rest position
3A = 3 way, A-T connection in rest position
3C = 3 way, P-B connection in rest position

Options (2):
R = with check valve on port P
WP = prolunged manual override

6: **Connector type**
6 = DIN 43650 (standard)

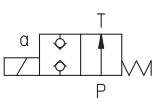
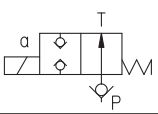
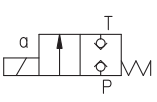
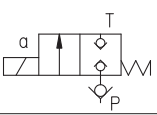
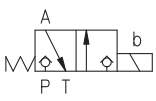
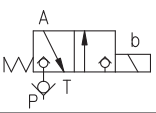
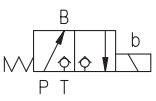
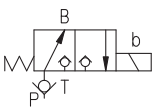
Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 VALVE CONFIGURATION

DLWH-2A	DLWH-2A/R	DLWH-2C	DLWH-2C/R
			
DLWH-3A	**DLWH-3A/R**	**DLWH-3C**	**DLWH-3C/R**
			

3 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Compliance	Intrinsically safe protection "Ex ia", see section 7 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Operating pressure	Ports P,A,B: **350** bar; Port T **160** bar
Rated flow	See Q/Δp diagrams at section 9
Maximum flow	**12 l/min**, see operating limits at section 10

5 ELECTRICAL CHARACTERISTICS - see also section 7

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type		DLWH		DLWH**/IE**			DLWH**/M**			DLWH**/IEM**		
Certification		**ATEX** (Group II)		**IECEx** (Group II)			**ATEX (mining)** (Group I)			**IECEx (mining)** (Group I)		
Solenoid code		**OW-18/6**		**OWI-18/6**			**OWM-18/6**			**OWIM-18/6**		
Type examination certificate **(1)**		CESI 02 ATEX 013		IECEx CES 12.0017			CESI 02 ATEX 013			IECEx CES 12.0017		
Method of protection		**Ex II 1G Ex ia**					**Ex I M2 Ex ia I Mb Ex ib I Mb**					
		IIA T5 Ga	**IIB T6 Ga**	**IIC T6 Ga**								
Electrical characteristics (max values)	Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
	Ii [mA]	396	250	130	360	360	396	250	130	360	360	2200
	Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
	Ci , Li	≅ 0	≅ 0				≅ 0					
Temperature class		**T5**	**T6**				–					
Surface temperature (ambient temp. +60°C)		≤ 100°C	≤ 85°C				≤ 150°C					
Ambient temperature		-20 ÷ +60°C -40 ÷ +60°C **(2)**					-20 ÷ +60°C					
Applicable standards		EN 60079-0 EN 60079-11 EN 60079-26		IEC 60079-0 IEC 60079-11 IEC 60079-26								

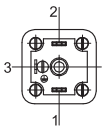
(1) The type examinator certificates can be downloaded from www.atos.com
(2) Only for **/BT** option

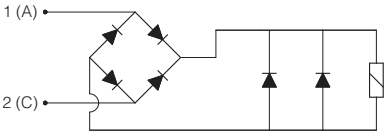
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 SOLENOIDS WIRING

Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

DIN 43650



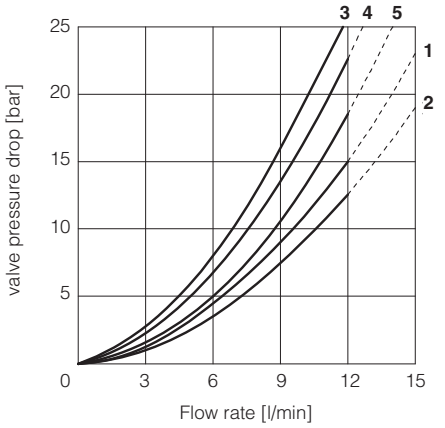


9 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C

configuration / Flow direction	2A	2C	3A	3C
P→A / P→B (1)	1	2	4	3
A→T / B→T	-	-	5	4

(1) For two-way valves pressure drop refers to P→T

DLWH

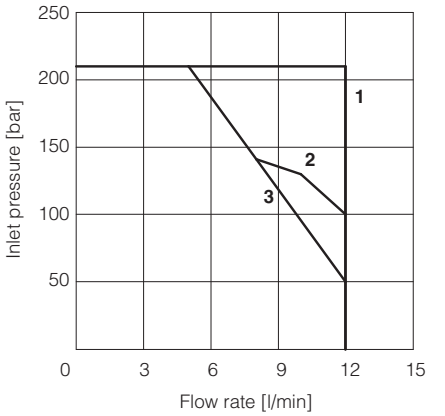


10 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams refer to warm solenoids and power supply provided by the Atos barrier type **Y-BXNE-412**.
In case of asymmetric flow the operating limits must be reduced.

configuration	2A	2C	3A	3C
Diagram	1	1	2	3

DLWH



11 INTERNAL LEAKAGES

DLWH internal leakages based on mineral oil ISO VG 46 at 50°C
less than 5 drops/min (0,36 cm³/min) at max pressure.

12 INTRINSICALLY SAFE BARRIERS - see tech. table **GX010**

The electric supply to these valves must be done through intrinsically safe barriers situated out of potentially flammable environment (i.e. in safe zone), which limit the electric current to the intrinsically safe solenoid. The "intrinsically safe" circuit is virtually unable to produce electrical surges or thermic effects able to cause explosion in hazardous environments also in presence of specific break-down situations. The intrinsically safe barriers must be approved and certified according to the Ex ia protection mode.

To select the proper intrinsically safe barriers following data must be considered:
1) Vmax and Imax of the solenoid as specified in section 7 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 10.

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

MODEL CODE OF I.S. BARRIER

Y-BXNE 412 00	*

Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

13 INSTALLATION DIMENSIONS [mm]

DLWH-2A, DLWH-2C

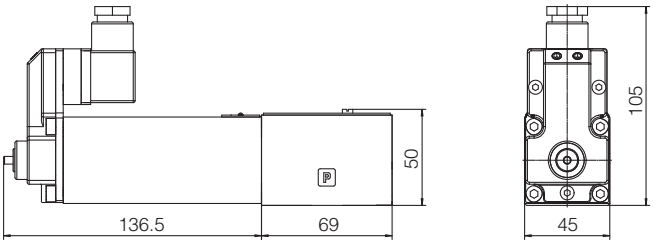
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Fastening bolts:
4 socket head screws M5x50 class 12.9

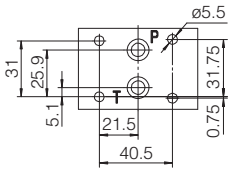
Tightening torque = 8 Nm

Seals: 2 OR 108

Diameter of ports P, T: Ø 7,5 mm (max)



Valve's bottom view



P = PRESSURE PORT
T = USE PORT

DLWH-3A, DLWH-3C

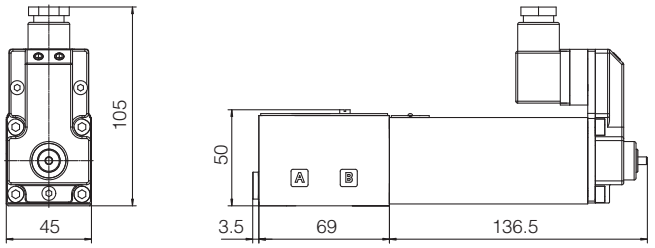
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Fastening bolts:
4 socket head screws M5x50 class 12.9

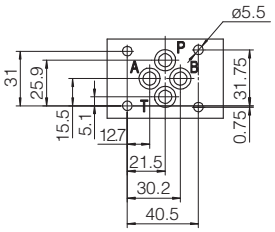
Tightening torque = 8 Nm

Seals: 4 OR 108

Diameter of ports P, A, B, T: Ø 7,5 mm (max)



Valve's bottom view



P = PRESSURE PORT

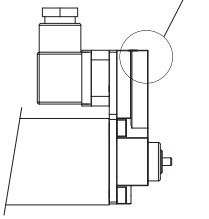
A = USE PORT
(not used for DLAH-3C version)

B = USE PORT
(not used for DLAH-3A version)

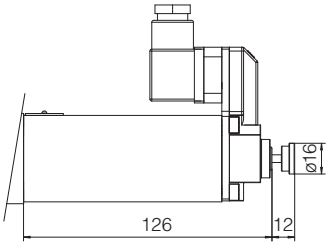
T = TANK PORT

Mass [kg]	
DLWH-02	2,3
DLWH-03	2,3

DLWH/M
(different cover shape)



Option **/WP**



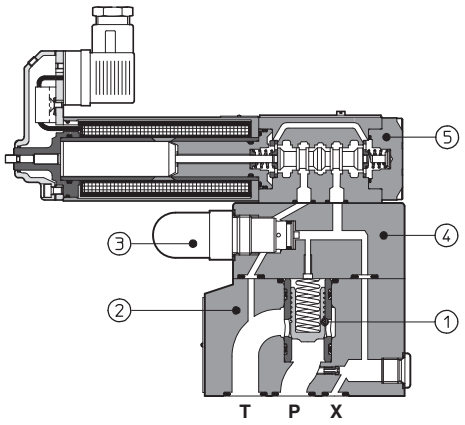
Note: the connector is supplied with the valve

14 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P005	Mounting surfaces for electrohydraulic valves

Intrinsically safe pressure relief valves

piloted, subplate or in line mounting - **ATEX** or **IECEx certification**



① main poppet
② valve main body
③ mechanical pressure limiter
④ cover
⑤ intrinsically safe pilot valve

AGAM-10/10/-WO**

AGAM, ARAM

Intrinsically safe pressure relief valves equipped with solenoid pilot valve for venting or multiple pressure selection, certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:

- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

The valves must be electrically powered through specific "safety barriers" limiting the max current to the solenoid, see section 10.

AGAM: pressure relief, subplate mounting
Size: **10, 20** and **32** - ISO 6264
Max flow: **200, 400** and **600 l/min**

ARAM: pressure relief, threaded connections
Size: **G 3/4"** and **G 1 1/4"**
Max flow: **350** and **500 l/min**

Max pressure: **350 bar**

1 MODEL CODE

AGAM	/	*	-	20	/	20	/	210/100/100	-	WO	/	*	/	6	*	/	*

AGAM
Intrinsically safe pressure relief valves, piloted

AGAM
subplate mounting

ARAM
threated connections

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Valve size:
10 = AGAM (ISO 6264)
20 = AGAM (ISO 6264)
32 = AGAM (ISO 6264)
20 = ARAM G 3/4"
32 = ARAM G 1 1/4"

Configuration, see section 2 :
10 **20** **22**
11 **21** **32**

Max regulated pressure
of first (second / third) setting, see section 4 :
50 = 50 bar **100** = 100 bar
210 = 210 bar **350** = 350 bar

WO = intrinsically safe solenoid

Options (2):
E = external pilot
V = regulating handweel for pressure adjustment
WP = ⚠ manual override
Y = external drain

Connector type:
6 = DIN 43650 (standard)

Series number

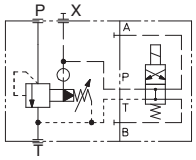
Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

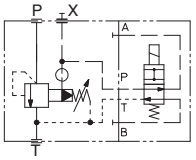
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS

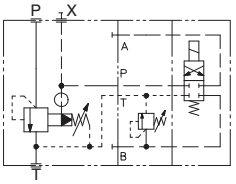
AGAM-/10**
ARAM-/10**
one setting pressure
+ venting with
de-energized solenoid



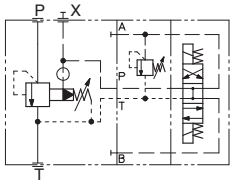
ARAM-/11**
AGAM-/11**
one setting pressure
+ venting with
energized solenoid



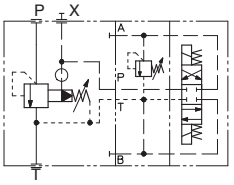
AGAM-/22**
ARAM-/22**
two setting pressure
without venting



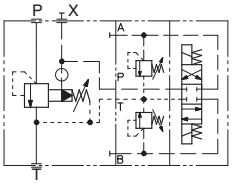
AGAM-/20**
ARAM-/20**
two setting pressure
+ venting with
de-energized solenoid



AGAM-/21**
ARAM-/21**
two setting pressure
+ venting with
energized solenoid



AGAM-/32**
ARAM-/32**
three setting pressure
without venting



3 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Intrinsically safe protection “Ex ia”, see section 7 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Valve size		**10**	**20**	**32**
Max operating pressure	[bar]	port P = **350** port T, Y = **210**		
Max regulated pressure	[bar]	**50**	**100** **210**	**350**
Pressure range	[bar]	4÷50;	6÷100; 7÷210;	8÷350
Max flow **AGAM (1)**	[l/min]	200	400	600
Max flow **ARAM (1)**	[l/min]	-	350	500

(1) see Q/Δp diagrams at section 11 and 12

5 ELECTRICAL CHARACTERISTICS - see also section 7

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type		AGAM ARAM	AGAM/**IE** ARAM/**IE**				AGAM/**M** ARAM/**M**			AGAM/**IEM** ARAM/**IEM**		
Certification		**ATEX** (Group II)	**IECEx** (Group II)				**ATEX (mining)** (Group I)			**IECEx (mining)** (Group I)		
Solenoid code		**OW-18/6**	**OWI-18/6**				**OWM-18/6**			**OWIM-18/6**		
Type examination certificate **(1)**		CESI 02 ATEX 013	IECEx CES 12.0017				CESI 02 ATEX 013			IECEx CES 12.0017		
Method of protection		**Ex II 1G Ex ia**					**Ex I M2 Ex ia I Mb Ex ib I Mb**					
		IIA T5 Ga	**IIB T6 Ga**	**IIC T6 Ga**								
Electrical characteristics (max values)	Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
	Ii [mA]	396	250	130	360	360	396	250	130	360	360	2200
	Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
	Ci , Li	≅ 0	≅ 0				≅ 0					
Temperature class		**T5**	**T6**				–					
Surface temperature (ambient temp. +60°C)		≤ 100°C	≤ 85°C				≤ 150°C					
Ambient temperature		-20 ÷ +60°C	-40 ÷ +60°C **(2)**				-20 ÷ +60°C					
Applicable standards		EN 60079-0 EN 60079-11 EN 60079-26	IEC 60079-0 IEC 60079-11 IEC 60079-26									

(1) The type examinator certificates can be downloaded from www.atos.com
(2) Only for **/BT** option

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").

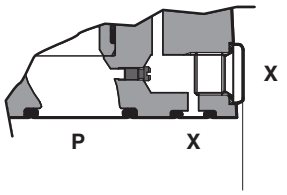
V = Regulating handweel for pressure adjustment

WP = Manual override protect by metallic cap

Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.

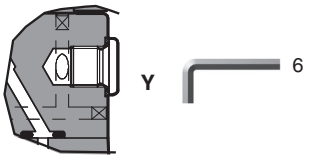
11.1 Possible combined options: all combinations are available

E option



Blinded plug SP-X100A

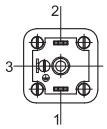
Y option

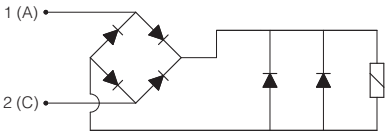


9 SOLENOIDS WIRING

Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

DIN 43650





10 INTRINSICALLY SAFE BARRIERS - see tech. table **GX010**

Intrinsically safe valves must be powered through safety barriers certified according to Ex-ie protection mode, limiting the energy to the solenoid.

To select the proper intrinsically safe barriers following data must be considered:
1) Vmax and Imax of the solenoid as specified in section 7 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 4.

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

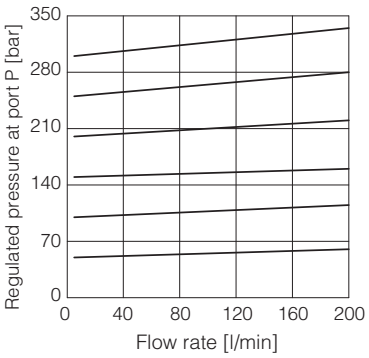
MODEL CODE OF I.S. BARRIER

Y-BXNE 412 00	*

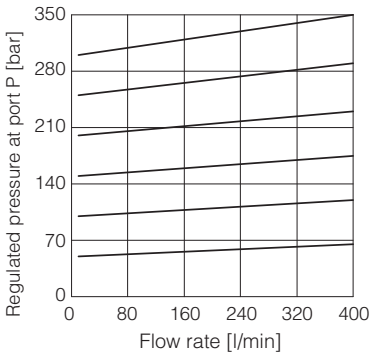
Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

11 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

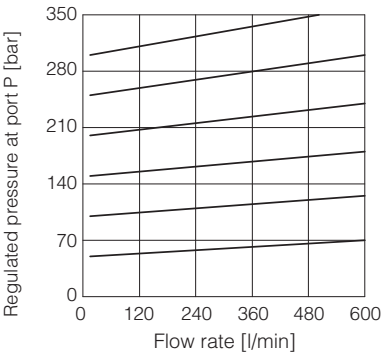
AGAM-10



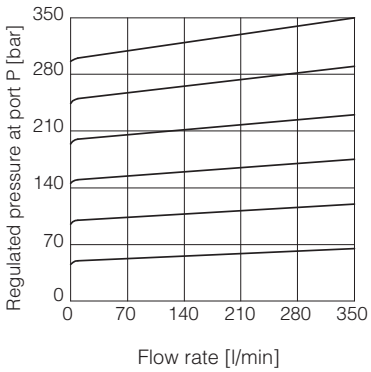
AGAM-20



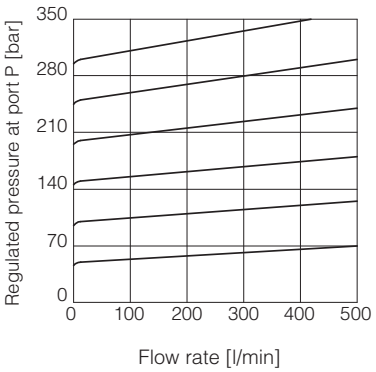
AGAM-32



ARAM-20

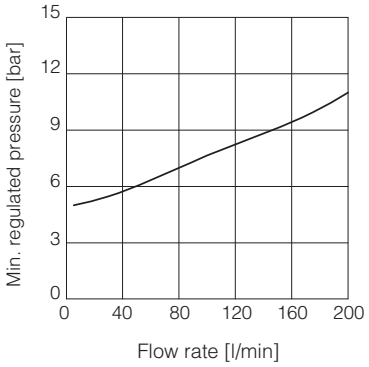


ARAM-32

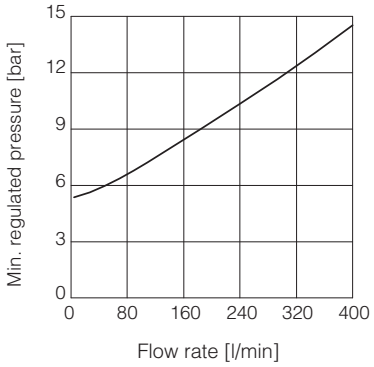


12 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

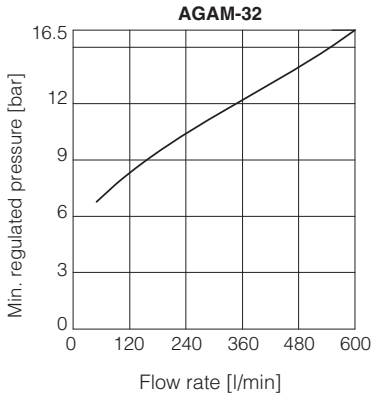
AGAM-10



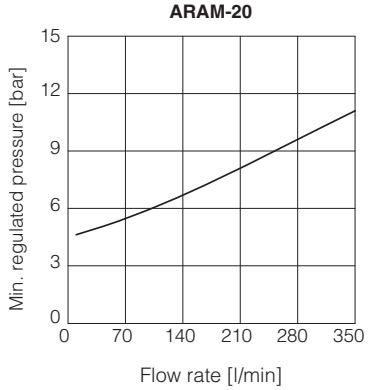
AGAM-20



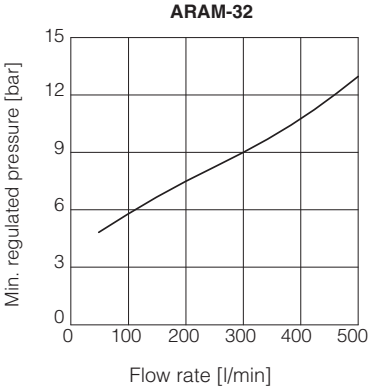
AGAM-32



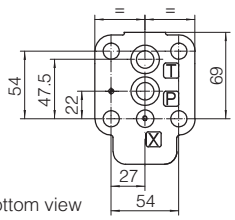
ARAM-20



ARAM-32



AGAM-10

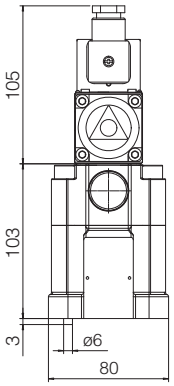


Valve's bottom view

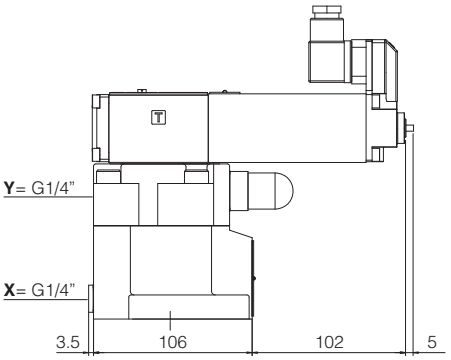
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-06-09-1-97
Fastening bolts:
4 socket head screws M12x35 class 12.9
Tightening torque = 125 Nm
Seals: 2 OR 123; 1 OR 109/70
Ports P, T: Ø = 14,5 mm
Ports X: Ø = 3,2 mm

X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

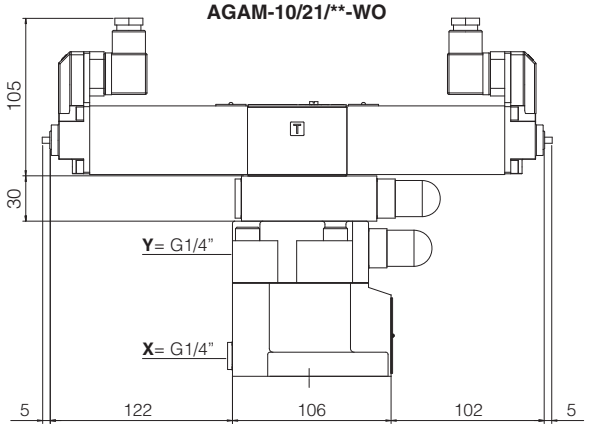
Mass [kg]	
AGAM-10/10 10/11	6,45
AGAM-10/20 10/21	7,55
AGAM-10/22 10/32	7,25 9



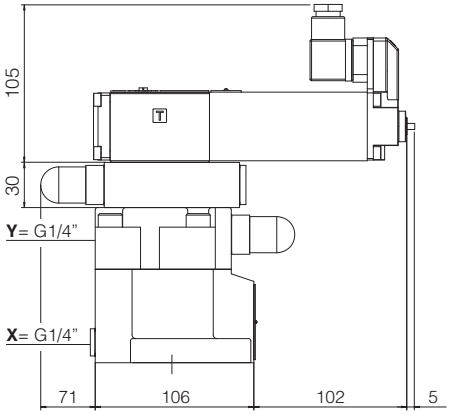
AGAM-10/10/-WO**
AGAM-10/11/-WO**



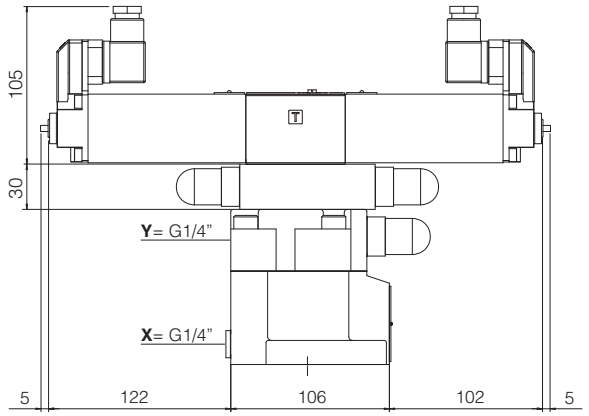
AGAM-10/20/-WO**
AGAM-10/21/-WO**



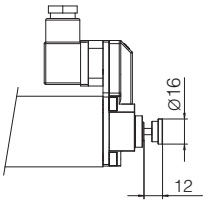
AGAM-10/22/-WO**



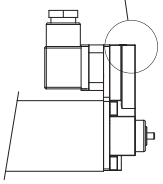
AGAM-10/32/-WO**



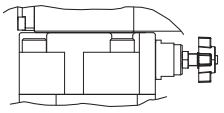
Option /WP



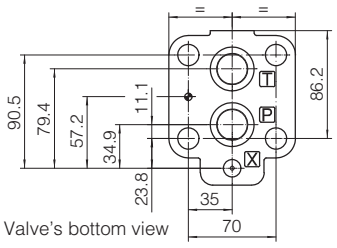
Mining version /M and /IEM
(different cover shape)



Option /V



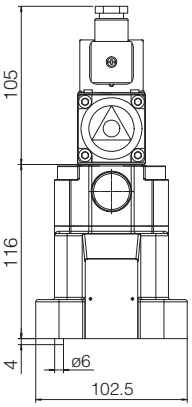
AGAM-20



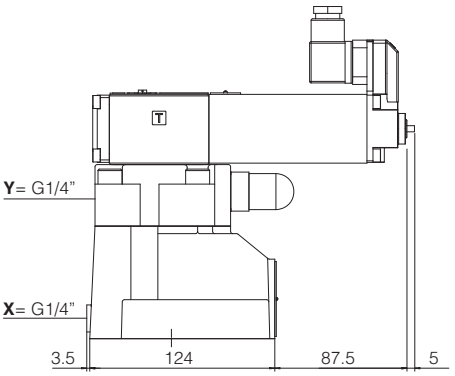
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-08-11-1-97
Fastening bolts:
4 socket head screws M16x50 class 12.9
Tightening torque = 300 Nm
Seals: 2 OR 4112; 1 OR 109/70
Ports P, T: Ø = 24 mm
Ports X: Ø = 3,2 mm

X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

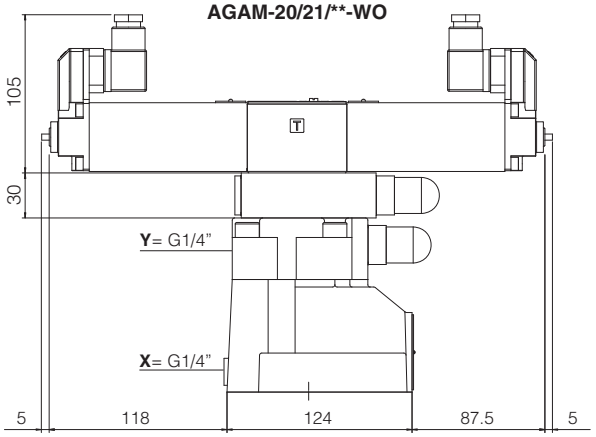
Mass [kg]	
AGAM-20/10 20/11	7,65
AGAM-20/20 20/21	8,75
AGAM-20/22 20/32	8,45 10,2



AGAM-20/10/-WO**
AGAM-20/11/-WO**



AGAM-20/20/-WO**
AGAM-20/21/-WO**



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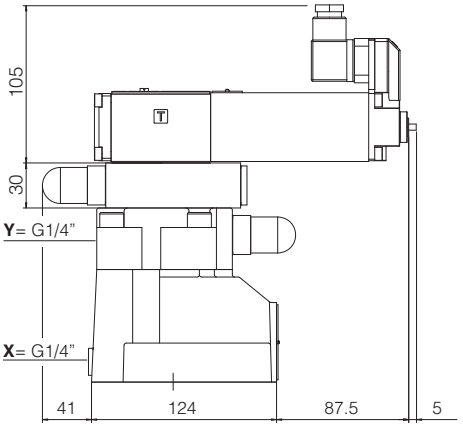
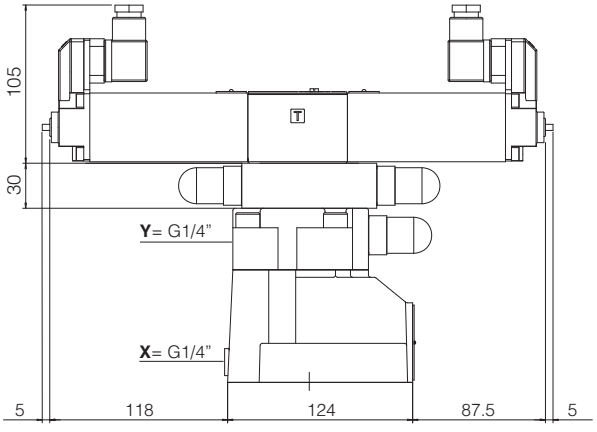
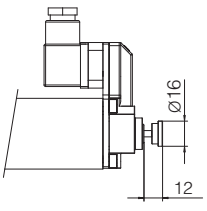


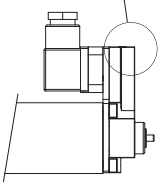
AGAM-20/32/-WO**



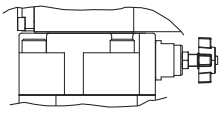
Option /WP



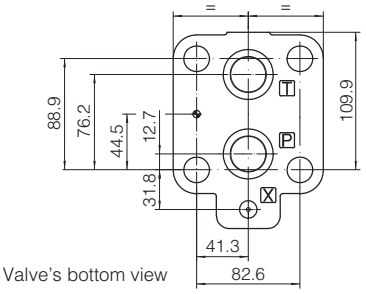
Mining version /M and /IEM
(different cover shape)



Option /V



AGAM-32

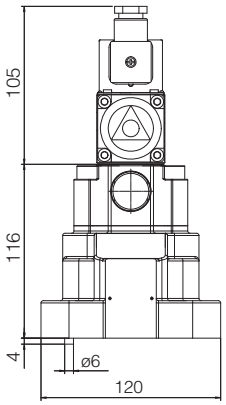


Valve's bottom view

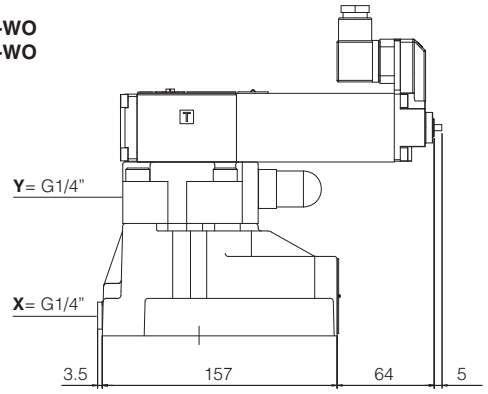
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)
Fastening bolts:
4 socket head screws M20x60 class 12.9
Tightening torque = 600 Nm
Seals: 2 OR 4131; 1 OR 109/70
Ports P, T: Ø = 28,5 mm
Ports X: Ø = 3,2 mm

X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

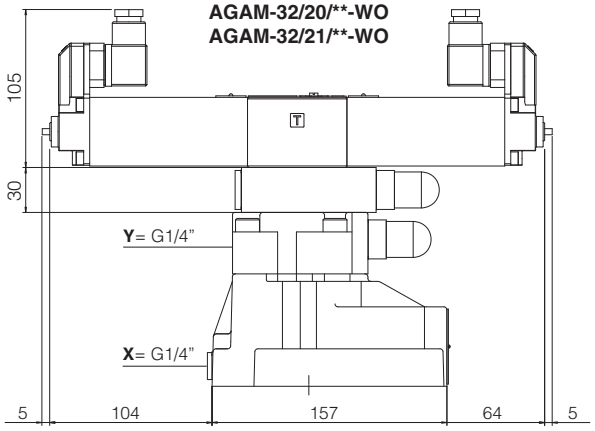
Mass [kg]	
AGAM-32/10 32/11	9,05
AGAM-32/20 32/21	10,05
AGAM-32/22 32/32	9,85 11,6



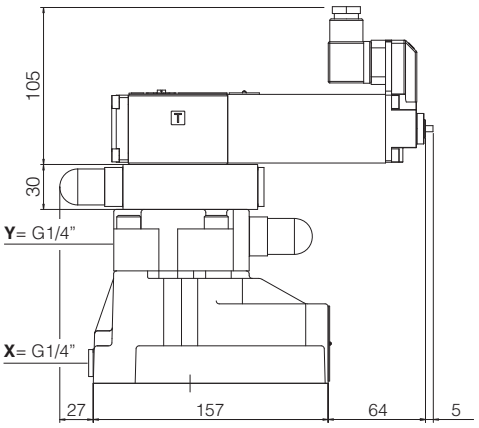
AGAM-32/10/-WO**
AGAM-32/11/-WO**



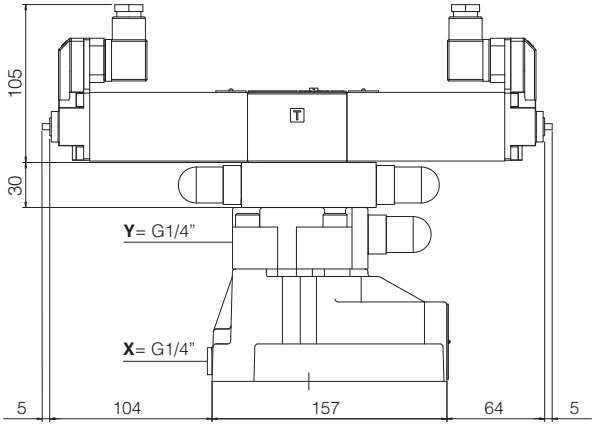
AGAM-32/20/-WO**
AGAM-32/21/-WO**



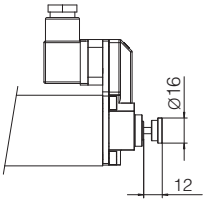
AGAM-32/22/-WO**



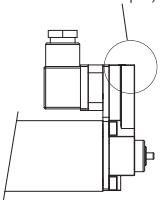
AGAM-32/32/-WO**



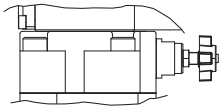
Option /WP



Mining version /M and /IEM
(different cover shape)



Option /V

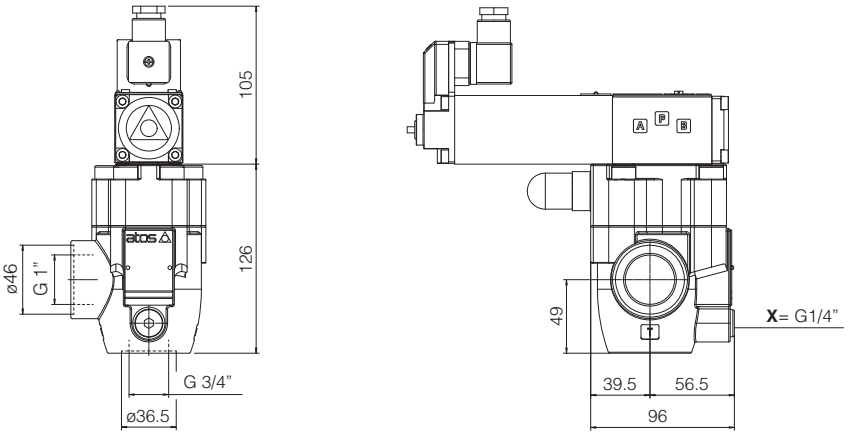


ARAM-20

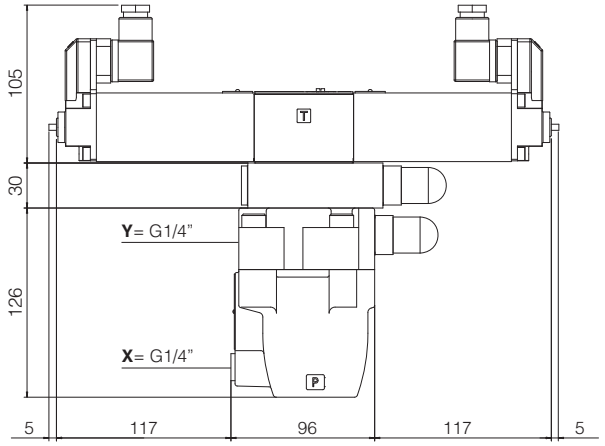
X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

Mass [kg]	
ARAM-20/10 20/11	6,75
ARAM-20/20 20/21	8,45
ARAM-20/22 20/32	8,15 10,1

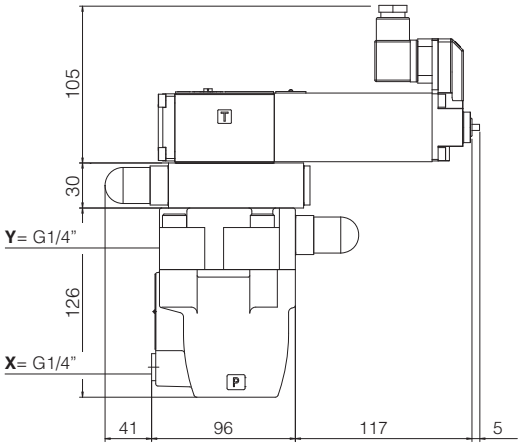
ARAM-20/10/-WO**
ARAM-20/11/-WO**



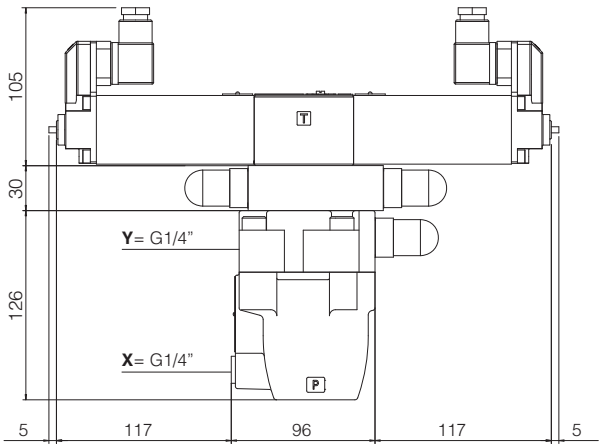
ARAM-20/20/-WO**
ARAM-20/21/-WO**



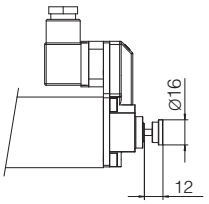
ARAM-20/22/-WO**



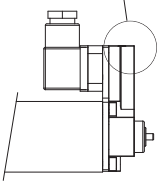
ARAM-20/32/-WO**



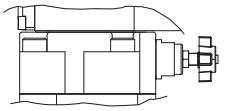
Option /WP



Mining version /M and /IEM
(different cover shape)



Option /V

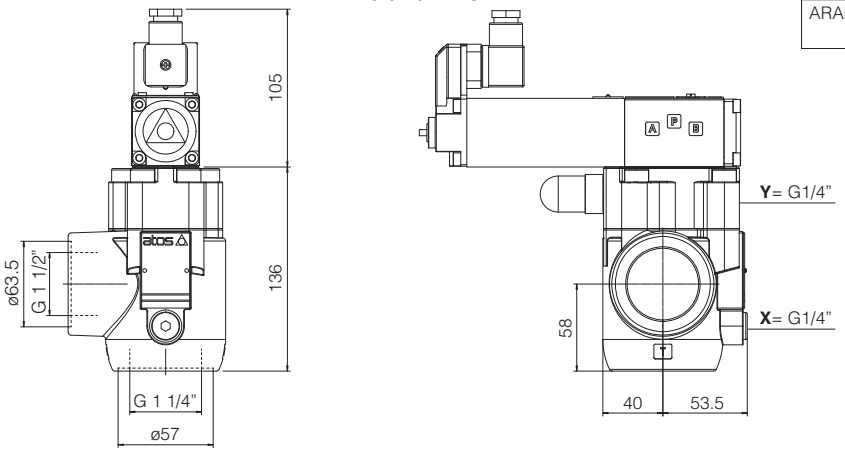


ARAM-32

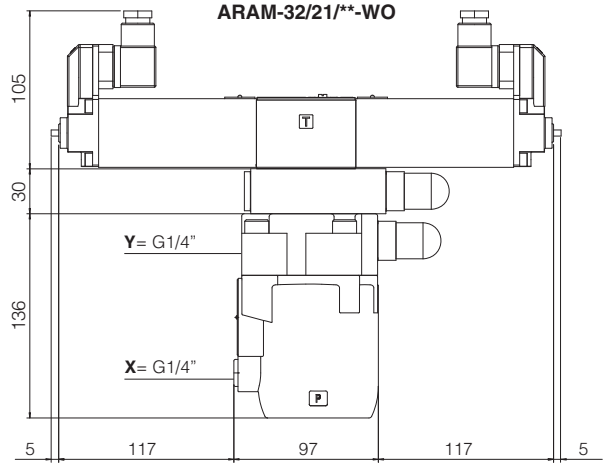
X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

Mass [kg]	
ARAM-32/10 32/11	7,05
ARAM-32/20 32/21	9,05
ARAM-32/22 32/32	8,55 10,7

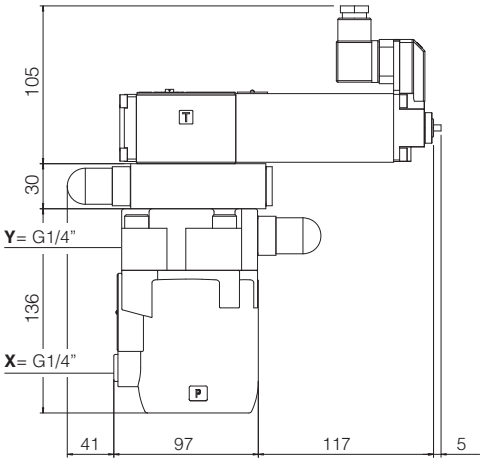
ARAM-32/10/-WO**
ARAM-32/11/-WO**



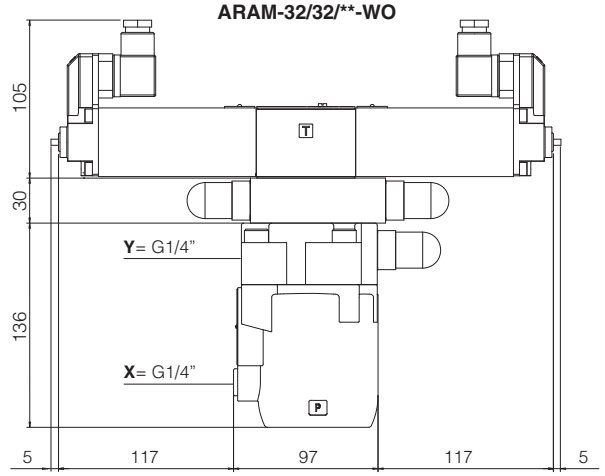
ARAM-32/20/-WO**
ARAM-32/21/-WO**



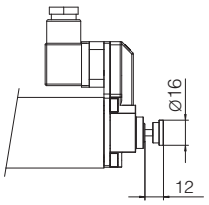
ARAM-32/22/-WO**



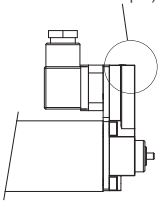
ARAM-32/32/-WO**



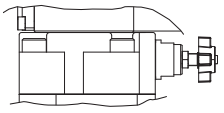
Option /WP



Mining version /M and /IEM
(different cover shape)



Option /V

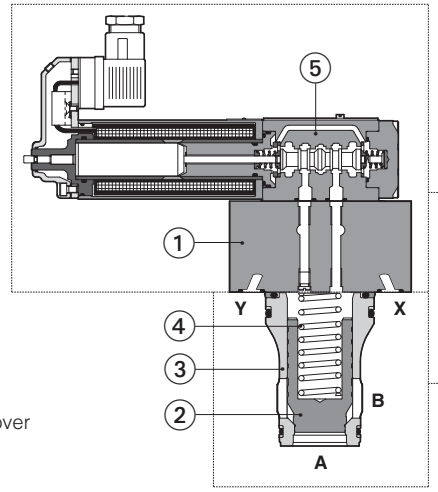


15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P005	Mounting surfaces for electrohydraulic valves

Intrinsically safe ISO cartridge valves

on-off directional control, ISO 7368 - **ATEX** or **IECEx**



LIDEW1-4/*-WO

SC LI-4043*

① functional cover
② poppet
③ sleeve
④ spring
⑤ intrinsically safe solenoid pilot valve

LIDEW, LIDBH, SC LI

On-off ISO directional cartridges equipped with intrinsically safe solenoid pilot valve for poppet control, certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:

- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

See section 11 for certification data

The valves must be electrically powered through specific “safety barriers” limiting the max current to the solenoid, see section 13

LIDEW: directional control with ex-proof solenoid valve for oppet control

LIDBH: directional control with solenoid valve and shuttle valve for pilot line selection

Size: **16** ÷ **63**
Flow: **240** ÷ **4000 l/min** at Δp 5 bar
Max pressure: **350 bar**

1 **MODEL CODE OF COVERS** - to be coupled with cartridge in section 5

LI	D	EW /	*	-	1	-	1	/	*	-	WO	/	6	*	/	*	*

Cover according to ISO 7368

D = directional function

EW = with pilot solenoid valve
BH = as EW plus shuttle valve for pilot selection

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Cover configuration see section 2 :
LIDEW: **-**, **1**, **2**, **4**, **5**, **6**
LIDBH: **1A**, **1C**, **2A**, **2C**

Valve size (ISO 7368):
1 = 16 **3** = 32 **5** = 50
2 = 25 **4** = 40 **6** = 63

Options (2):
B = cartridge piloted via port “B” of solenoid pilot valve
E = external attachments X (1/4" GAS) and underneath port X supplied plugged (only for sizes 40...63)
WP = ⚠ manual override

WO = Intrinsically safe slenoid

Connector type:
6 = DIN 43650 (standard)

Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR **(1)**

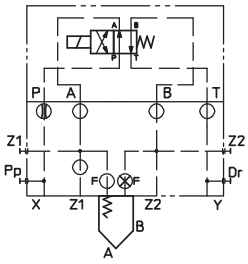
Optional different setting of the calibrated plugs in the pilot channels see section 3

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

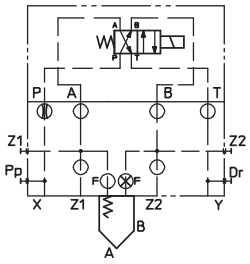
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 VALVES CONFIGURATIONS AND HYDRAULIC SYMBOLS

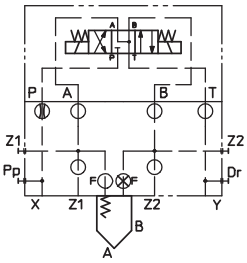
LIDEW



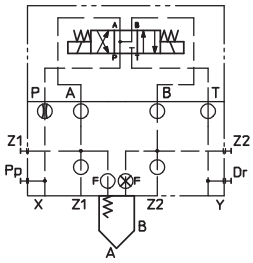
LIDEW1-*



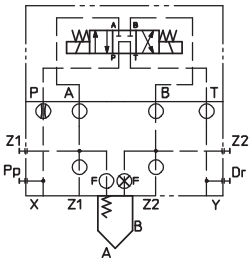
LIDEW2-*



LIDEW4-*

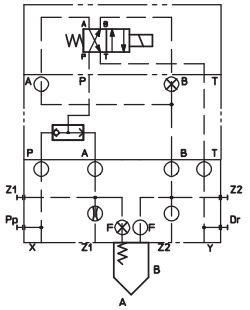


LIDEW5-*

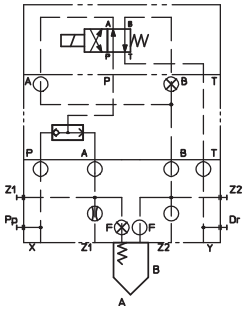


LIDEW6-*

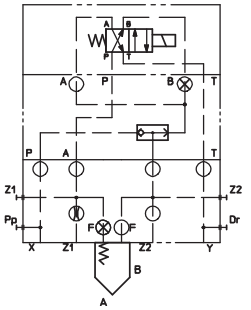
LIDBH



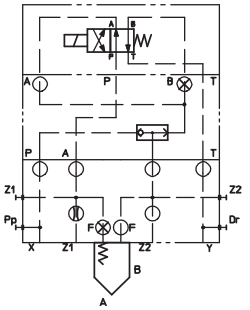
LIDBH1A-*



LIDBH1C-*



LIDBH2A-*



LIDBH2C-*

3 OPTIONS

For LIDEW*, LIDBH* covers (sizes 40…100):

/E = with external attachments Pp and underneath port X supplied plugged;

For all the models:

/B = cartridge piloted via port "B" of solenoid pilot valve;

/F = prearranged for coupling to an intermediate element with poppet position detector for safety function. See tab. EY120.

/WP = prolonged manual override protected for solenoid pilot valve.

******* = Calibrated plugs different from standard ones reported in section 4. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIDEW2	-	1	/*	-	WO	/6	**

P
Channel where the orifice has to be provided: **P** = channel X, port P **Z1** = channel Z1 **F** = channel F **Z2** = channel Z2

06
Size of the throttling hole in teths of millimeters: **05** = 0,5 mm **10** = 1 mm **17** = 1,7 mm **06** = 0,6 mm **12** = 1,2 mm **20** = 2 mm **08** = 0,8 mm **15** = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Port \ Cover	LIDEW*-1 LIDBH*-1	LIDEW*-2 LIDBH*-2	LIDEW*-3 LIDBH*-3	LIDEW*-4 LIDBH*-4	LIDEW*-5 LIDBH*-5	LIDEW*-6 LIDBH*-6
Z1 (only for LIDBH*-*)	M4 12A	M4 12A	M6 15A	M6 17A	M6 20A	M6 20A
P	M6 12A	M6 12A	M6 15A	M6 17A	M6 20A	M6 20A

M4 ÷ M8 = screw size; **12A ÷ 20A** = calibrated orifices diameter in tenths of mm; **A** = short calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES, to be coupled with covers in section 1

SC LI	-	16	43	1	40	/*

SC LI: Cartridge valve

16: **Size** (ISO 7368): **16 25 32 40 50 63**

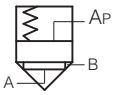
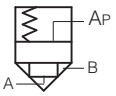
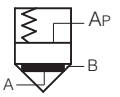
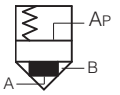
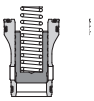
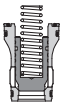
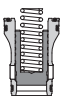
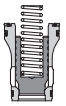
43: **Type of poppet**, see section 6 for maximum flow
32, 33
42 = as 32 but with dumping nose
43 = as 33 but with dumping nose

1: **Spring cracking pressure**:
1 = 0,3 bar for poppet 32, 42;
1 = 0,6 bar for poppet 33, 43;
2 = 1,5 bar for poppet 32, 42;
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

40: **High flow:**
40 = all sizes

/*: Seals material:
- = NBR
PE = FKM
BT = HNBR

6 TYPE OF POPPET

Type of poppet		**32**	**33**	**42**	**43**
Functional sketch (Hydraulic symbol)					
Operating pressure		**420 bar max** (only SCLI cartridge)			
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 9	Size **16**	270	270	240	240
	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
Typical section					
Area ratio A:Ap		**1:1,1**	**1:1,5**	**1:1,1**	**1:1,5**
Cracking pressure A→B	Spring **1**	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	3 bar	3 bar	3 bar
	6	5,5 bar	5,5 bar	5,5 bar	5,5 bar
Cracking pressure B→A	Spring **1**	3 bar	1,2 bar	3 bar	1,2 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	6 bar	32,5 bar	6 bar
	6	54,5 bar	11 bar	54,5 bar	11 bar

7 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100)
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	Intrinsically safe protection "Ex ia", see section 11 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS

Functional cover operating pressure	port A, B, X, Z1, Z2 = **350**; port Y = **160**
Rated flow	see section 6

9 ELECTRICAL CHARACTERISTICS - see also section 11

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type		LIDEW LIDBH		LIDEW/**IE** LIDBH/**IE**			LIDEW/**M** LIDBH/**M**			LIDEW/**IEM** LIDBH/**IEM**		
Certification		**ATEX** (Group II)		**IECEx** (Group II)			**ATEX (mining)** (Group I)			**IECEx (mining)** (Group I)		
Solenoid code		**OW-18/6**		**OWI-18/6**			**OWM-18/6**			**OWIM-18/6**		
Type examination certificate **(1)**		CESI 02 ATEX 013		IECEx CES 12.0017			CESI 02 ATEX 013			IECEx CES 12.0017		
Method of protection		**Ex II 1G Ex ia**					**Ex I M2 Ex ia I Mb Ex ib I Mb**					
		IIA T5 Ga	**IIB T6 Ga**	**IIC T6 Ga**								
Electrical characteristics (max values)	Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
	Ii [mA]	396	250	130	360	360	396	250	130	360	360	2200
	Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
	Ci , Li	≅ 0	≅ 0				≅ 0					
Temperature class		**T5**	**T6**				–					
Surface temperature (ambient temp. +60°C)		≤ 100°C	≤ 85°C				≤ 150°C					
Ambient temperature		-20 ÷ +60°C	-40 ÷ +60°C **(2)**				-20 ÷ +60°C					
Applicable standards		EN 60079-0 EN 60079-11 EN 60079-26		IEC 60079-0 IEC 60079-11 IEC 60079-26								

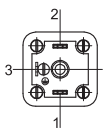
(1) The type examinator certificates can be downloaded from www.atos.com
(2) Only for **/BT** option

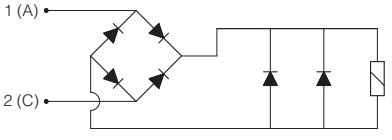
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

12 SOLENOIDS WIRING

Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

DIN 43650





13 **INTRINSICALLY SAFE BARRIERS** - see tech. table **GX010**

The electric supply to these valves must be done through intrinsically safe barriers situated out of potentially flammable environment (i.e. in safe zone), which limit the electric current to the intrinsically safe solenoid. The "intrinsically safe" circuit is virtually unable to produce electrical surges or thermic effects able to cause explosion in hazardous environments also in presence of specific break-down situations. The intrinsically safe barriers must be approved and certified according to the Ex ia protection mode.

To select the proper intrinsically safe barriers following data must be considered:
1) Vmax and Imax of the solenoid as specified in section **11** must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section **8**.

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

MODEL CODE OF I.S. BARRIER

Y-BXNE 412 00	*

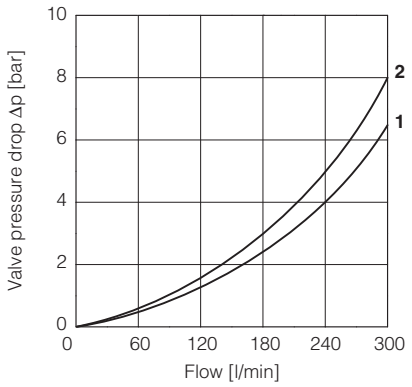
Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

14 **Q/Δp DIAGRAMS** based on mineral oil ISO VG 46 at 50 °C

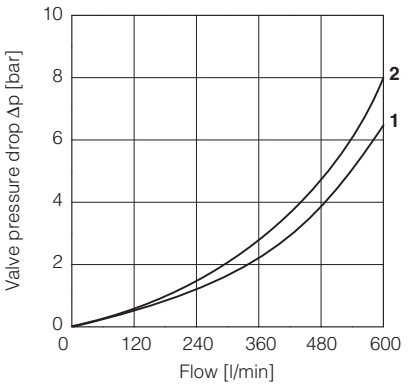
SC LI High flow - series 40

1 = poppet type 32 and 33 **2** = poppet type 42 and 43

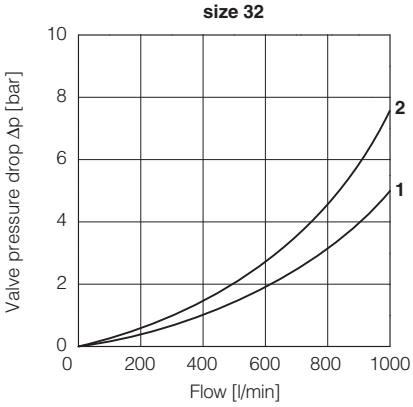
size 16



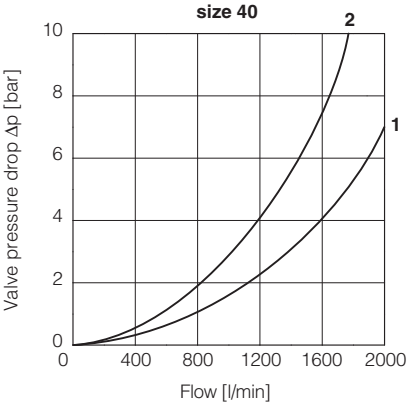
size 25



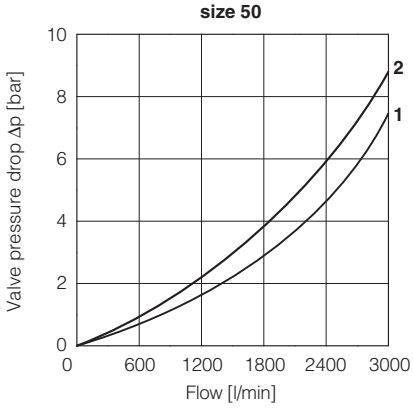
size 32



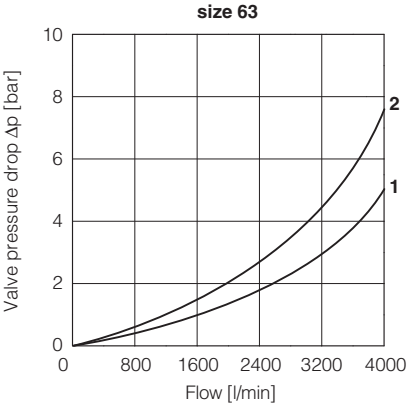
size 40



size 50

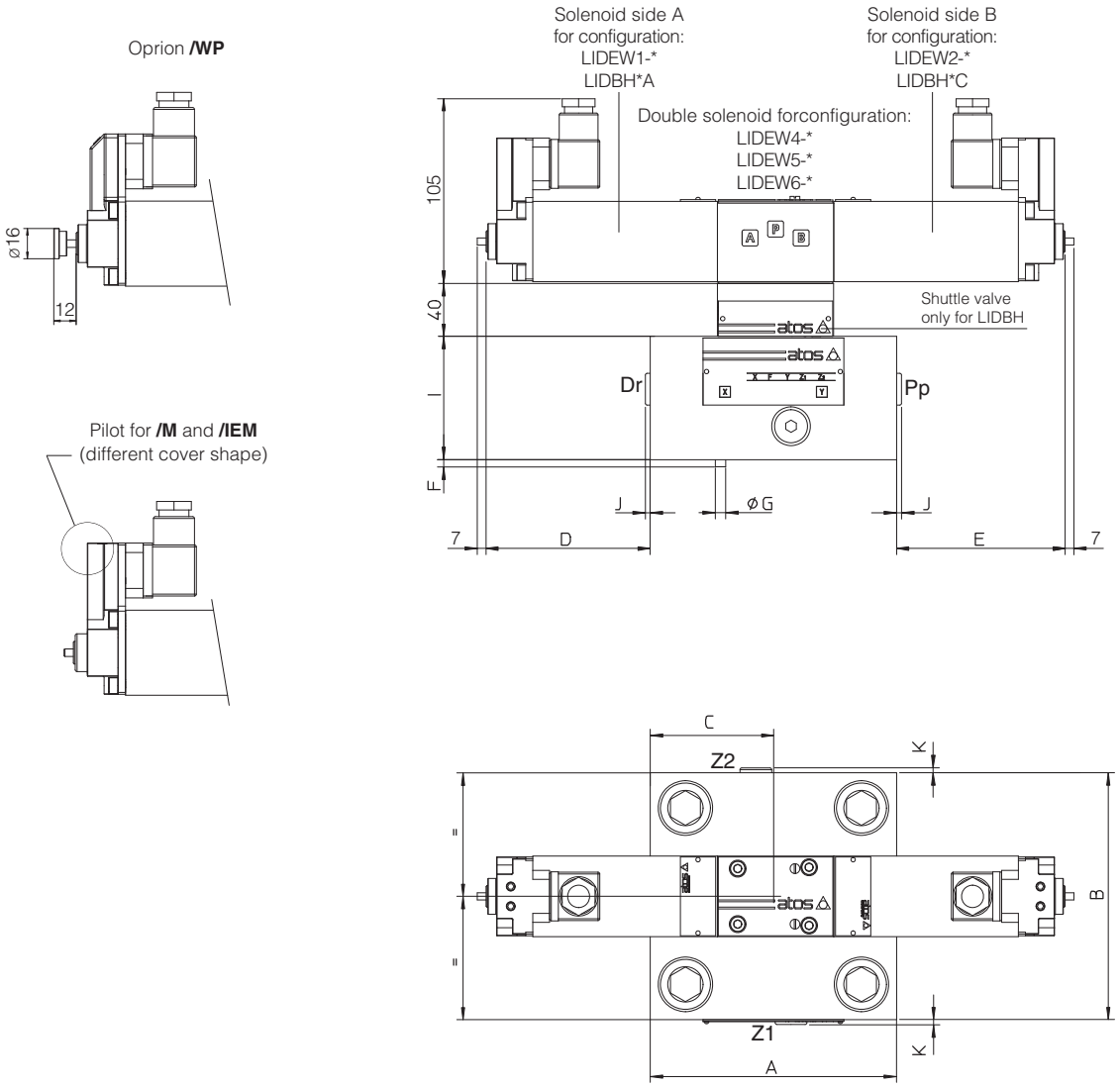


size 63



15 COVER INSTALLATION DIMENSIONS [mm] - for cartridge cavity dimensions see tech. table P006

Size 16 ÷ 63
Drawing of size 50



Notes referred to the below table:

(1) LIDEW1* - LIDBH*A: solenoid at side of port Y of cover
LIDEW2* - LIDBH*C: solenoid at side of port X of cover

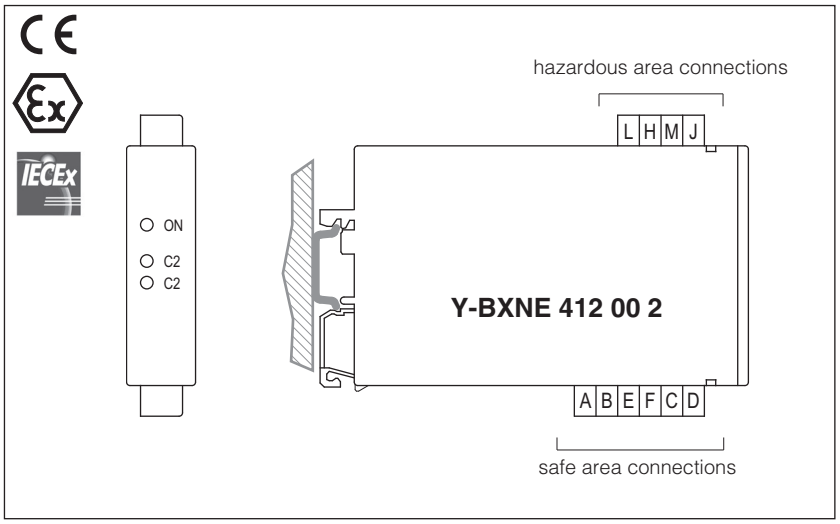
Size (1)	A	B	C	D max	E max	F	G	I	J	K	Ports Pp-Dr	Ports Z_1-Z_2	Seals	Fastening bolts (3)	Tightening torque [Nm]	Mass [Kg]
16	70	65	41	135	123	4	3	40	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	3,95 ÷ 5,7
25	85	85	42,5	123	123	6	5	40	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	4,35 ÷ 6,1
32	100	100	50	115	115	6	5	50	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	4,85 ÷ 6,7
40	125	125	62,5	102	102	6	5	60	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7,75 ÷ 9,6
50	140	140	70	95	95	4	6	70	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,85 ÷ 12,7
63	180	180	90	75	75	4	6	80	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	18,65 ÷ 20,4

16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P006	Mounting surfaces and cavities for cartridge valves

Safety barriers for on-off intrinsically safe valves

DIN-rail panel format - **ATEX** and **IECEx**



Y-BXNE

Safety barriers are designed to electrically supply Atos intrinsically safe valves.

In intrinsically safe systems, the safety barrier is installed between the “safe area” and the “hazardous area” with potential presence of explosive gases and vapors, so that any fault that generates a high energy level, would not get carried over to the hazardous area.

Y-BXNE safety barriers are ATEX and IECEx certified according to the Ex ia protection mode

1 MODEL CODE OF I.S. BARRIER

Y-BXNE	412	00	*
Intrinsically safe barrier	**Model:** **412** = output voltage 19,5 V output current 170 mA 2 channels	**00** = no options	**Power supply**: **E** = 110 / 230 VAC **2** = 24 / 48 VDC

The above barrier can be used both for double or for single solenoid valves.
With one barrier, two single solenoid valves can be operated but not contemporary

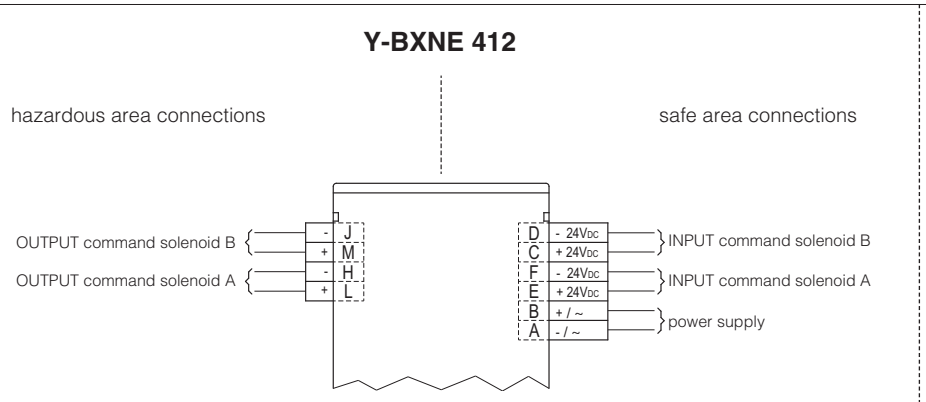
2 TECHNICAL CHARACTERISTICS

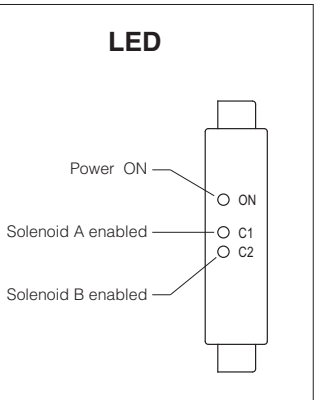
Power supply	21,6 ÷ 53 VDC or 110÷230 VAC ±10% (50/60 HZ)
Power consumption	< 3W
Output voltage Uo	19,5 V
Output current Io	170 mA
Output power Po	1,64 W
N° output channels	2
Galvanic insulation supply/output	2500 VAC / 50 Hz
Storage temperature	-25 °C ÷ +70 °C
Working temperature	-10 °C ÷ +60 °C
Format	Plastic box ; IP20 protection degree ; DIN-rail mounting as per EN50022
Electrical connections	screw terminals
Max conductor size	2,5 mm^2 max
Mass	200 gr

2.1 CERTIFICATION DATA

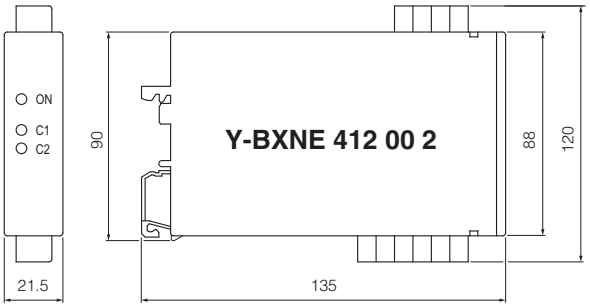
Certification	ATEX	IECEx
Type examination certificate	LCIE 02 ATEX 6104 X	LCI 09.0013 X
Method of protection	Ex II 1 G , Ex ia II C , Ex II 1 D , Ex ia D II C	
Applicabile standards	EN 60079 - 0 EN 60079 - 11 EN 61241 - 0 EN 61241 - 11	IEC 60079 - 0 IEC 60079 - 11 IEC 61241 - 0 IEC 61241 - 11

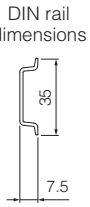
3 ELECTRIC CONNECTIONS AND LED

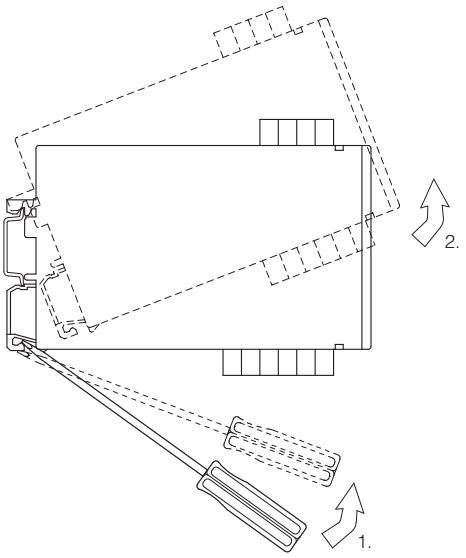




4 OVERALL DIMENSION

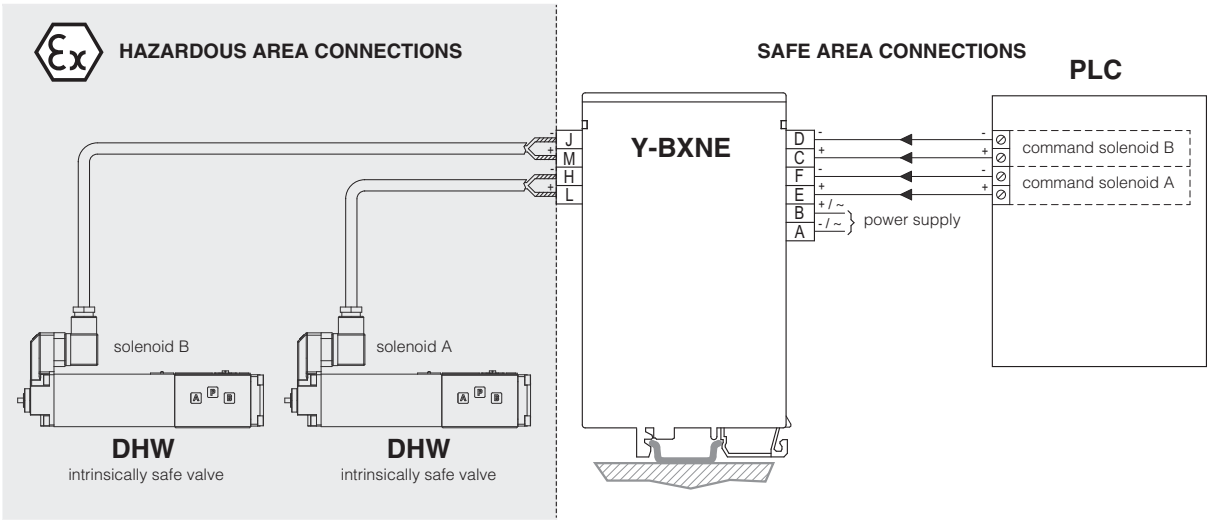






To unlock the safety barrier from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the safety barrier

5 INSTALLATION EXAMPLE



Example of two single solenoid valves connection - the valves cannot be contemporaly operated

4 CYLINDERS & PUMPS

INDEX

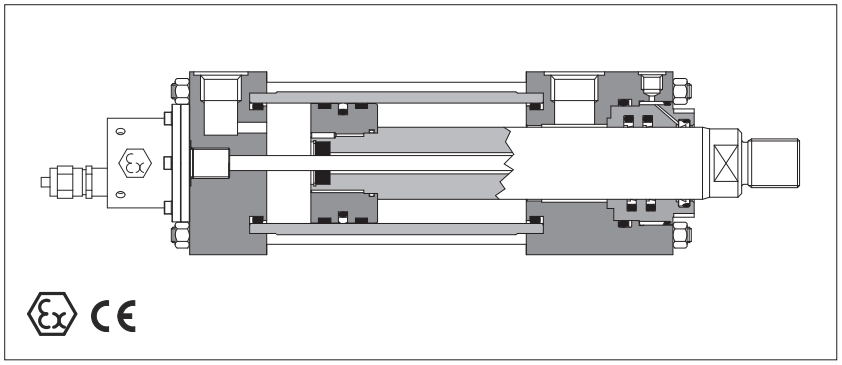
CYLINDERS & PUMPS

Ex-h

Supplementary components range available on **www.atos.com**

Hydraulic cylinders type CKA - for potentially explosive atmospheres

ATEX - ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CKA cylinders are derived from standard CK (tab.B137) with certification according to ATEX 2014/34/EU. They are designed to limit the external surface temperature, according to the certified class, to avoid the self-ignition of the explosive mixtures potentially present in the environment. CKAM servocylinders are equipped with ex-proof built-in digital magnetostrictive position transducer, ATEX certified.

- Optional ex-proof proximity sensors, ATEX certified
- Bore sizes from **25** to **200** mm
- Up to **3** rod diameters per bore
- Strokes up to **5000** mm
- Single or double rod
- **15** standard mounting styles
- **5** seals options
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's dimensions and options **see tab B.137**

For cylinder's choice and sizing criteria **see tab. B015**

1 ATEX CERTIFICATION

Cylinder type	Group	Equipment category	Gas/dust group	Temperature class (1)	Zone
CKA	II	2 GD	II C/III C	T85°C(T6) / T135 °C(T4)	1,2,21,22
CKA + ex-proof rod position transducer **(2)**	II	2 G	II B	T6/T5	1,2
	II	2 D	III C	T85°C/T100°C	21,22
CKA + ex-proof proximity sensors	II	3 G	II	T4	2

(1) Temperature class depends to the max fluid temperature and sealing system
(2) The rod position transducer is certified to work with explosive gas (cat. 2G) and dust (cat. 2D)

2 MODEL CODE

CKA	M	/	10	-	50	/	22	/	22	*	0500	-	S	3	0	1	-	A	-	B1E3X1Z3	**

Cylinder series
CKA to ATEX 2014/34/EU dimensions to ISO 6020 - 2

Ex-proof position transducer
See section 5
- = omit if not requested
M = Digital magnetostrictive

Incorporated subplate (1)
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size (1)
from **25** to **200** mm

Rod diameter (1)
from **12** to **140** mm

Second rod diameter for double rod **(1)**
from **12** to **140** mm, omit for single rod

Stroke (1)
up to **5000** mm (**4000** mm for **CKAM**)

Mounting style (1)

		REF. ISO
C	fixed clevis	MP1 **(4)**
D	fixed eye	MP3 **(4)**
E	feet	MS2
G	front trunnion	MT1
H	rear trunnion	MT2 **(4)**
L	intermediate trunnion	MT4 **(5)**
N	front flange	ME5
P	rear flange	ME6 **(4)**
S	fixed eye + spherical bearing	MP5 **(4)**
T	threaded hole+tie rods extended	MX7
V	rear tie rods extended	MX2
W	both end tie rods extended	MX1
X	basic execution	-
Y	front tie rods extended	MX3
Z	front threaded holes	MX5

Cushioning (1)
0 = none

Fast adjustable	Slow adjustable	Fast fixed
1 = rear only	**4** = rear only	**7** = rear only
2 = front only	**5** = front only	**8** = front only
3 = front and rear	**6** = front and rear	**9** = front and rear

Spacer (1)
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Sealing system, see section 7
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
6 = (NBR + PTFE) very low friction, single acting - pushing
7 = (NBR + PTFE) very low friction, single acting - pulling

Options (1)(3):
Rod end
F = female thread
G = light female thread
H = light male thread
Oversized oil ports
D = front oversized oil port
Y = rear oversized oil port
Ex-proof proximity sensors, see section 8
R = front sensor
S = rear sensor
Rod treatment
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds
A = front air bleed
W = rear air bleed
Draining
L = rod side draining

Heads' configuration (1)(3)
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
* = selected position (1, 2, 3 or 4)

Series number **(2)**

(1) For details see table **B137**
(2) For spare parts request indicate the series number printed on the nameplate only for series < 30
(3) To be entered in alphabetical order
(4) Not available for double rod
(5) XV dimension must be indicated in the model code

3 CERTIFICATION

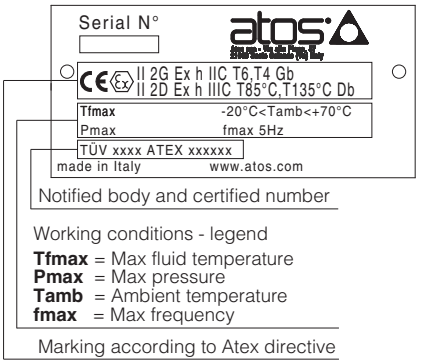
In the following are resumed the cylinders marking according to Atex certification.
Reference norm ISO 80079-36, ISO 80079-37.

II 2G Ex h IIC T6, T4 Gb (gas) **II 2D Ex h IIIC T85°C, T135°C Db (dust)**

GROUP II, Atex

II = Group II for surface plants
2 = High protection (equipment category)
G = For gas, vapours
D = For dust
Ex = Equipment for explosive atmospheres
IIC = Gas group
IIIC = Dust group
T85°C/T135°C = Surface temperature class for dust, see section 6
T6/T4 = Surface temperature class for gas, see section 6
Gb/Db = EPL Equipment group

Compliance RoHS Directive 2011/65/EU as last update by 2015/65/EU (only CKAM)
REACH Regulation (EC) no.1907/2006



4 INSTALLATION NOTES

Before installation and start-up refer to tab. BX900

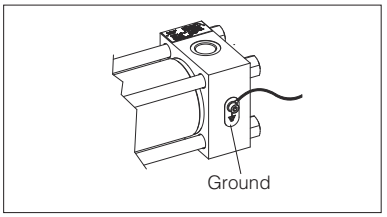
- The max surface temperature indicated in the nameplate must be lower than the following values:

GAS - **80% of gas ignition temperature**

DUST - max value between **dust ignition temperature - 75°C** and **2/3 of dust ignition temperature**

- The ignition temperature of the fluid must be 50°C greater than the maximum surface temperature indicated in the nameplate
- The cylinder must be grounded using the threaded hole on the rear head, evidenced by the nameplate with ground symbol. The hydraulic cylinder must be put at the same electric potential of the machine

GROUNDING



5 EX-PROOF ROD POSITION TRANSDUCER

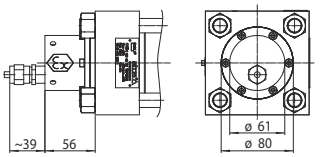
CODE: **M**
CKA cylinders are available with "Balluff" Ex-proof rod position transducer, ATEX certified to **II 1/2 G Ex d IIC T6/T5 Ga/Gb** for gas and **II 2D Ex tb IIIC T85°C/T100°C Db IP 67 -40°C Ta +65°C (T6) -40°C Ta +80°C (T5)** for dust. Ex-proof transducers meet the requirements of the following european standard documentations:

II 1/2 G Ex d IIC T6/T5 Ga/Gb	**II 2D Ex tb IIIC T85°C/T100°C Db IP 67**
EN 60079-0	EN 61241-0
EN 60079-1	EN 61241-0/AA
EN 60079-26	EN 61241-1

The transducer housing is made in AISI 303.
For dimensions and details, contact our technical office.

For certification and start-up refer to the user's guide included in the supply
The transducer is available with SIL certified on request

CKAM WITH ROD POSITION TRANSDUCER



cable connection with protection degree IP 67

6 MAIN CHARACTERISTICS AND FLUID REQUIREMENTS

Ambient temperature	-20÷+70°C; -40 ÷ +65°C for **CKAM**
Fluid temperature	-20÷+70°C (**T6**); -20÷+120°C (**T4**) for seals type **2** (*)
Max surface temperature	≤ +85 °C (**T6**); ≤ +135 °C (**T4**) for seals type **2** (*)
Max working pressure	16 MPa (160 bar)
Max pressure	25 MPa (250 bar)
Max frequency	5 Hz
Max speed (see section 7)	1 m/s (seals type 2, 4, 6, 7); 0,5 m/s (seals type 1)
Recommended viscosity	15 ÷ 100 mm²/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

Note: (*) Cylinders with seals type **2** may also be certified **T6** limiting the max fluid temperature to 70°C

CKA cylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters) depending to the sealing system.

7 SEALING SYSTEM FEATURES

The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**
When single acting seals are selected (types **6** and **7**), the not pressurized cylinder's chamber must be connected to the tank. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition.

Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
1	NBR + POLYURETHANE	**high static and dynamic sealing**	0.5	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	**very low friction and high temperatures**	1	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, fire resistance fluids HFA, HFB, HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	1	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
6 - 7	NBR + PTFE	**very low friction single acting - pushing/pulling**	1	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2

8 EX-PROOF PROXIMITY SENSORS

CODES: **R** = front sensor; **S** = rear sensor
CKA cylinders are available with ex-proof proximity sensors, ATEX certified to **Ex II 3G Ex nA II T4 -25≤Ta≤80°C**. They meet the requirements of the following european standard documentations: EN 60079-0, EN 60079-15.
Their functioning is based on the variation of the magnetic field, generated by the sensor itself, when the cushioning piston enters on its influence area, causing a change of state (on/off) of the sensors. The sensor housing is made in stainless steel.
For dimensions and details, contact our technical office.

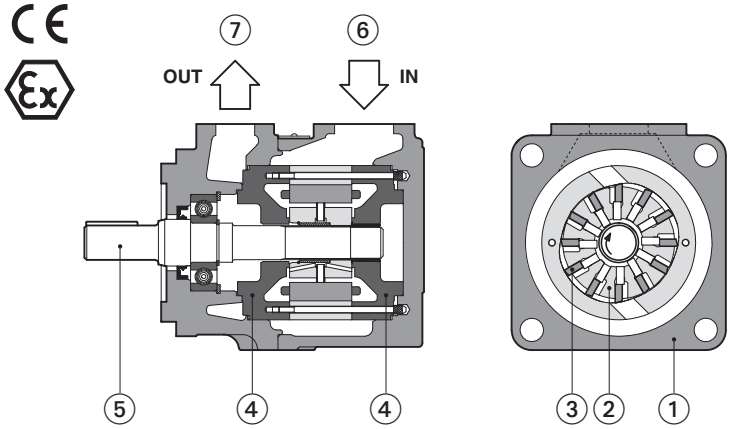
For certification and start-up refer to the user's guide included in the supply

SENSORS TECHNICAL DATA

Ambient temperature	-25 ÷ +80°C
Nominal voltage	24 VDC
Operating voltage	10 ÷ 30 VDC
Max load	200 mA
Repeatability	<5%
Protection degree	IP 68
Max frequency	1000 Hz
Max pressure	25 MPa

Ex-proof vane pumps type PFEA

fixed displacement - for potentialy explosive atmospheres - **ATEX**



PFEA

① body
②③ rotor with vanes
④ balanced plates
⑤ shaft
⑥ inlet port
⑦ outlet port

PFEA are fixed displacement-twelve-vane pumps available in threebody sizes and two different executions.
They are certified for application in potentially explosive atmospheres according to ATEX 2014/34/EU, protection mode

Ex II 2/2G Ex h IIC T5, T4 Gb, and
Ex II 2/2D Ex h IIIC T100°C, T135°C Db
(group II for surface plants with gas, vapours and dust environment, category 2, zone 1, 2, 21 and 22).

The external surface temperature of the pump is in accordance with the certified class, to avoid the self ignition of the explosive mixture present in the environment.

PFEA are available in two executions:

PFEA-*1 max pressure **210** bar

PFEA-*2 max pressure **300** bar

Displacements up to **150** cm³/rev.

1 MODEL CODE

PFEA	XA	-	31	036	/	1	D	T	/	7	*	/	*

PFEA: Fixed displacement vane pump with ex-proof certification

XA = for coupling with PFEA-31
XB = for coupling with PFEA-41 (only for PFEA-41, 42 and PFEA-51, 52)
XC = for coupling with PFEA-51 (only for PFEA-51 and 52)
XO = with through shaft, without rear flange

Additional suffix for pumps with through shaft, for coupling with 2nd pump type PFEA:

Size:
31, 41, 51 (standard)
32, 42, 52 (high pressure and low noise)

Displacement of **PFEA-31, 41, 51** [cm³/rev]
for PFEA-31: **010, 016, 022, 028, 036, 044**
for PFEA-41: **029, 037, 045, 056, 070, 085**
for PFEA-51: **090, 110, 129, 150**

Displacement of **PFEA-32, 42, 52** [cm³/rev]
for PFEA-32: **016, 022, 028, 036**
for PFEA-42: **045, 056, 070, 085**
for PFEA-52: **090, 110, 129, 150**

Drive shaft:
cylindrical, keyed (not for PFEA rear pumps to be coupled with PFEAX*)
1 = standard (only for PFEA 31, 41, 51)
2 = long version (only for PFEA-41 and PFEA-51)
3 = for high torque applications

splined
5 = for signal and through-shift pumps (1)
6 = for signal and through-shift pumps (only first position)
7 = for signal and through-shift pumps (only second and third position)
(only PFEA-31,42 / PFEA-32,42)

Direction of rotation (viewed from the shaft end):
D = clockwise
S = counterclockwise
Note: PFEA* are not reversible

Port orientation, see section 8:
T = standard
U, V, W = on request

Option:
7 = for ambient temperature up to 70°C **(2)**

Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FKM **(2)**

(1) Shaft type 5 has to be selected for PFEA rear pumps to be coupled with PFEAX* first pumps
(2) Pumps with option **/7** are always equipped with seals FKM

2 GENERAL CHARACTERISTICS

Assembly position	Any position
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.
Ambient temperature range	-20°C to +70°C
Recommended pressure on inlet port	from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm
Compliance	Explosion proof protection "Ex h", see section 6 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

3 OPERATING CHARACTERISTICS of PFEA - 31,41,51 at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

Model	Displacement cm³/rev	Max pressure (1)	Speed range rpm (2)	7 bar (3)		140 bar (3)		210 bar (3)	
				l/min	kW	l/min	kW	l/min	kW
PFEA-31010	10,5	160	800-2400	15	0,2	12	5	-	-
PFEA-31016	16,5	210 bar	800-2800	23	0,5	19	5	16	8,3
PFEA-31022	21,6			30	0,6	26	7	23	10,8
PFEA-31028	28,1			40	0,8	36	10	33	14
PFEA-31036	35,6			51	1	46	12,5	43	17,8
PFEA-31044	43,7		800-2500	63	1,3	58	15,5	55	22
PFEA-41029	29,3			41	0,8	37	10	34	14,7
PFEA-41037	36,6			52	1	48	12,5	45	18,3
PFEA-41045	45,0			64	1,3	60	16	57	22,6
PFEA-41056	55,8			80	1,6	75	21	72	28
PFEA-41070	69,9			101	2	95	26	91	35
PFEA-41085	85,3		800-2000	124	2,4	118	32	114	43
PFEA-51090	90,0		800-2200	128	2,7	119	33	114	45
PFEA-51110	109,6			157	3,2	147	40	141	55
PFEA-51129	129,2			186	3,7	174	47	168	65
PFEA-51150	150,2		800-1800	215	4,2	204	55	197	75

(1) Max pressure is 160 bar for /PE version and water glycol fluid
(2) Max speed is 1800 rpm for /PE versions; 1500 rpm for water glycol fluid
(3) Flow rate and power consumption are proportional to the rotation speed

4 OPERATING CHARACTERISTICS of PFEA - 32, 42, 52 at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

Model	Displacement cm³/rev	Max pressure (1)	Speed range rpm (2)	7 bar (3)		140 bar (3)		at max. pressure (3)	
				l/min	kW	l/min	kW	l/min	kW
PFEA-32016	16,5	210 bar	1000-2500	23	0,35	20	6	16	10
PFEA-32022	21,6	300 bar	1200-2500	30	0,6	26	7	20	16
PFEA-32028	28,1			40	0,8	36	10	30	20
PFEA-32036	35,6			51	1	46	12,5	40	26
PFEA-42045	45	280 bar	1000-2200	64	1,3	60	16	56	31
PFEA-42056	55,8			80	1,6	75	21	70	40
PFEA-42070	69,9	250 bar		101	2	95	26	90	42
PFEA-42085	85,3	210 bar	800-2000	124	2,4	118	32	114	43
PFEA-52090	90	250 bar	1000-2000	128	2,7	119	33	111	54
PFEA-52110	109,6			157	3,2	147	40	138	66
PFEA-52129	129,2			186	3,7	174	47	163	78
PFEA-52150	150,2	210 bar	800-1800	215	4,2	204	55	197	80

(1) Max pressure is 160 bar for /PE version and water glycol fluid
(2) Max speed is 1800 rpm for /PE versions; 1500 rpm for water glycol fluid
(3) Flow rate and power consumption are proportional to the rotation speed

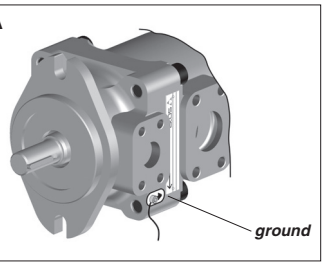
5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		15÷100 mm²/s - max start-up viscosity = 1000 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 19/17/14 NAS1638 class 8		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR	HFC	

6 CERTIFICATION MAIN DATA

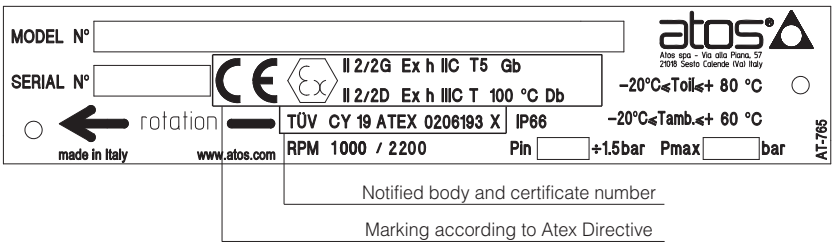
Certification	**ATEX**	
Protection mode	Ex II 2/2G Ex h IIC T5, T4 Gb, Ex II 2/2D Ex h IIIC T100°C, T135°C Db	
Type examination certificate	TUV CY 19 ATEX 026182X	
Pump version	(**std** and **/PE**)	**/7 /PE**
Temperature class	T6	T5
Surface temperature	≤ 85 °C	≤ 100 °C
Ambient temperature	-20 ÷ +60 °C	-20 ÷ +70 °C
Max inlet fluid temperature	+60 °C	+80 °C
Protection degree	IP 66	

PFEA



6.1 EXAMPLE OF PFEA NAMEPLATE MARKING

At side are resumed the pumps marking according to Atex certification



Ex = Equipment for explosive atmospheres
II = Group II for surfaces plants
2/2 = Pump category
G = For gas and vapours
D = For dust
h = Marking includes one on more of the following types of protection ("c", "b", "k")
IIC = Gas group (acetylene, hydrogen)
IIIC = Conduictive dust
T* = Temperature class (T6, T5)
T°C** = Max surface temperature (85, 100)
Zone 1 (gas) **and 21** (dust) = Possibility of explosive atmosphere during normal functioning
Zone 2 (gas) **and 22** (dust) = Low probability of explosive atmosphere

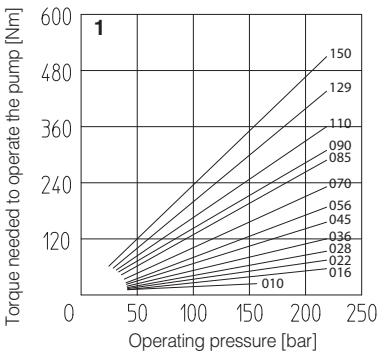
6.2 Related documentation

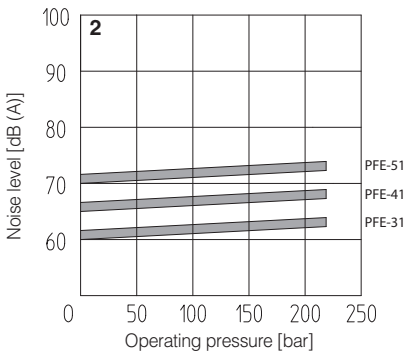
X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
AX900	Operating and maintenance information for ex-proof pumps

7 **DIAGRAMS** for PFEA -31, 41, 51 (Fbased on mineral oil ISO VG 46 at 50°C)

1 = Torque versus pressure diagram

2 = Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm.

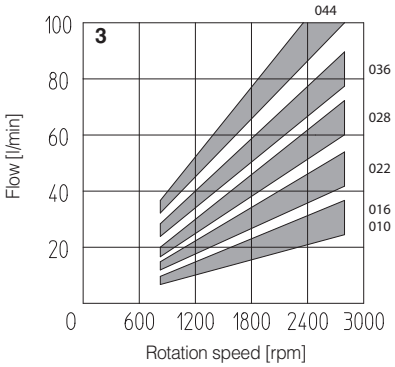


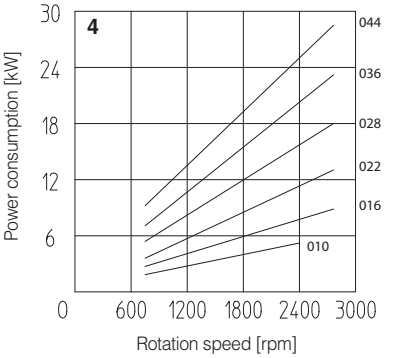


PFE-31:

3 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

4 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

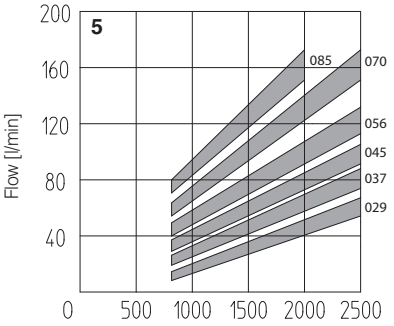


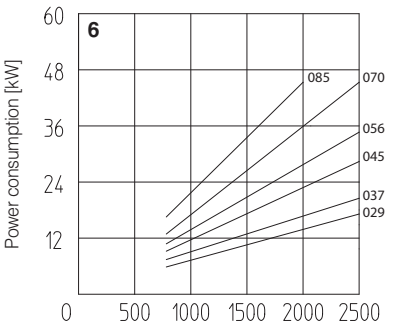


PFE-41:

5 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

6 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

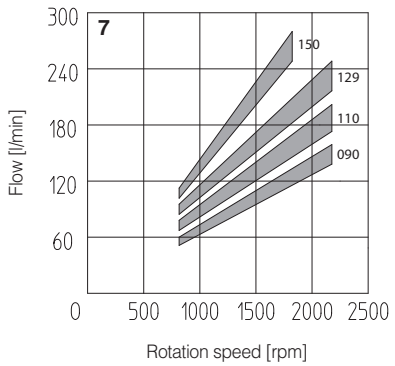


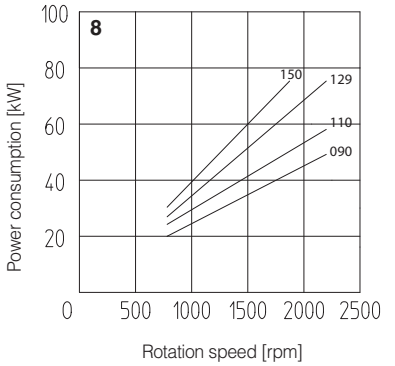


PFE-51:

7 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

8 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

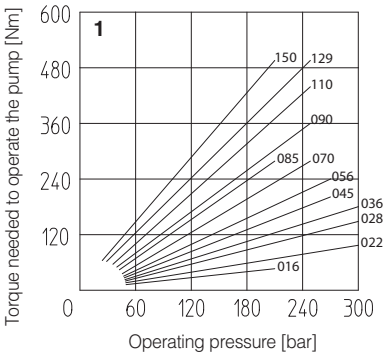


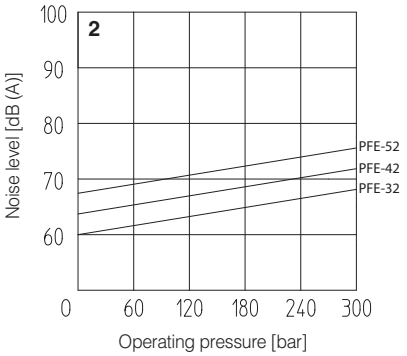


8 **DIAGRAMS** for PFEA -32, 42, 52 (based on mineral oil ISO VG 46 at 50°C)

1 = Torque versus pressure diagram

2 = Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm.

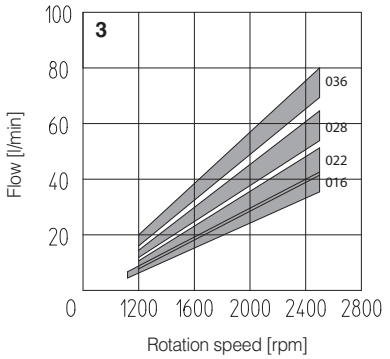


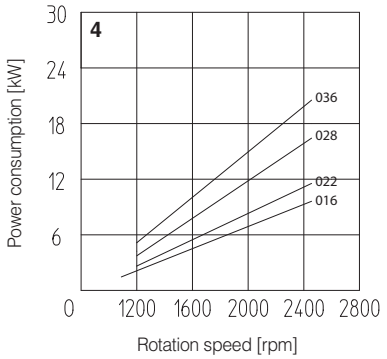


PFE-32:

3 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

4 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

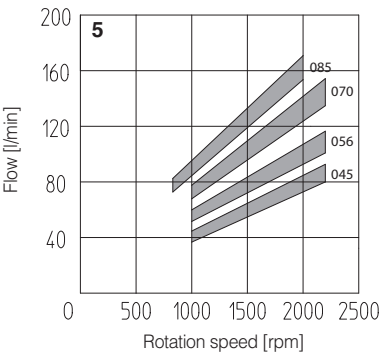


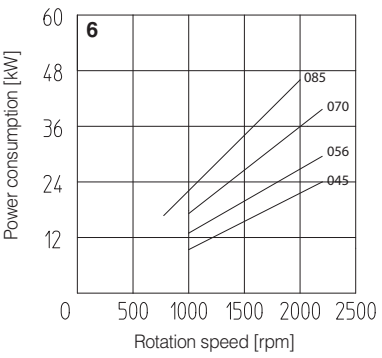


PFE-42:

5 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

6 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

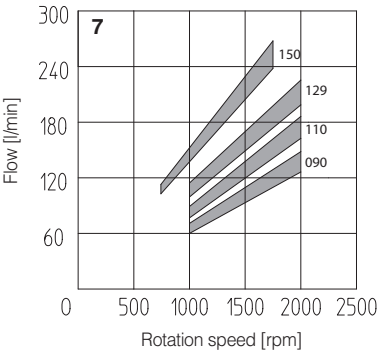


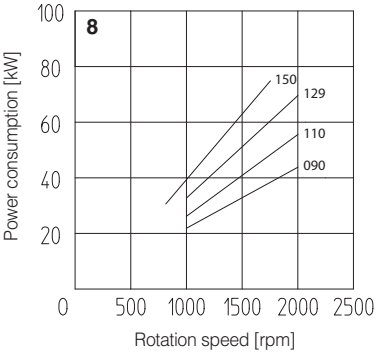


PFE-52:

7 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

8 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.



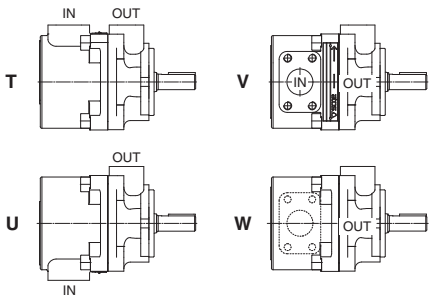


9 PORT ORIENTATION

Single pumps can be supplied with oil ports oriented in different configuration in relation to the drive shaft, as follows (wiewed from the shaft end);

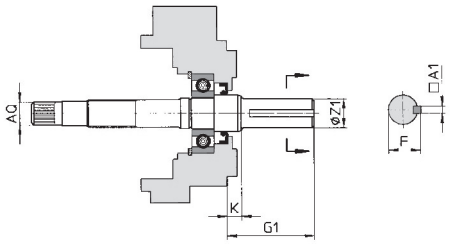
T = inlet and outlet ports on the same axis (standard)
U = outlet orientated 180° with respect to the inlet
V = outlet oriented 90° with respect to the inlet
W = outlet oriented 270° with respect to the inlet

In multiple pumps inlet ports and outlet ports are in line.
Ports orientation can be easily changed by rotating the pump body that carries inlet port.



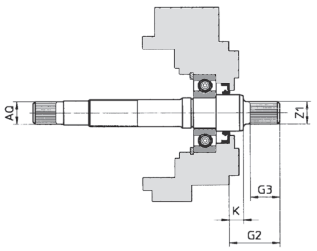
10 DRIVE SHAFT

CYLINDRICAL SHAFT KEYED



PFEA Model	PFEA - 31,41,51						PFEA - 41,51						ALL VERSIONS					
	Keyed shaft type 1 (only PFEA - 31,41,51)						Keyed shaft type 2 (only PFEA - 41,51)						Keyed shaft type 3					
	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ
31,32	4,78	21,11	56,00	8,00	19,05	SAE 16/32-9T	–	–	–	–	–	–	4,78	24,54	56,00	8,00	22,22	SAE 16/32-9T
	4,75	20,94			19,00								4,75	24,41			22,20	
41,42	4,78	24,54	59,00	11,40	22,22	SAE 32/64-24T	6,36	25,03	71,00	8,00	22,22	SAE 32/64-24T	6,38	28,30	78,00	11,40	25,38	SAE 32/64-24T
	4,75	24,41			22,20		6,35	24,77			22,20		6,35	28,10			25,36	
51,52	7,97	35,33	73,00	14	31,75	SAE 16/32-13T	7,95	35,33	84,00	8,10	31,75	SAE 16/32-13T	7,97	38,58	84,00	14	34,90	SAE 16/32-13T
	7,94	35,07			31,70		7,94	35,07			31,70		7,94	38,46			34,88	

SPLINED SHAFT



PFEA Model	Splined shaft type 5					Splined shaft type 6					Splined shaft type 7				
	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ
31,32	32,00	19,50	6,50	SAE 16/32-9T	SAE 16/32-9T	41,00	28	8,00	SAE 16/32-13T	SAE 16/32-9T	32,00	19	8,00	SAE 16/32-13T	SAE 16/32-9T
41,42	41,25	28	8,00	SAE 16/32-13T	SAE 32/64-24T	55,60	42	8,00	SAE 12/24-14T	SAE 32/64-24T	41,60	28	8,00	SAE 12/24-14T	SAE 32/64-24T
51,52	56,00	42	8,10	SAE 12/24-14T	SAE 16/32-13T	–	–	–	–	–	–	–	–	–	–

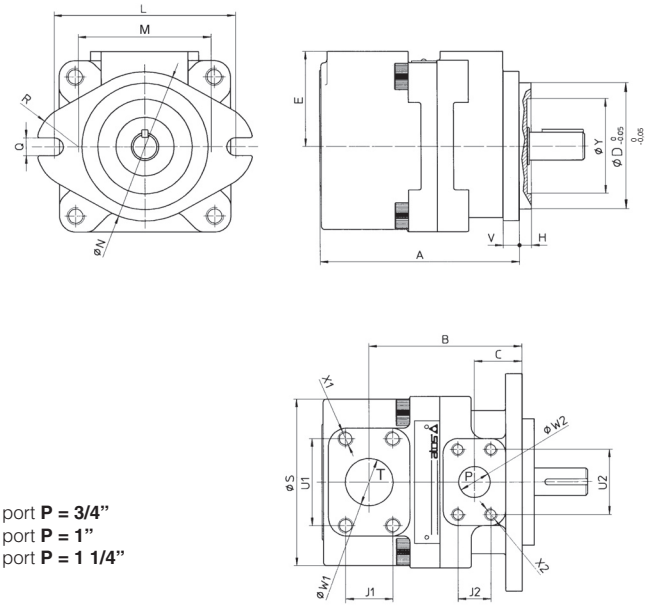
11 LIMITS OF SHAFT TORQUE

PFEA Model	Maximum driving torque [Nm]						Maximum torque available at the end of the through shaft [Nm]
	Shaft type 1	Shaft type 2	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7	Any type of shaft
31,32	160	–	240	110	240	240	130
41,42	250	250	400	200	400	400	250
-51,52	500	500	850	450	–	–	400

The values of torque required to operate the pumps are shown for each type on the “torque versus pressure” diagram at section 4.
In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

12 DIMENSIONS OF PFEA - 31, 41, 51 SINGLE PUMPS [mm]

T = inlet port
P = outlet port



SAE FLANGES
PFEA-31: port **T = 1 1/4”**; port **P = 3/4”**
PFEA-41: port **T = 1 1/2”**; port **P = 1”**
PFEA-51: port **T = 2**; port **P = 1 1/4”**

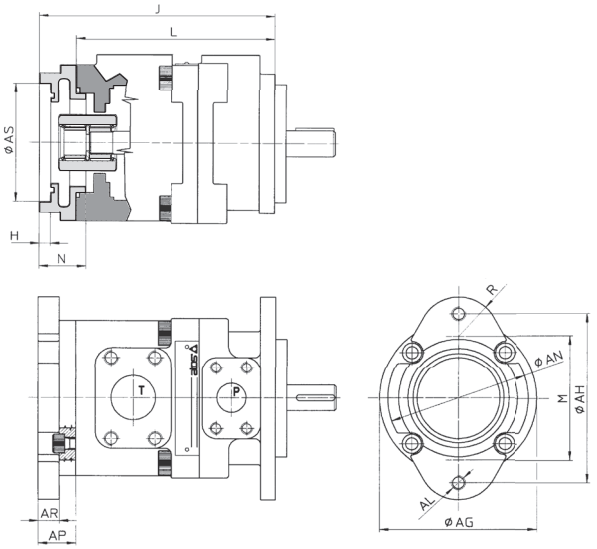
Mass:
PFE-31 = 9 kg
PFE-41 = 14 kg
PFE-51 = 25,5 kg

SAE flanges can be supplied with the pump

Model	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFEA-31	136	100	28	82,55	70	6,4	106	73	95	11,1	28,5
PFEA-41	160	120	38	101,6	76,2	9,7	146	107	120	14,3	34
PFEA-51	186,5	125	38	127	82,6	12,7	181	143,5	148	17,5	35
Model	**ØS**	**U1**	**U2**	**V**	**ØW1**	**ØW2**	**J1**	**J2**	**X1**	**X2**	**ØY**
PFEA-31	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFEA-41	134	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFEA-51	160	77,8	58	15	51	32	42,9	30,2	M12X20	M10X20	76

13 DIMENSIONS OF PFEA-31, 41, 51 WITH THROUGH-SHAFT [mm]

T = inlet port
P = outlet port



SAE FLANGES
PFEAX-31: port **T = 1 1/4”**; port **P = 3/4”**
PFEAX-41: port **T = 1 1/2”**; port **P = 1”**
PFEAX-51: port **T = 2**; port **P = 1 1/4”**

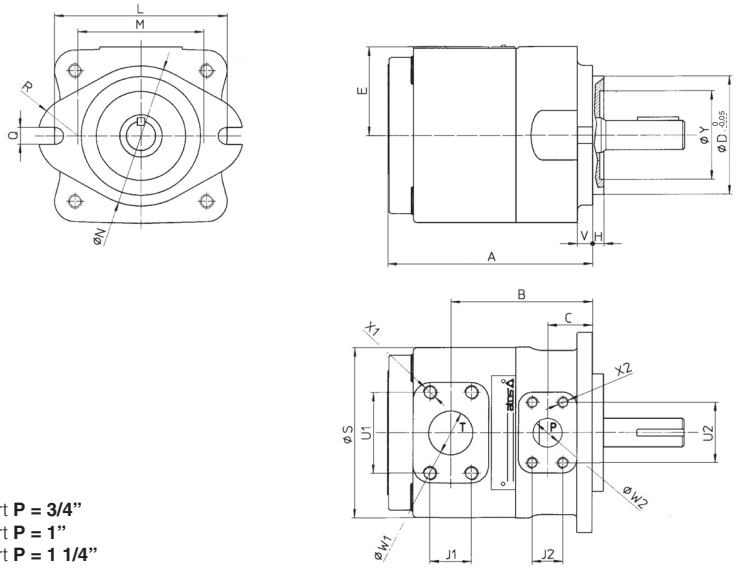
For other dimensions, see section 8

Model	Ø AG	Ø AH	AL	Tightening torque (Nm)(1)	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEXA-31	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	165,5	132,5	79	32	28,5
PFEXA-41	134	106	M10X17	70	95	23	11	82,57 82,63	6,42 6,47	194	171	73	32	28,5
PFEXB-41	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	41	34
PFEXA-51	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	32	28,5
PFEXB-51	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	41	34
PFEXC-51	134	181	M16	300	148	46,5	30,7	127,02 127,02	12,73 12,78	230	183,5	143,5	56	35

(1) Tightening torque for screw class 12.9

14 DIMENSIONS OF PFEA -32, 42, 52 SINGLE PUMPS [mm]

T = inlet port
P = outlet port



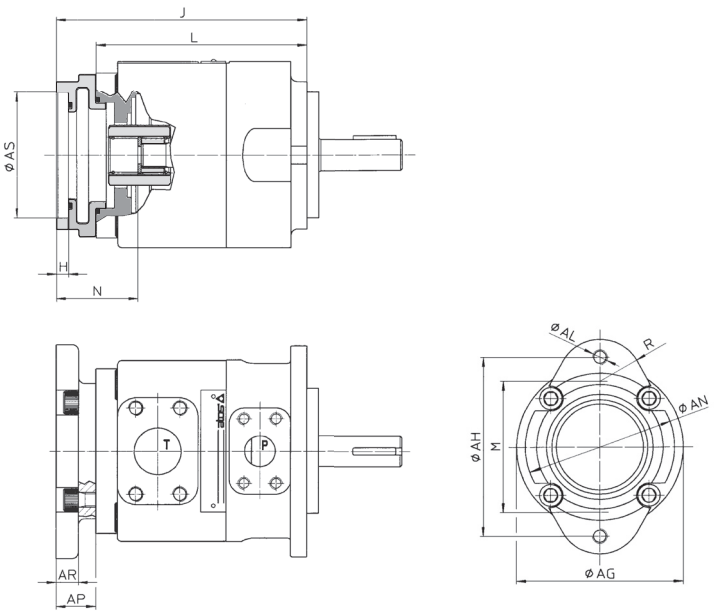
SAE FLANGES
PFEA-32: port **T = 1 1/4"**; port **P = 3/4"**
PFEA-42: port **T = 1 1/2"**; port **P = 1"**
PFEA-52: port **T = 2**; port **P = 1 1/4"**

Mass:
PFE-32 = 9 kg
PFE-42 = 20,5 kg
PFE-52 = 32,1 kg

Model	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFEA-32	136	100	28	82,5	70	6,4	106	73	95	11	28,5
PFEA-42	175,5	121	38	101,6	78	9,7	146	107	121	14,3	34
PFEA-52	189	125	38	127	89	12,7	181	143,5	148	17,5	35
Model	**ØS**	**U1**	**U2**	**V**	**ØW1**	**ØW2**	**J1**	**J2**	**X1**	**X2**	**ØY**
PFEA-32	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFEA-42	148	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFEA-52	174	77,8	58,7	16,3	50	50	42,9	30,2	M12X20	M10X20	76

15 DIMENSIONS OF PFEA - 32, 42, 52 WITH THROUGH-SHAFT [mm]

T = inlet port
P = outlet port



SAE FLANGES
PFEAX-32: port **T = 1 1/4"**; port **P = 3/4"**
PFEAX-42: port **T = 1 1/2"**; port **P = 1"**
PFEAX-52: port **T = 2**; port **P = 1 1/4"**

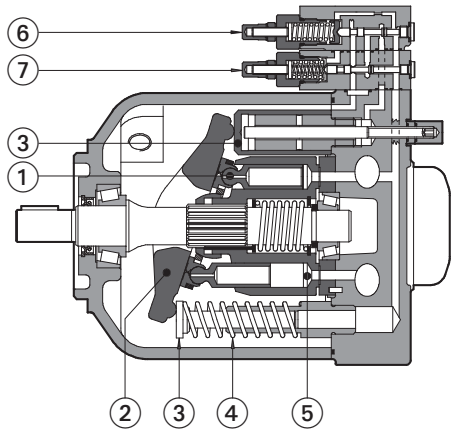
For other dimensions, see section 8

Model	Ø AG	Ø AH	AL	Tightening torque (Nm)(1)	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEXA-32	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	193,7	132,5	79	32	28,5
PFEXA-42	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	194	171	73	34	28,5
PFEXB-42	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	43	34
PFEXA-52	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	34,5	28,5
PFEXB-52	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	43,8	34
PFEXC-52	134	181	M16	300	148	46,7	30,7	127,02 127,02	12,73 12,78	230,2	183,5	143,5	58,5	35

(1) Tightening torque for screw class 12.9

Ex-proof axial piston pumps type PVPCA

for potentially explosive atmospheres - **ATEX**



① pumping piston
② swashing plate
③ servo piston
④ spring
⑤ rotation barrel
⑥ pressure compensator
⑦ flow regulator

PVPCA-L-4046

PVPCA are variable displacement axial piston pumps for high pressure operation, and low noise level, available in a wide range of hydraulic and proportional controls.

They are certified for application in potentially explosive atmospheres according to ATEX 2014/34/EU, protection mode Ex II 2/2G Ex h IIC T5, T4 Gb, and Ex II 2/2D Ex h IIIC T100°C, T135°C Db (group II for surface plants with gas, vapours and dust environment, category 2, zone 1, 2, 21 and 22).

The external surface temperature of the pump is in accordance with the certified class, to avoid the self ignition of the explosive mixture present in the environment.

Displacement: **29**-**46**-**73**-**88** cm³/rev.
Pressure: **280 bar working**
350 bar peak

1 MODEL CODE

PVPCA	XA	-	C	-	4	046	/	31044	/	1	D	-	GK	/	7	24DC	*	/	*

Variable displacement vane pump with ex-proof certification

Additional suffix for pumps with through shaft, for coupling with 2nd pump type PFEA:
XA =for coupling with PFEA-3* (only for PVPCA*-3*)
XB =for coupling with PFEA-4* (only for PVPCA*-4*)
XC =for coupling with PFEA-5* (only for PVPCA*-5*)

Type of control **(1)**:
C = manual pressure compensator
CH= manual pressure compensator with venting
R = remote pressure compensator
L = load sensing (pressure & flow)
LW= constant power (combined pressure & flow)
For proportional controls see note (2)

Size:
3 = for displacement 029
4 = for displacement 046
5 = for displacement 073 and 090

Max displacement of axial piston pump:
029 = 29 cm³/rev
046 = 46 cm³/rev
073 = 73 cm³/rev
090 = 88 cm³/rev

Type of PVPCA (for double pumps), see tech table A160

Shaft (SAE Standard):
1 = keyed (7/8" for 029 - 1" for 046 - 1 1/4" for 073 and 090)
5 = splined (13 teeth for 029 - 15 for 046 - 14 for 073 and 090)

Direction of rotation (viewed at the shaft end):
D = clockwise
S = counterclockwise

Solenoid threaded connection (only for CH control):
GK = GK-1/2" ISO/UNI-6125 (tapered)
NPT= 1/2" NPT ANSI B2.1 (tapered)
M = M20x1,5 UNI-4535

Option:
7 = for ambient temperature up to 70°C **(3)**
Only for CH control:
O = horizontal cable entrance
WP = prolongued manual override protected by metallic cap

Voltage code, only for CH: see tech table EX010

Series number

Seals material: omit for NBR (mineral oil & water glycol)
PE = FKM **(3)**

(1) Pumps CH, CZ, LQZ, PES and PERS are supplied with two certificates, one for the pump, and one for control valve

(2) Pumps with proportional controls type: CZ, LQZ, PES and PERS are available on request.
For the technical characteristics of PVPCA pumps with proportional controls, see tech table AS170

(3) Pumps with option **/7** are always equipped with seals FKM

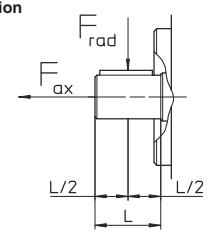
2 GENERAL CHARACTERISTICS

Assembly position	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line lenght is 3 m.
Ambient temperature range	-20°C to +70°C
Compliance	Explosion proof protection "Ex h", see section 6 RoHs Directive 2011/65/EU as last update by 2015/65/EU (only PVPCA-CH) REACH Regulation (EC) n°1907/2006

3 OPERATING CHARACTERISTICS

Pump model		PVPCA*-3029	PVPCA*-4046	PVPCA*-5073	PVPCA*-5090
Displacement	[cm³/rev]	29	46	73	88
Theoretical max flow at 1450 rpm	[l/min]	42	66,7	105,8	127,6
Max working pressure / Peak pressure	[bar]	280/350	280/350	280/350	250/315
Min/Max inlet pressure	[bar abs.]	0,8 / 25	0,8 / 25	0,8 / 25	0,8 / 25
Max pressure on drain port	[bar abs.]	1,5	1,5	1,5	1,5
Power consumption at 1450 rpm and at maximum pressure and displacement	[kW]	19,9	31,6	50,1	54,1
Max torque on the first shaft	[Nm]	Type 1 210 / Type 5 270	Type 1 350 / Type 5 440	Type 1 670 / Type 5 810	Type 1 670 / Type 5 810
Max permissible load on drive shaft	[N] F_{ax}	1000	1500	2000	2000
	[N] F_{rad}	1500	1500	3000	3000
Speed rating	[rpm]	500 ÷ 3000	500 ÷ 2600	500 ÷ 2600	500 ÷ 2200

External load position



F_{ax} = axial load
F_{rad} = radial load

Notes: For speeds over 1800 rpm the inlet port must be under oil level with adequate pipes.
Maximum pressure for all models with water glycol fluid is 160 bar, with option /PE is 190 bar.
Max speed with options /PE and for water glycol fluid is 2000/1900/1600/1500 rpm respectively for the four sizes.

4 ELECTRICAL CHARACTERISTICS FOR VERSION CH

Valve type	DHA
Voltage code **(1)** V_{DC} ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**
Voltage code **(1)** VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C	8W
Coil insulation	class H
Protection degree with relevant cable gland	IP66/67 to DIN EN60529
Duty factor	100%

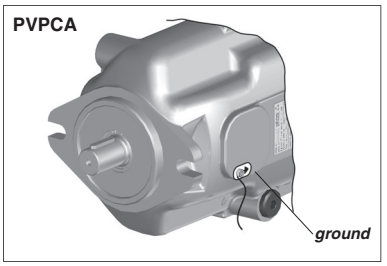
(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max start-up viscosity = 1000 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 20/18/15 NAS1638 class 9	see also filter section at www.atos.com or KTF catalog	
Max fluid contamination level — longer life	ISO4406 class 18/16/13 NAS1638 class 7		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

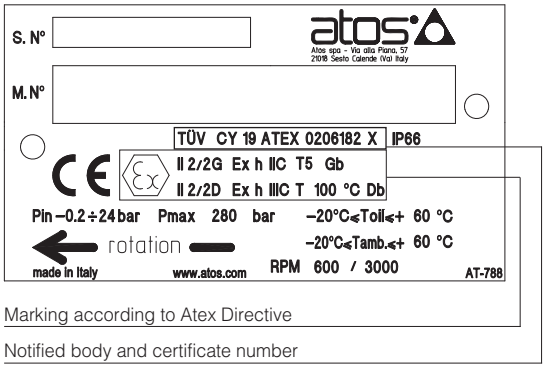
6 CERTIFICATION DATA

Certification	ATEX	
Protection mode	Ex II 2/2G Ex h IIC T5, T4 Gb, Ex II 2/2D Ex h IIIC T100°C, T135°C Db	
Type examination certificate	TUV CY 19 ATEX 026182X	
Pump version	(**std** and **/PE**)	**/7 /PE**
Temperature class	T5	T4
Surface temperature	≤ 100 °C	≤ 135 °C
Ambient temperature	-20 ÷ +60 °C	-20 ÷ +70 °C
Max inlet fluid temperature	+60 °C	+80 °C
Protection degree	IP 66	



6.1 EXAMPLE OF PVPCA NAMEPLATE MARKING

At side are resumed the pumps marking according to Atex certification

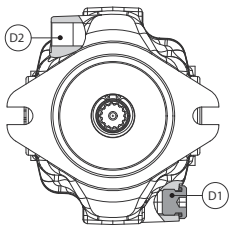


Marking according to Atex Directive

Notified body and certificate number

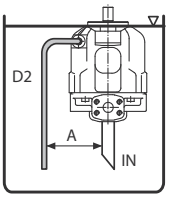
Ex = Equipment for explosive atmospheres
II = Group II for surfaces plants
2/2 = Pump category
G = For gas and vapours
D = For dust
h = Marking includes one on more of the following types of protection ("c", "b", "k")
IIC = Gas group (acetylene, hydrogen)
IIIC = Conduictive dust
T* = Temperature class (T6, T5, T4)
T°C** = Max surface temperature (85, 100, 135)
Zone 1 (gas) **and 21** (dust) = Possibility of explosive atmosphere during normal functioning
Zone 2 (gas) **and 22** (dust) = Low probability of explosive atmosphere

7 INSTALLATION POSITION

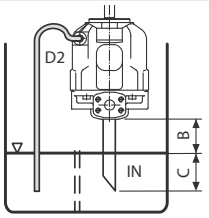


The pump is supplyed whit drain D2 open, and D1 plugged.
Before installation fill the pump with hydraulic oil for at least 3/4 of its volume, keeping it in horizontal position.
With exception of pump mounted below the oil level, we recomend to interpose a baffle plate between inlet and drain line.

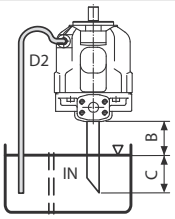
VERTICAL INSTALLATION



INSIDE THE TANK
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm

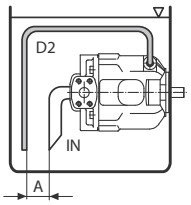


INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm

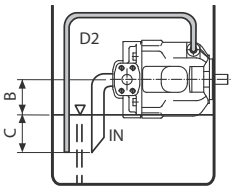


OUTSIDE THE TANK,
above oil level
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm

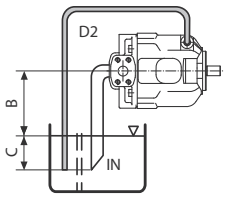
HORIZONTAL INSTALLATION



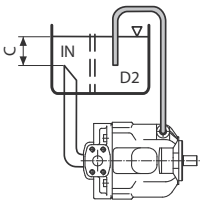
INSIDE THE TANK
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm



INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm



OUTSIDE THE TANK,
above oil level
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm



OUTSIDE THE TANK,
below oil level
C= 200mm

IN: inlet line - **D1:** drain line - **A:** minimum distance between inlet and drain line - **B+C:** permissible suction height - **C:** inlet line immersion dept

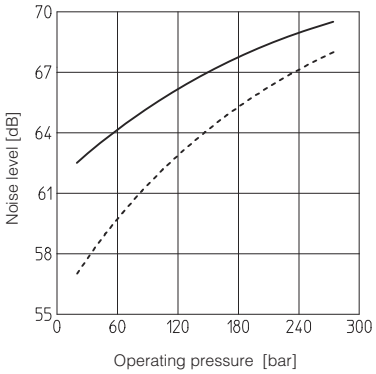
8 DIAGRAMS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

8.1 Noise level curves

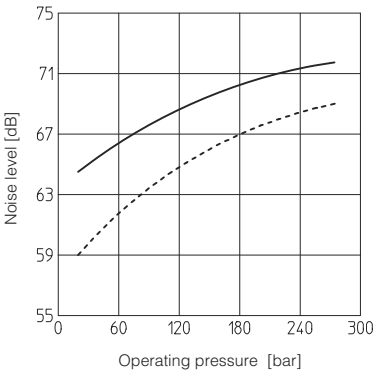
Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm.

—— = Qmax ------ = Qmin

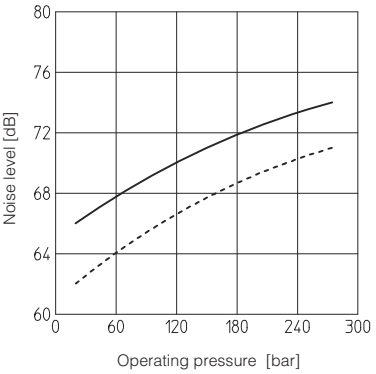
PVPCA-*-3029



PVPCA-*-4046



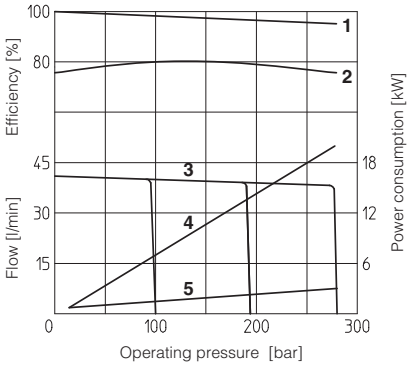
PVPCA-*-5073 and PVPCA-*-5090



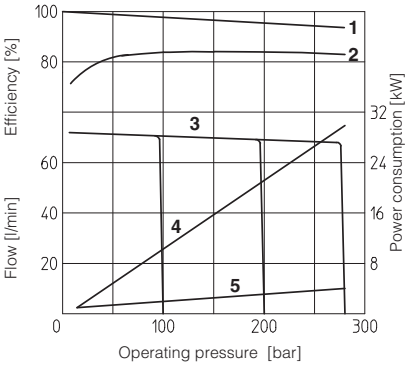
8.2 Operating limits

1 = Volumetric efficiency
2 = Overall efficiency
3 = Flow versus pressure curve
4 = Power consumption with full flow
5 = Power consumption at pressure compensation

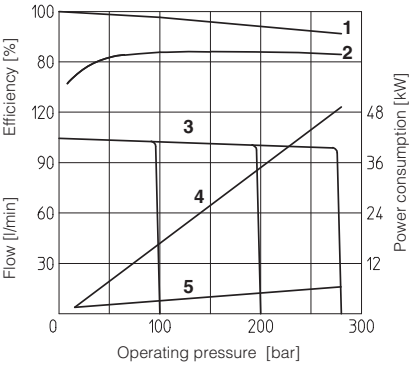
PVPCA-*-3029



PVPCA-*-4046



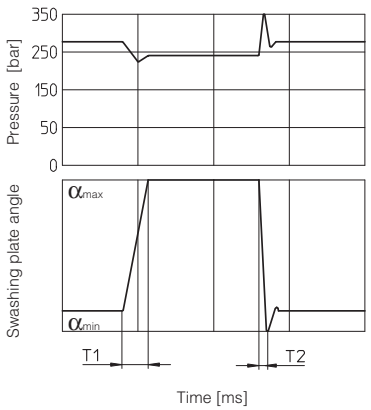
PVPCA-*-5073



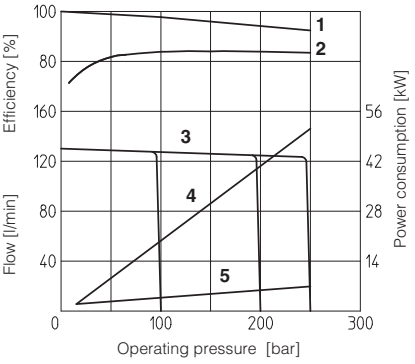
8.3 Response times

8.3.1 Response times and pressure peack due to variation 0% → 100% → 0% of the pump displacement, obtained with an istantaneously opening and shut-off of the delivery line.

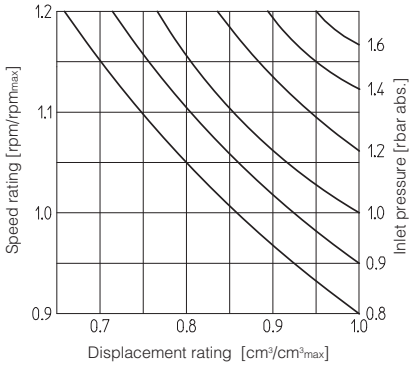
Pump type	**T1** (ms)	**T2** (ms)
PVPCA-*-3029	31	19
PVPCA-*-4046	44	20
PVPCA-*-5073	50	25
PVPCA-*-5090	53	28

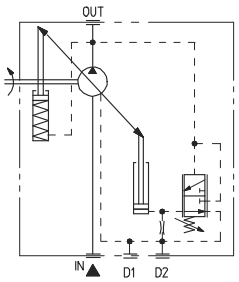


PVPCA-*-5090



8.3.2 Variation of inlet pressure and reduction of displacement with increasing speed rating

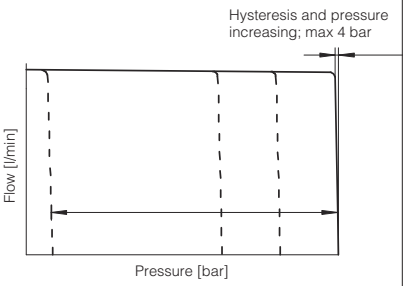


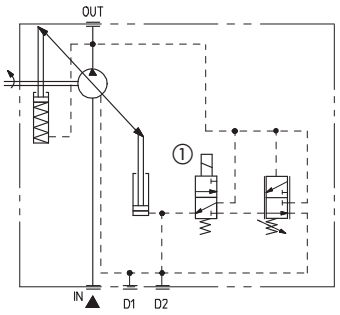


C

Manual pressure compensator

The pump displacement decreases when the line pressure approaches the setting pressure of the compensator. The pump supplies only the fluid required by the system. Pressure may be steplessly adjusted at the pilot valve.
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)



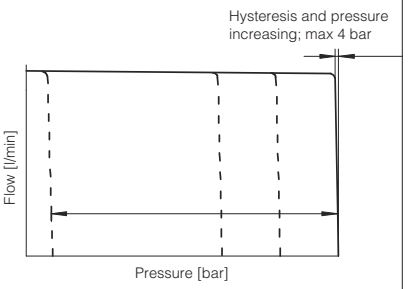


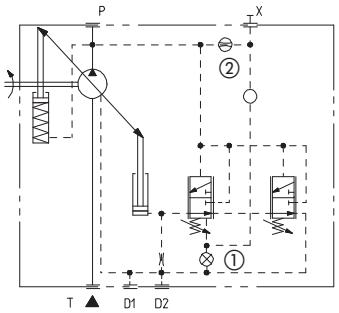
① solenoid venting valve

CH

Manual pressure compensator with venting

As C plus venting function, when a long unloading time is required and heat generation and noise have to be kept at lowest level.
Venting valve solenoid voltage, see section 5
Venting valve OFF = null displacement
Venting valve ON = max displacement
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)

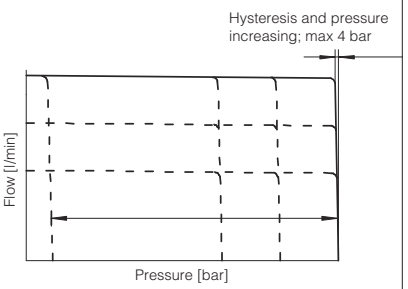


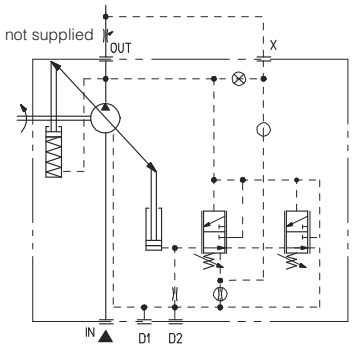


R

Remote pressure compensator

As C, but with remote setting of the compensator by means of a pressure relief valve on the piloting line X.
This version can be obtained from version L using a blind plug UNI 5923 M4x12 in pos. ① and a restrictor M4 drilled ø 0,75 mm in pos. ②.
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)

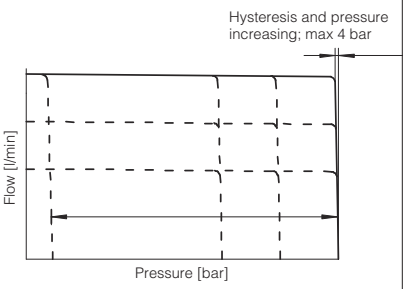


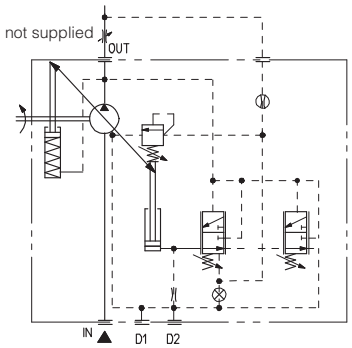


L

Load sensing

The pump displacement is automatically adjusted to maintain a constant (load indipendent) pressure drop across an external throttle. Changing the throttle regulation, the pump flow is consequently adjusted.
Load sensing control always incorporates an hydraulic compensator to limit the maximum pressure.
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)
Differential pressure setting range: 10 ÷ 40 bar
Differential pressure standard setting: 14 bar

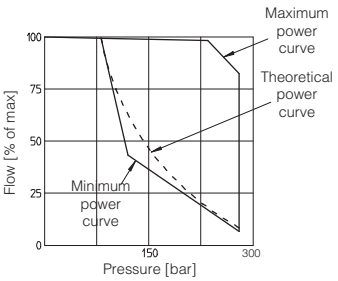




LW

Constant power

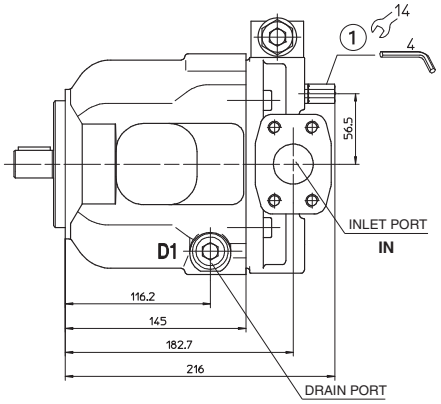
In order to achieve a constant drive torque with varying operating pressure. The swashing angle and therefore the outlet flow is varied so that the product of flow and pressure remains constant.
For the best regulation, minimum working pressure is 80 bar.
While selecting LW control, the required value of power must be communicated with the order (ex. 10 kW at 1450 rpm).

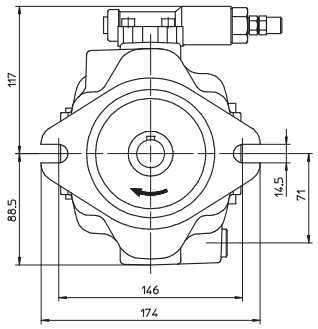


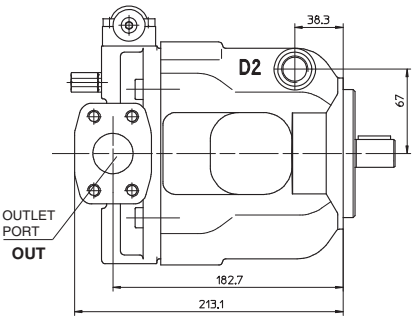
10 DIMENSIONS OF PVPCA-*-3029: BASIC VERSION "C" CONTROL

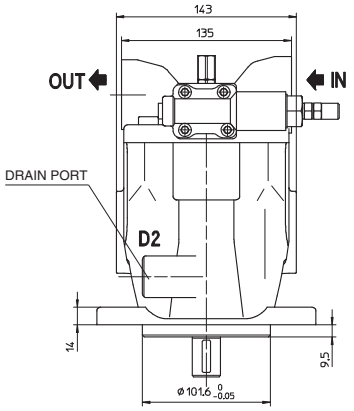
PORTS DIMENSION

IN = Flange SAE 3000 1 1/4"
OUT = Flange SAE 6000 3/4"
D1, D2 = 1/2" BSPP
① = Regulation screw for max displacement 1,5 cm³/rev per turn. Adjustable range 20 to 29 cm³/rev.
In case of double pump the regulation screw is not always available, please contact our technical office.



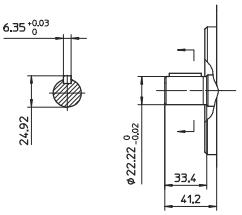




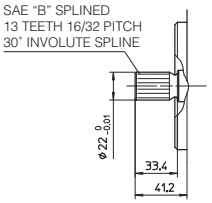


Mass: 18 kg

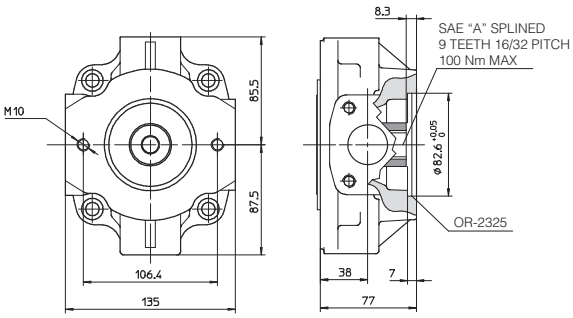
SHAFT TYPE "1"



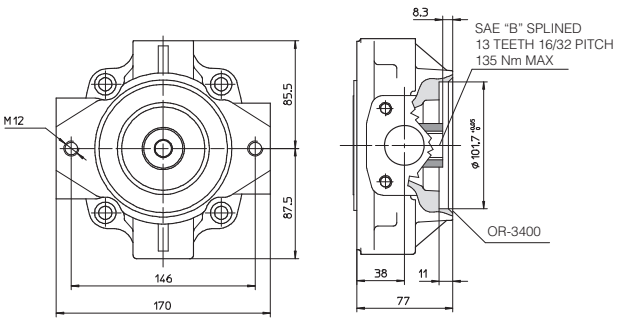
SHAFT TYPE "5"



INTERMEDIATE FLANGE SAE "A" FOR PFEA-31



INTERMEDIATE FLANGE SAE "B" FOR PFEA-41

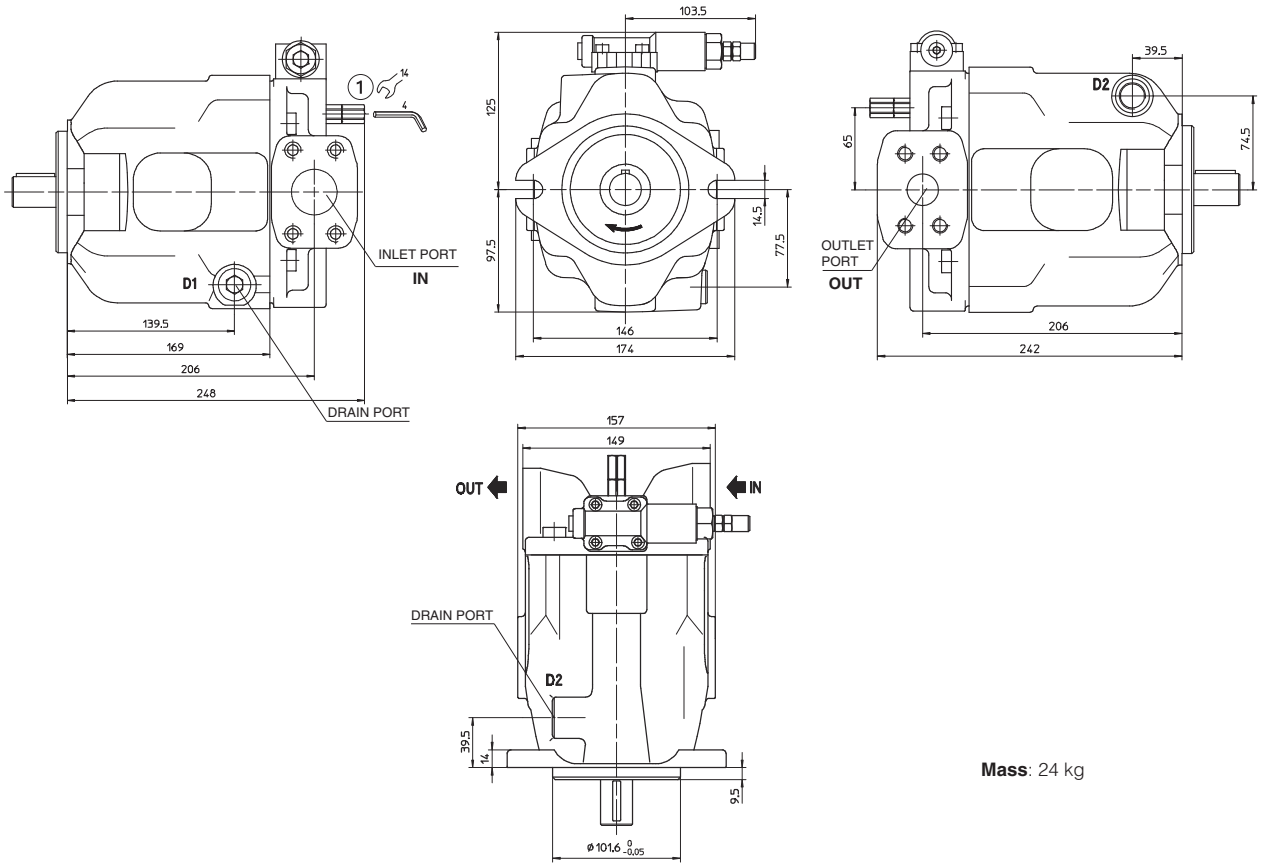


Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

11 DIMENSIONS OF PVPCA-*-4046: BASIC VERSION "C" CONTROL

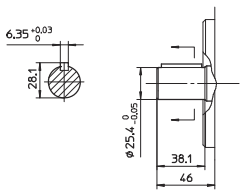
PORTS DIMENSION

IN = Flange SAE 3000 1 1/2"
OUT = Flange SAE 6000 1"
D1, D2 = 1/2" BSPP
① = Regulation screw for max displacement 2,2 cm³/rev per turn. Adjustable range 31,8 to 46 cm³/rev.
In case of double pump the regulation screw is not always available, please contact our technical office.

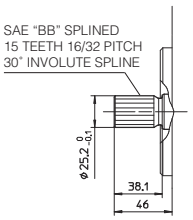


Mass: 24 kg

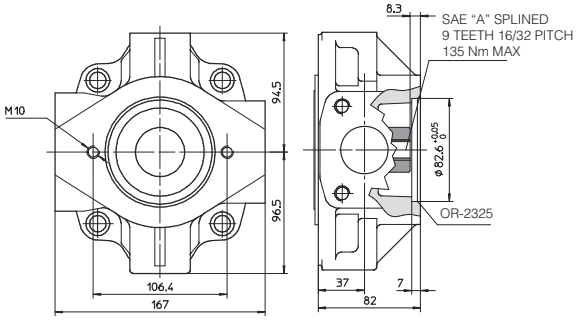
SHAFT TYPE "1"



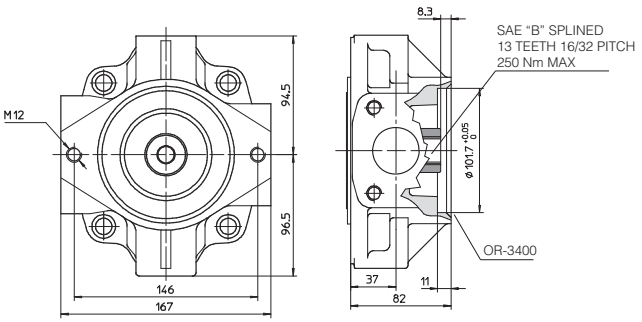
SHAFT TYPE "5"



INTERMEDIATE FLANGE SAE "A" FOR PFEA-31

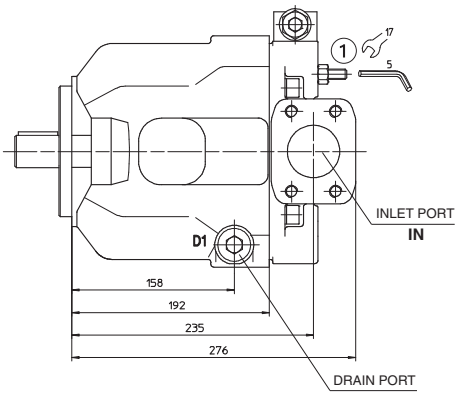


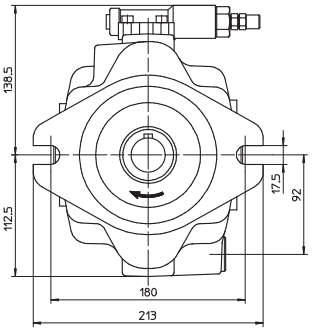
INTERMEDIATE FLANGE SAE "B" FOR PFEA-41

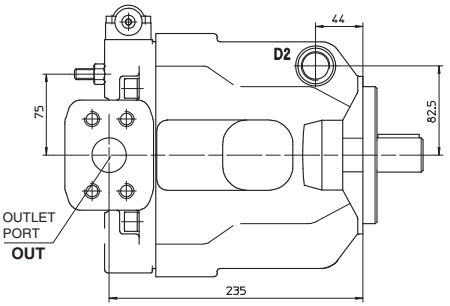


Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

12 DIMENSIONS OF PVPCA-*-5073 and PVPC-*-5090: BASIC VERSION "C" CONTROL

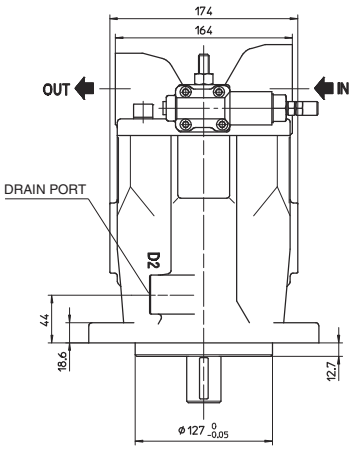






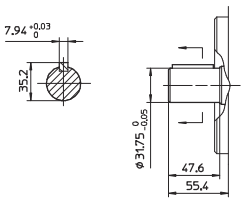
PORTS DIMENSION

IN = Flange SAE 3000 2"
OUT = Flange SAE 6000 1 1/4"
D1, D2 = 3/4" BSPP
① = Regulation screw for max displacement
3,2 cm³/rev per turn.
Adjustable range :
PVPC-5073 = 36,8 to 46 cm³/rev
PVPC-5073 = 44 to 88 cm³/rev.
In case of double pump the regulation screw is not always available, please contact our technical office.

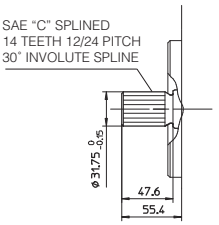


Mass: 33 kg

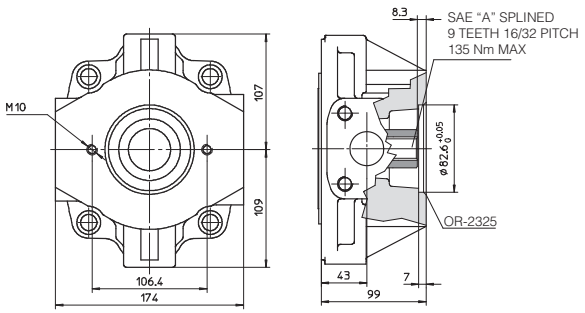
SHAFT TYPE "1"



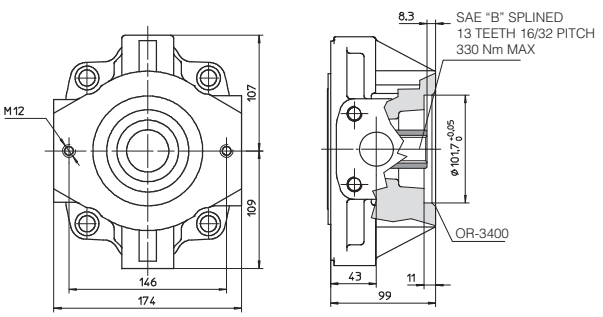
SHAFT TYPE "5"



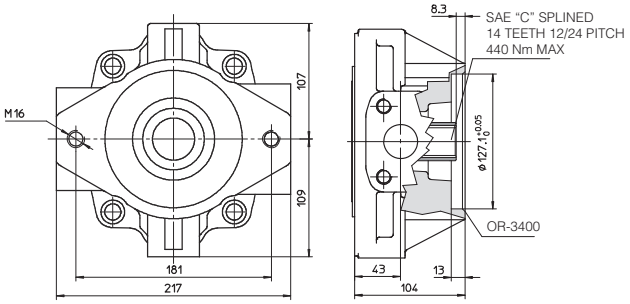
INTERMEDIATE FLANGE SAE "A" FOR PFEA-31



INTERMEDIATE FLANGE SAE "B" FOR PFEA-41



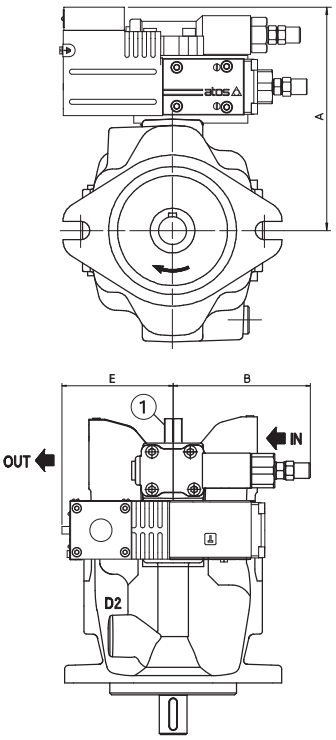
INTERMEDIATE FLANGE SAE "C" FOR PFEA-51



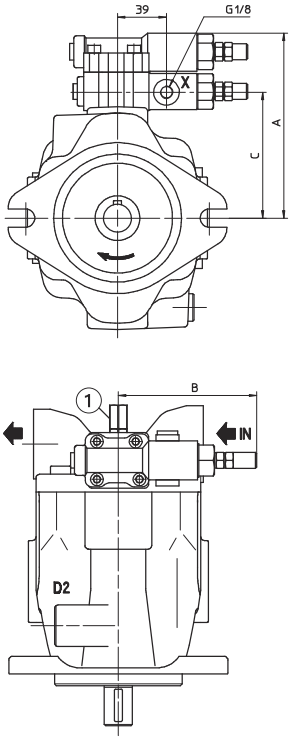
Drawing show pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

13 DIMENSIONS OF PVPCA: OTHER CONTROLS

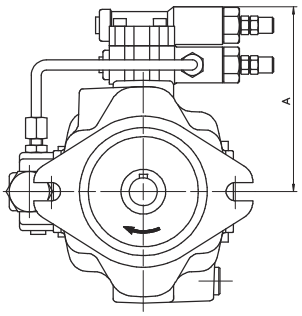
VERSION CH

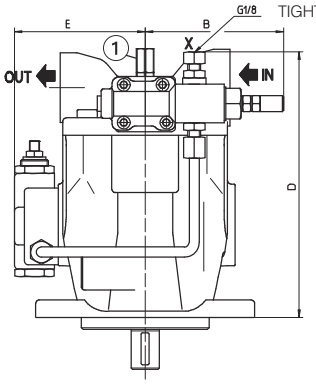


VERSIONS L, R



VERSION LW





① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement).
In case of double pump the regulation screw is not always available, please contact our technical office.

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups

Pump type	Version	A	B	C	D	E	Mass (kg)
PVPCA-*-3029	**CH**	144	111	-	-	92	22
	L -R	144	111	100	-	-	19,2
	LW	144	111	-	211	104	20
PVPCA-*-4046	**CH**	153	111	-	-	92	28
	L -R	153	111	109	-	-	25,2
	LW	153	111	-	235	111	26
PVPCA-*-5073 PVPCA-*-5090	**CH**	166	111	-	-	92	36,9
	L -R	166	111	122	-	-	34,2
	LW	166	111	-	258	120	35

14 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
AX900	Operating and maintenance information for ex-proof pumps

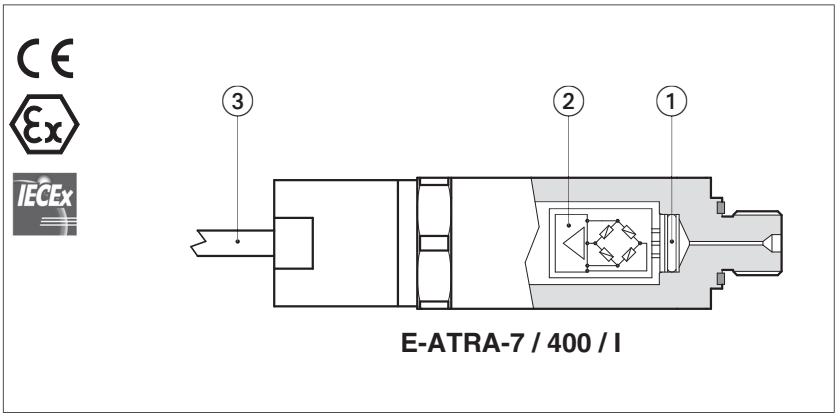
5 ACCESSORIES

INDEX

ACCESSORIES

Ex-proof pressure transducers type E-ATRA-7

analog, for open and closed loop systems - **ATEX** and **IECEx**



E-ATRA-7 / 400 / I

Ex-proof E-ATRA-7 are pressure transducers used to measure the static and dynamic pressure.

The sensor is composed by a thin-film circuit a, with high resistance to overloads and pressure peaks.

The integrated electronic circuit b supplies an amplified voltage or current output signal, proportional to the hydraulic pressure, with thermal drift compensation.

The transducer housing and electronics housing are designed to contain the possible explosion which could be caused by the presence of the gas mixture inside the housing, thus avoiding dangerous propagation in the external environment.

E-ATRA-7 equip ex-proof proportional pressure control valves, RES execution.

They are also used in association with directional proportionals with option SP, SF to perform closed loop pressure controls:

Features:

- Factory preset and calibrated
- 5 m cable connection c
- 1/4" GAS - DIN 3852 hydraulic connection (pressure port orifice Ø 0,6 mm)
- IP67 protection degree
- CE mark according to EMC directive

1 MODEL CODE

E-ATRA-7	/	400	/	I	*
Pressure transducer amplified type for ex-proof applications		**Pressure measuring range:** **60** = 0 ÷ 60 bar **160** = 0 ÷ 160 bar **250** = 0 ÷ 250 bar **400** = 0 ÷ 400 bar		**I** = current output signal 4 ÷ 20 mA **(1)**	Series number

(1) Available only with current output signal 4 ÷ 20 mA

2 EXPLOSION PROOF CERTIFICATION MAIN DATA

ATEX certification **IECEx certification**	**II 2G Ex db IIC T6...T1 Gb** **Ex db IIC T6...T1 Gb**		
Temperature class (only for Group II)	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature	-40 ÷ +60 °C	-40 ÷ +75 °C	-40 ÷ +102 °C
Mechanical construction	Flame proof housing classified Ex d, according to EN 60079-0: EN 60079-1		
Electrical connection	Type: 5 m cable 2 wires + shield		
Special features	Available on request with FM, CSA, EAC, INMETRO and KAZINMETR certification For further details, please contact Atos technical department		

3 MAIN CHARACTERISTICS OF EX-PROOF PRESSURE TRANSDUCER

Pressure measuring range	0 ÷ 60/160/250/400 bar; other values availables on request Note: negative pressure can damage the pressure transducer
Overload pressure	2 x FS without exceeding 600 bar
Burst pressure	5 x FS without exceeding 1700 bar
Response time	≤ 1 ms
Temperature compensated	0 ÷ +80 °C
Thermal drift	@ zero: ≤ ±0,025 % FS/°C max; @ FS: ≤ ±0,025 % FS/°C max
Accuracy	≤ ±0,5 % FS
Non-Linearity	≤ ±0,2 % of FS (BFSL) as per IEC 61298-2
Fluid Compatibility	Hydraulic oil as per DIN51524...535 for other fluid please contact Atos technical department
Power supply	24 VDC nominal; maximum range 10 ÷ 30 V_{DC}
Output signal	Current output signal 4 ÷ 20 mA (2 wire); for max load see section 5
Wiring protections	Against reverse polarity on power supply and short-circuit on output signal
Materials	Wetted parts: stainless steel and Elgiloy®; seals: FPM
Mass	Approx. 240 g
Electromagnetic compatibility (EMC)	EN 61326 emission (group 1, class B) and immunity (industrial application)
Vibration resistance	20 g according to DIN EN 60068-2-6
Shock resistance	1000 g according to DIN EN 60068-2-27
Protection class	IP67

Notes: FS = Full Scale; **BFSL** = Best Fit Straight Line

4 INSTALLATION AND COMMISSIONING

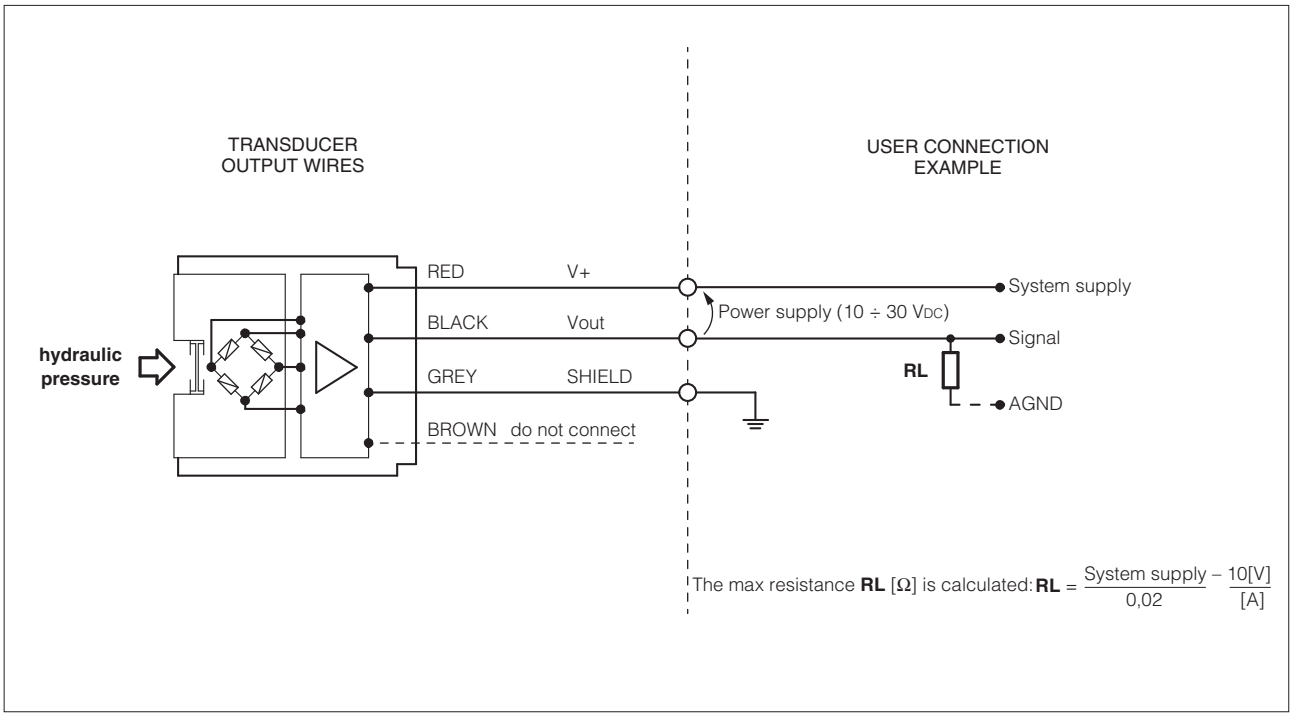
4.1 Warning

E-ATRA-7 transducers have to be installed as near as possible to the point where the pressure have to be measured, taking care that the oil flow is not turbulent.

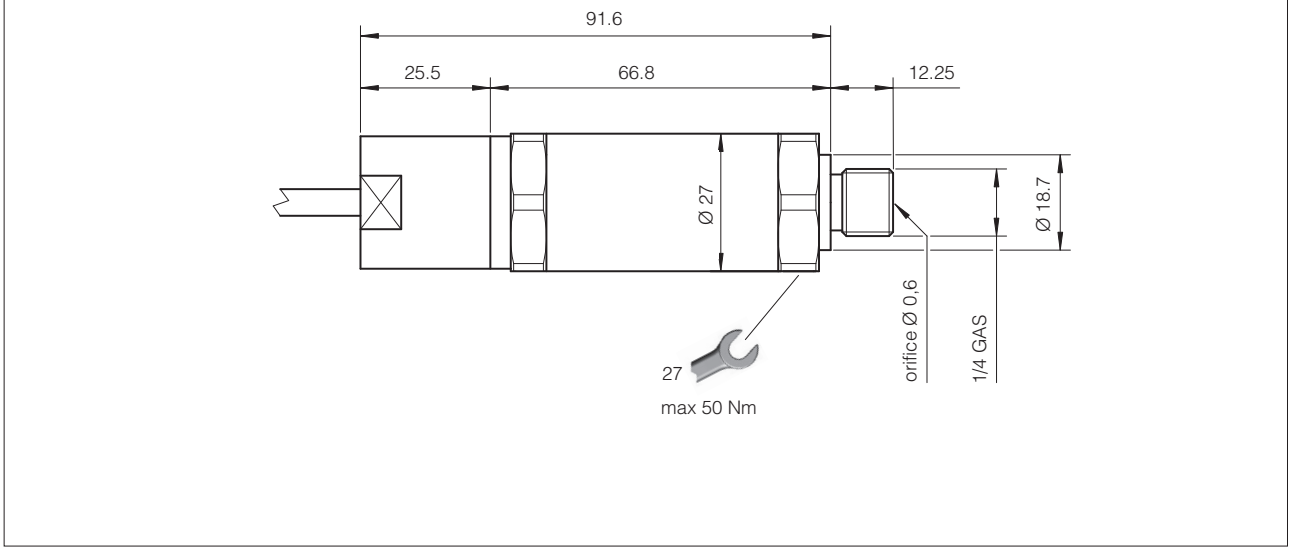
4.2 Commissioning

Install the transducer in the hydraulic circuit.
Switch-off the power supply before connecting and disconnecting the transducer cable as shown in scheme 5 .

5 ELECTRONIC CONNECTIONS



6 OVERALL DIMENSIONS [mm]



Mounting subplates type BA

single, for ISO valves size 06 to 32

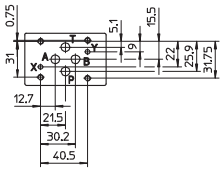
BA-* are single subplates with ISO mounting surface for installation of Atos valves and they are provided with threaded ports for connectios to pressure, tank and users lines. They are characterized by low pressure drops and they are specific for directional, flow and pressure control valves ISO size 06, 10, 16, 20, 25 and 32;
Special subplates or manifolds for customized applications are available upon request.
The set of screws for the valve installation on the BA subplate must be ordered separately, see the code SET SC-* specified in the following sections.

1 TECHNICAL CHARACTERISTICS

Installation position	Any position
Operating pressure	Ports P, T, A, B = **350 bar** see the technical table of the valves to be assembled
Ambient temperature	From -20°C to +70°C
Fluid	Hydraulic oil as per DIN 51524...535, for other fluids contact our technical office
Recommended viscosity	15 ÷ 100 mm^2/s - max allowed range: see the technical table of the valves to be assembled
Fluid contamination class	See the technical table of the valves to be assembled
Fluid temperature	See the technical table of the valves to be assembled

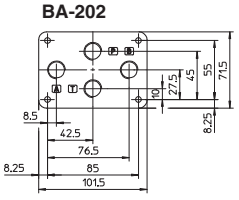
2 SINGLE STATION SUBPLATES FOR VALVES SIZE 06

ISO 4401:2005
Mounting surface: 4401-03-03-0-05

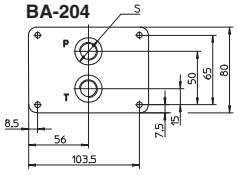


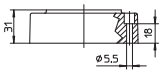
Matching valves	**Set of screw** (to be ordered separately)
DH-00	SET SC-DHZ
DH-01	SET SC-DHZ
DH-02	SET SC-DHZ
DH-04	SET SC-DHZ
DH-05	SET SC-DHZ
DH-08	SET SC-DHZ
DH-09	SET SC-DHZ
DHI, DHE	SET SC-DHZ
DHA, DHW	SET SC-DHZ
DHQ	SET SC-DHZ
DLEH, DLEHM	SET SC-DHZ
DLAH, DLAHM	SET SC-DHZ
DLWH	SET SC-DHZ
QV-06	SET SC-QV
RZMO, RZMA	SET SC-DHZ
RZGO, RZGA	SET SC-DHZ
DHZO, DHZA	SET SC-DHZ
DLHZO, DLHZA	SET SC-DHZ
QVHZO-*-06	SET SC-DHZ
QVHZA	SET SC-DHZ

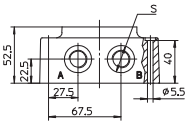
BA-202



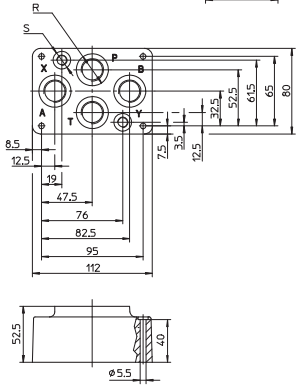
BA-204







BA-302/Y



VERSIONS

BA-202: basic version without ports X and Y; ports P, A, B, T (3/8") on the base.

BA-204: basic version without ports X and Y; ports P and T (3/8") on the base; ports A and B (3/8") on the side.

BA-302: basic version without ports X and Y; ports P, A, B, T (1/2") on the base.

BA-302/Y: version dimensionally identical to the corresponding basic version with the addition of X and Y ports (1/8") on the base (see figure on the left).
The /Y version is always used for DHZO and DLHZO valves when drain from port Y is required.

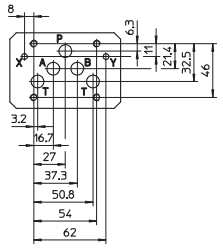
BA-*/N**: versions identical to the corresponding basic versions, but supplied without fixing bolts for type QVZO-*-06 valves (already equipped with fixing bolts).

X and Y ports are only present in the /Y versions.

Code	Ports (GAS) A,B,P,T	Ports (GAS) (X-Y)	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-202	3/8"	–	–	–	1,2
BA-204	3/8"	–	25,5	16,5	1,8
BA-302 (/Y)	1/2"	(1/8")	30	16,5	1,8

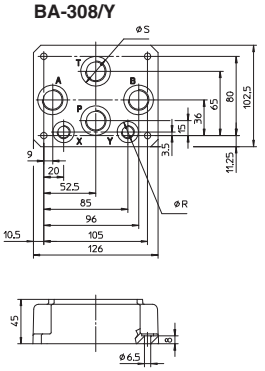
3 SINGLE STATION SUBPLATES FOR VALVES SIZE 10

ISO 4401:2005
Mounting surface: 4401-05-05-0-05

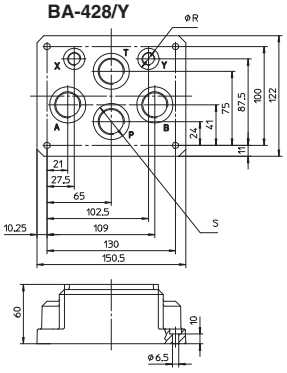


Matching valves	**Set of screw** (to be ordered separately)
DK-11	SET SC-DK/DP-1
DK-12	SET SC-DK/DP-1
DKE	SET SC-DK/DP-1
DKQ	SET SC-DK/DP-1
DKZOR	SET SC-DK/DP-1
DKZA	SET SC-DK/DP-1
DLKZOR	SET SC-DK/DP-1
DLKZA	SET SC-DK/DP-1

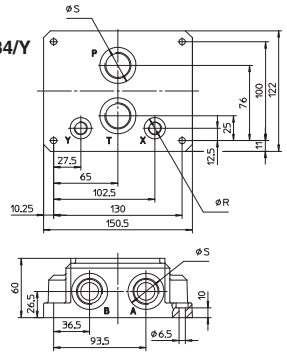
BA-308/Y



BA-428/Y



BA-434/Y



VERSIONS

BA-308: basic version without ports X and Y; ports P, A, B, T (1/2") on the base.

BA-428: basic version without ports X and Y; ports P, A, B, T (3/4") on the base.

BA-434: basic version without ports X and Y; ports P and T (3/4") on the base; ports A and B (3/4") on the side.

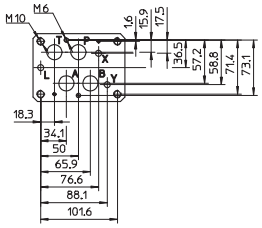
BA-*/Y**: versions dimensionally analogous to the corresponding basic versions with the addition of X and Y ports (1/4") on the base (see figure on the left).
The /Y versions are always used for valves type DKZOR, DLKZO, when drainage from port Y is required.

X and Y ports are only present in the /Y versions.

Code	Ports (GAS) A,B,P,T	(X-Y)	Ø Counterbore S [mm]	R [mm]	Mass [Kg]
BA- 308 (/Y)	1/2"	(1/4")	30	21,5	2,5
BA- 428 (/Y)	3/4"	(1/4")	36,5	21,5	5,5
BA- 434 (/Y)	3/4"	(1/4")	36,5	21,5	8,5

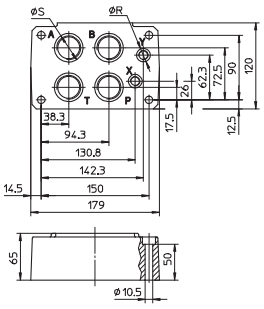
4 SINGLE STATION SUBPLATES FOR VALVES SIZE 16

ISO 4401:2005
Mounting surface: 4401-07-07-0-05

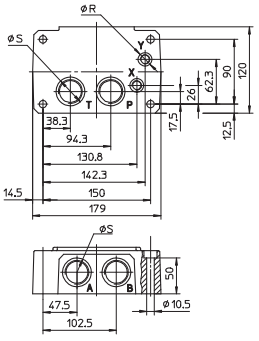


Matching valves	**Set of screw** (to be ordered separately)
DP-21	SET SC-DP2
DP-24	SET SC-DP2
DP-25	SET SC-DP2
DPH-28	SET SC-DP2
DPH-29	SET SC-DP2
DPHI-2	SET SC-DP2
DPHE-2	SET SC-DP2
DPHA-2	SET SC-DP2
DPHW-2	SET SC-DP2
DPZO-*-2	SET SC-DP2
DPZA-*-2	SET SC-DP2

BA-518



BA-519



VERSIONS

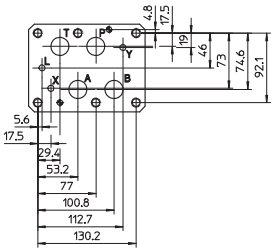
BA-518: basic version with ports P, A, B, T (1") and X, Y (1/4") on the base.

BA-519: basic version with ports P, T (1") and X, Y (1/4") on the base; ports A, B (1") on the side.

Code	Ports (GAS) A,B,P,T	X-Y	Ø Counterbore S [mm]	R [mm]	Mass [Kg]
BA-518	1"	1/4"	46	21,5	8
BA-519	1"	1/4"	46	21,5	8

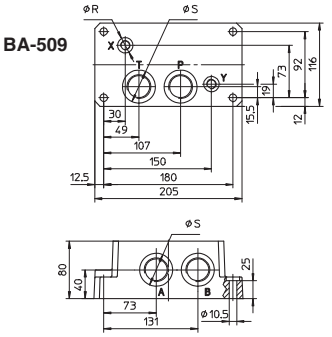
5 SINGLE STATION SUBPLATES FOR VALVES SIZE 25

ISO 4401:2005
Mounting surface: 4401-08-08-0-05

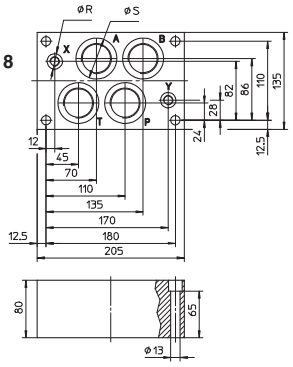


Matching valves	Set of screw (to be ordered separately)
DP-41	SET SC-DP4
DP-44	SET SC-DP4
DP-45	SET SC-DP4
DPH-48	SET SC-DP4
DPH-49	SET SC-DP4
DPHI-4	SET SC-DP4
DPHE-4	SET SC-DP4
DPHA-4	SET SC-DP4
DPHW-4	SET SC-DP4
DPZO-*-4	SET SC-DP4
DPZA-*-4	SET SC-DP4

BA-509



BA-618



VERSIONS

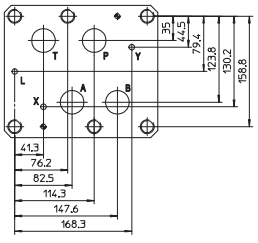
BA-509: basic version with ports P, T (1") and X, Y (1/4") on the base, ports A, B (1") on the side.

BA-618: basic version with ports P, A, B, T (1 1/4") and X, Y (1/4") on the base.

Code	Ports (GAS) A,B,P,T	Ports (GAS) X-Y	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-509	1"	1/4"	46	21,5	12,5
BA-618	1 1/4"	1/4"	57	21,5	13,5

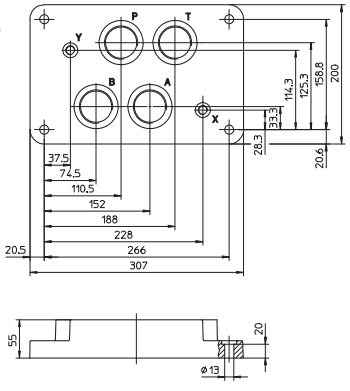
6 SINGLE STATION SUBPLATES FOR VALVES SIZE 32

ISO 4401:2005
Mounting surface: 4401-10-09-0-05



Matching valves	Set of screw (to be ordered separately)
DP-64	SET SC-DP6
DP-65	SET SC-DP6
DPH-68	SET SC-DP6
DPH-69	SET SC-DP6
DPHI-6	SET SC-DP6
DPHE-6	SET SC-DP6
DPHA-6	SET SC-DP6
DPZO-*-6	SET SC-DP6
DPZA-*-6	SET SC-DP6

BA-708



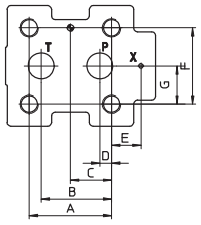
VERSIONS

BA-708: basic version with ports P, A, B, T
(1 1/2") and X, Y (1/4") on the base.

Code	Ports (GAS) A,B,P,T	Ports (GAS) X-Y	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-708	1 1/2"	1/4"	63,5	21,5	17

7 SINGLE STATION SUBPLATES FOR PRESSURE CONTROL VALVE SIZE 10, 20 AND 32

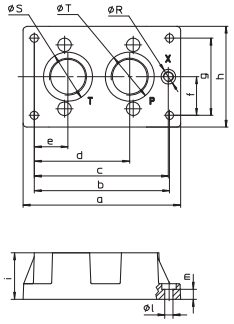
Mounting surface ISO 6264: 1998



BA-306
Mounting surface ISO 6264-06-09-0-97
matching valves:
AGAM-10
AGMZO-*-10
AGMZA-*-10

BA-506
Mounting surface ISO 6264-08-13-0-97
matching valves:
AGAM-20
AGMZO-*-20
AGMZA-*-20

BA-706
Mounting surface ISO 6264-10-17-0-97
matching valves:
AGAM-32
AGMZO-*-32
AGMZA-*-32



BA-306
BA-506
BA-706

Matching valves **Set of screw**
to be ordered separately

AGAM-10	SET SC-AGA-10
AGMZO-10	SET SC-AGA-10
AGMZA-10	SET SC-AGA-10
AGAM-20	SET SC-AGA-20
AGMZO-20	SET SC-AGA-20
AGMZA-20	SET SC-AGA-20
AGAM-32	SET SC-AGA-32
AGMZO-32	SET SC-AGA-32
AGMZA-32	SET SC-AGA-32

size	A	B	C	D	E	F	G
10	53,8	47,5	22,1	22,1	-	53,8	26,9
20	66,7	55,6	33,4	11,1	23,8	70	35
32	88,9	76,2	44,5	12,7	31,8	82,6	41,3

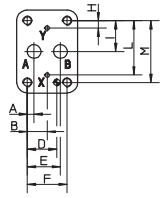
Code	a	b	c	d	e	f	g	h	i	l	m	Ø Blade S	R	T
BA - 306	130	104	97	64,5	19,5	27	54	80	40	8,4	15	36,5	21,5	30
BA - 506	180	150	133,25	92,25	37,25	37,5	75	105	50	10,5	13	46	21,5	46
BA - 706	204	175	173,5	123,5	43,5	50	100	130,5	60	10,5	13	63,5	21,5	63,5

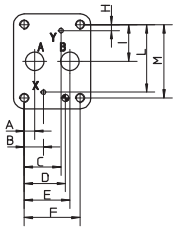
VERSIONS

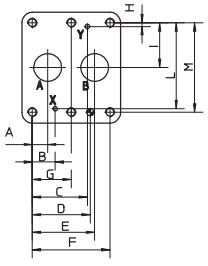
BA-306, BA-506, BA-706: basic version, see figure on left and dimensional tables.

Code	size	Ports (GAS) P	T	X	Mass [Kg]
BA - 306	10	1/2"	3/4"	1/4"	1,5
BA - 506	20	1"	1"	1/4"	3,5
BA - 706	32	1 1/2"	1 1/2"	1/4"	6

Mounting surface ISO 5781: 2000

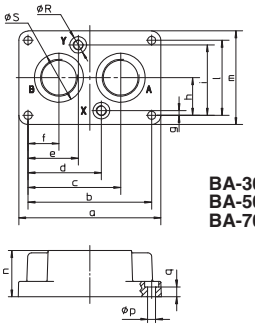






Mounting surface ISO 5781-06-07-0-00
matching valves:
AGI*-10
AGRL-10
AGRLE-10
AGRZO-*-10

Mounting surface ISO 5781-08-10-0-00
matching valves:
AGI*-20
AGRL-20
AGRLE-20
AGRZO-*-20



BA-305
BA-505
BA-705

Mounting surface ISO 5781-10-13-0-00
matching valves:
AGI*-32
AGRL-32
AGRLE-32

Matching valves **Set of screw**
to be ordered separately

AGI*-10(20)	SET SC-AGI
AGRL(E)-10(20)	SET SC-AGI
AGRCZO-10(20)	SET SC-AGI
AGRCZA-10(20)	SET SC-AGI
AGI*-32	SET SC-AGI-32
AGRL(E)-32	SET SC-AGRL-32

Code	a	b	c	d	e	f	g	h	i	l	m	n	p	q	Ø Blade S	R
BA - 305	113	90	67	45	45	23	8	33,3	58,7	66,7	90	30	10,5	10	30	21,5
BA - 505	133	110	82,5	64,5	45,5	27,5	6,4	39,7	73	79,4	102,5	42	10,5	10	46	21,5
BA - 705	184	160	120	95	65	40	6	48,5	91	97	121	60	10,5	13	63,5	21,5

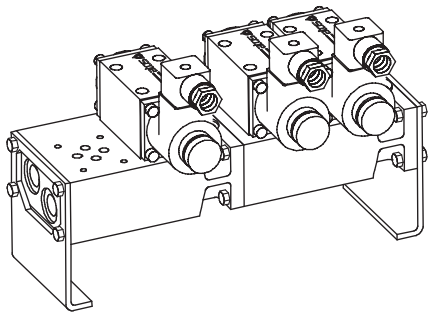
VERSIONS

BA-305, BA-506 and **BA-705**:see figure on left and dimensional tables.

Code	size	Ports (GAS) A	B	X-Y	Mass [Kg]
BA - 305	10	1/2"	1/2"	1/4"	1
BA - 505	20	1"	1"	1/4"	2
BA - 705	32	1 1/2"	1 1/2"	1/4"	7,5

Mounting subplates type BA-214, 314 and 244

Multi-station, for valves ISO 4401 size 06 and 10



example of **BA-244/2 + BA-244/2** modular assembling

BA-214, **BA-314** and **BA-244** are multi-station subplates for assembling of directional and modular valves with mounting surface ISO 4401, size 06 and 10.
They are made in cast iron with high corrosion protection black zinc surface treatment, and they are provided with P, T passing through lines and A, B user ports connections.

BA-214 are **multistaion subplates** with 1 to 10 stations for valves ISO size 06.

BA-314 are **multistaion subplates** with 1 to 6 stations for valves ISO size 10.

BA-244 are **modular subplates** with 1 to 4 stations for valves ISO 4401 size 06.

They are designed for installation on power units cover and they can be easily assembled together by means of n° 4 screws M6 class 12.9 (included in the supply), combining up to max 12 stations.

1 MODEL CODE OF SUBPLATES TYPE BA-214 and BA-314

BA-214	/	**5**	**/P**	******

Type of subplate:
BA-214 = for valves ISO size 06
BA-314 = for valves ISO size 10

Number of stations (see section 4 5 6):
1 = one station
2 = two stations
3 = three stations
4 = four stations
5 = five stations
6 = six stations
7 = seven stations (only for BA-214)
8 = eight stations (only for BA-214)
9 = nine stations (only for BA-214)
10 = ten stations (only for BA-214)

Series number

- = with A and B lateral ports
/P = with A and B rear ports (not for **BA-214/1** and all **BA-314**)

Model	Port P	Port T	Ports A, B	Qmax	Qmax ports A, B	Pmax
BA-214	G 1/2"	G 1/2"	G 3/8" lateral	80 l/min	60 l/min	350 bar
BA-214/*/P	G 1/2"	G 1/2"	G 3/8" rear	80 l/min	60 l/min	350 bar
BA-314	G 3/4"	G 1"	G 3/4" lateral	150 l/min	100 l/min	300 bar

2 MODEL CODE OF SUBPLATES TYPE BA-244

BA-244	/	**4**	******

Type of subplate:
BA-244 = modular subplate for valves ISO size 06

Number of stations:
1 = one station
2 = two stations
3 = three stations
4 = four stations

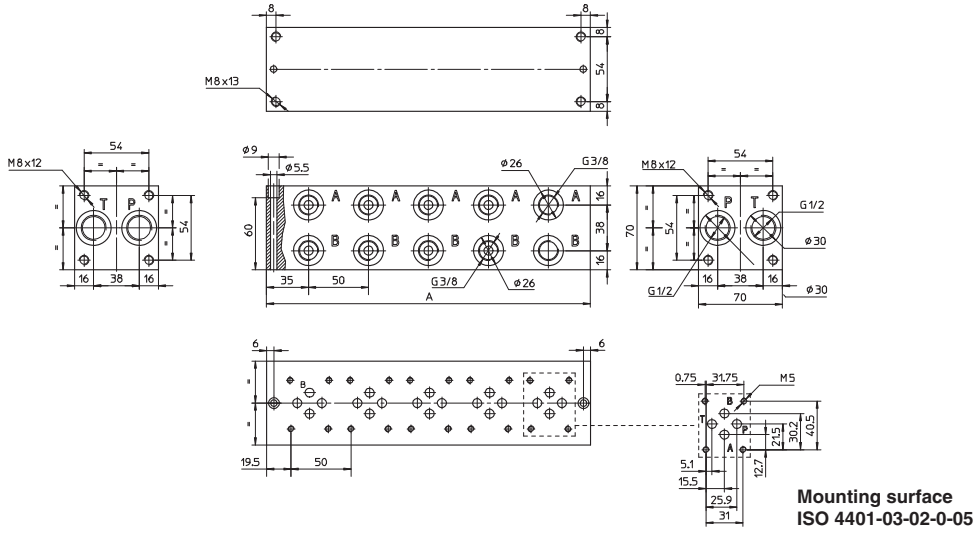
Series number

3 TECHNICAL CHARACTERISTICS

Installation positions	Any position. For BA-244, a maximum of 12 stations can be combined; in case of horizontal mounting proper brackets are recommended.
Operating pressure	Ports P, T, A, B = **350 bar** (BA-214), **300 bar** (BA-314), **250 bar** (BA-244) see the technical table of the valves to be assembled
Ambient temperature	From -20°C to +70°C
Fluid	Hydraulic oil as per DIN 51524...535, for other fluids contact our technical office
Recommended viscosity	15 ÷ 100 mm^2/s - max allowed range: see the technical table of the valves to be assembled
Fluid contamination class	See the technical table of the valves to be assembled
Fluid temperature	See the technical table of the valves to be assembled

4 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214 [mm]

Ports P and T = G 1/2" (passing through)
Ports A and B = G 3/8"
Q_{max} = 80 l/min
Q_{max} A and B ports = 60 l/min
P_{max} = 350 bar



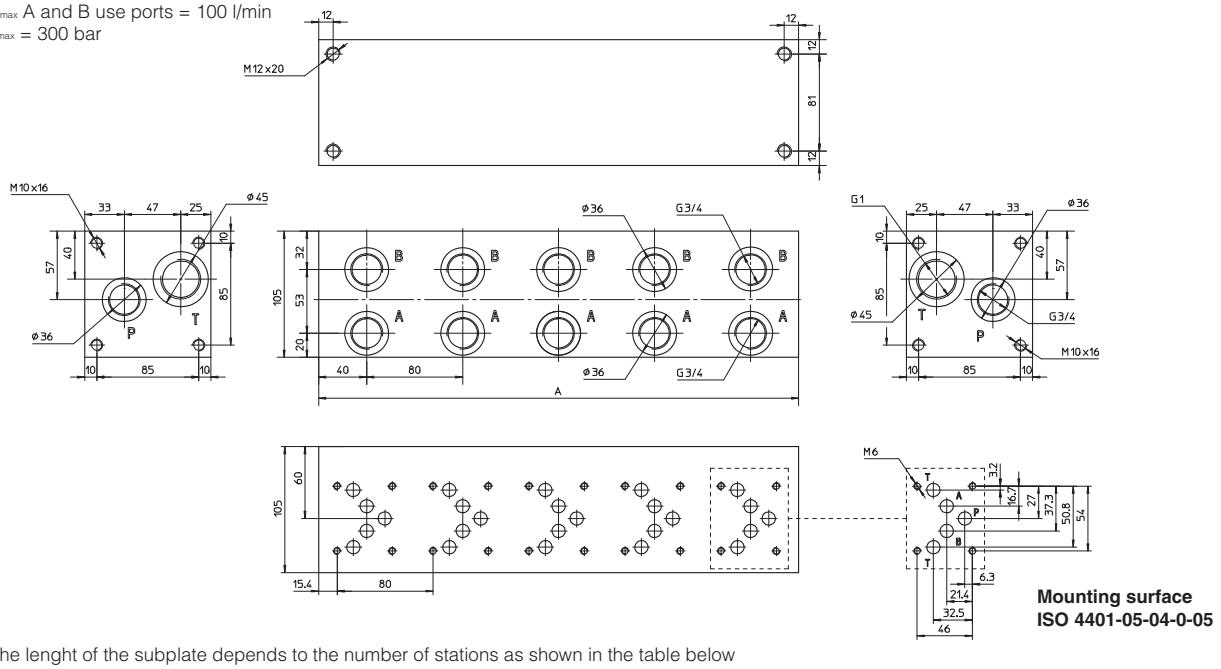
The lenght of the subplate depends to the number of stations as shown in the table below

Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	70	120	170	220	270	320	370	420	470	520
Mass [Kg]	2	3,5	5	6,5	8	9,5	11	12,5	14	15,5

The 5-station version is shown in the drawing

5 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-314 [mm]

Ports P = G 3/4" (passing through)
Ports T = G 1" (passing through)
Ports A and B = G 3/4"
Q_{max} = 150 l/min
Q_{max} A and B use ports = 100 l/min
P_{max} = 300 bar



The lenght of the subplate depends to the number of stations as shown in the table below

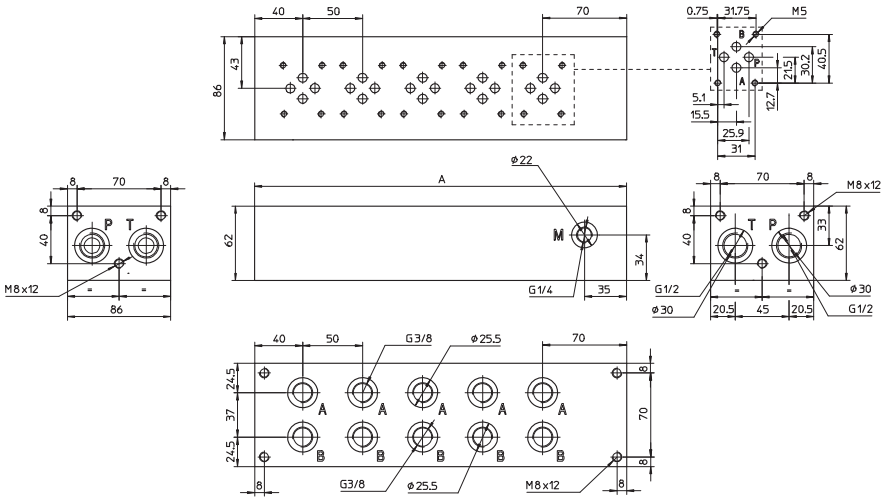
Stations	1	2	3	4	5	6
Dimension A	80	160	240	320	400	480
Mass [Kg]	4	8,5	13	17,5	22	26,5

The 5-station version is shown in the drawing

6 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*/P [mm]

Ports P and T = G 1/2”
Ports A and B = G 3/8”
Q_{max} = 80 l/min
Q_{max} A and B ports = 60 l/min
P_{max} = 350 bar

Mounting surface
ISO 4401-03-02-0-05



The lenght of the subplate depends to the number of stations as shown in the table below

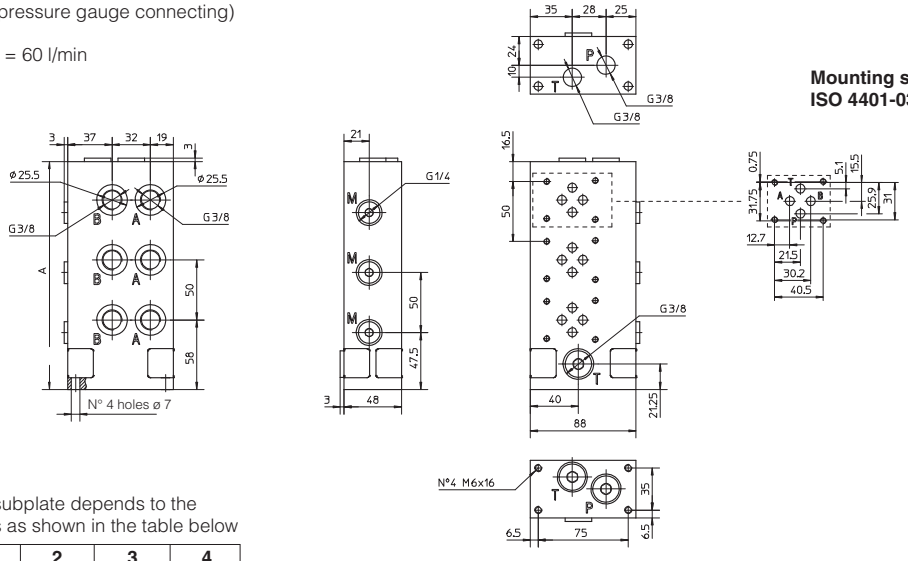
Stations	2	3	4	5	6	7	8	9	10
Dimension A	160	210	260	310	360	410	460	510	560
Mass [Kg]	5,4	7	8,7	10,4	12,1	13,8	15,5	17,2	18,9

The 5-station version is shown in the drawing

7 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-244 [mm]

Ports P and T = G 3/8” (passing through)
Ports A and B = G 3/8”
Ports M = G 1/4” (pressure gauge connecting)
Q_{max} = 35 l/min
Q_{max} A and B ports = 60 l/min
P_{max} = 250 bar

Mounting surface
ISO 4401-03-02-0-05



The lenght of the subplate depends to the number of stations as shown in the table below

Stations	1	2	3	4
Dimension A	90	140	190	240
Mass [Kg]	2,5	3,5	5,2	7

The 3-station version is shown in the drawing

Fastening bolts: 4 exagonal head screws M6x20 class 12.9 included in the supply
Tightening torque = 15 Nm
Seals: 2 OR-3081 included in the supply

Mounting subplates type BA-214/*-AL

multi-station, for valves ISO 4401 size 06, in aluminium

The multi-stations subplates type BA-214/*-AL for directional control valves are in aluminium and their mounting surface are in accordance with the international standards ISO 4401.

They perform limited pressure drop and are made by a **single subplate** from 1 to 10 stations for directional valves and modular elements ISO 4401 size 06.

Main characteristics:
P and T ports = G 1/2; A and B lateral use ports G 3/8; M pressure gauge connection G1/4; Q_{max} = 80 l/min; Q_{max} use ports = 60 l/min; Pmax = 250 bar
Note: for versions /M and /MH Q_{max} = 35 l/min;

For other technical characteristics, see section 2 and 3.

1 MODEL CODE OF SUBPLATES TYPE BA-214/*-AL

BA-214 / **5** / **MH** / **210** - **AL** *****

Series number

Type of subplate:
BA-214 = for valves ISO size 06
On request, available with rear ports A and B

AL = in aluminium
On request, available with anodizing

Pressure range of pressure relief valve, for versions /M and /MH:
100 = 100 bar
210 = 210 bar
250 = 250 bar

Number of stations:
1 = one station
2 = two stations
3 = three stations
4 = four stations
5 = five stations
6 = six stations
7 = seven stations
8 = eight stations
9 = nine stations
10 = ten stations

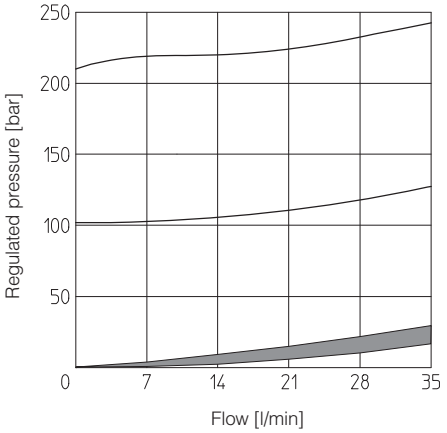
M = with direct operated pressure relief cartridge CART M-5/** - see tab. C010 (available also as spare part)
MH = with pressure relief valve type CART M-5, arranged with venting solenoid valve

2 TECHNICAL CHARACTERISTICS

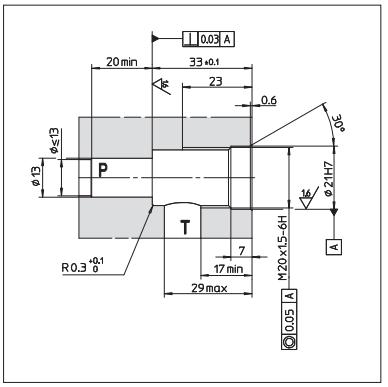
Installation position	Horizontal or vertical position
Ambient temperature	From - 20°C to + 70°C
Fluid	Hydraulic oil as per DIN 51524 ... 535, for other fluids contact our technical office
Recommended viscosity	15 ÷ 100 mm 2 /s at 40°C (ISO VG 15 ÷ 100)
Fluid contamination class	ISO 19/16 achieved with in line filters at 25µm and $ß_{25}$ 75 (recommended only for versions /M and /MH)
Fluid temperature	-20°C +60°C (standard and /WG seals) -20°C +80°C (/PE seals)

3 REGULATED PRESSURE/FLOW DIAGRAM FOR VERSIONS /M and /MH

MAIN CHARACTERISTICS OF ENCLOSED PRESSURE RELIEF VALVE	
Model code	Regulation range
CART M-5/100	3 ÷ 100 bar
CART M-5/210	5 ÷ 210 bar
CART M-5/250	7 ÷ 250 bar
Q_{max} = 35 l/min	

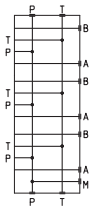


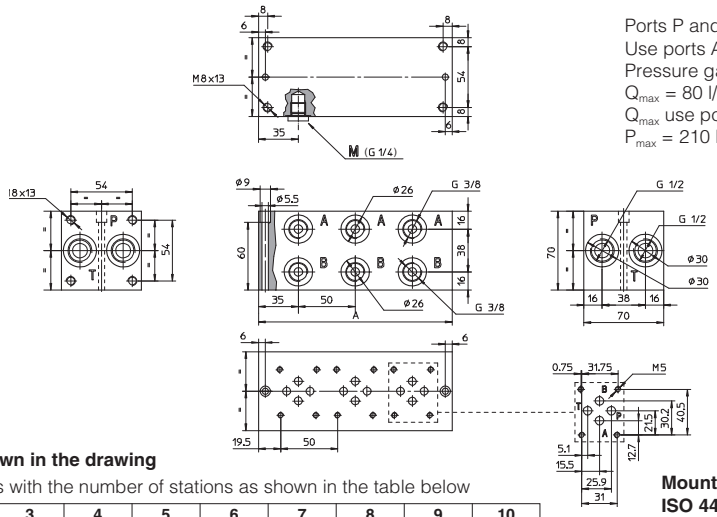
4 INSTALLATION DIMENSIONS OF CART M-5/***



5 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*-AL [mm]

Hydraulic scheme





Ports P and T = G 1/2
Use ports A and B = G 3/8
Pressure gauge port M = G1/4 (plugged)
Q_{max} = 80 l/min
Q_{max} use ports = 60 l/min
P_{max} = 210 bar

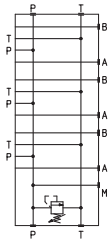
The 3-stations subplate is shown in the drawing

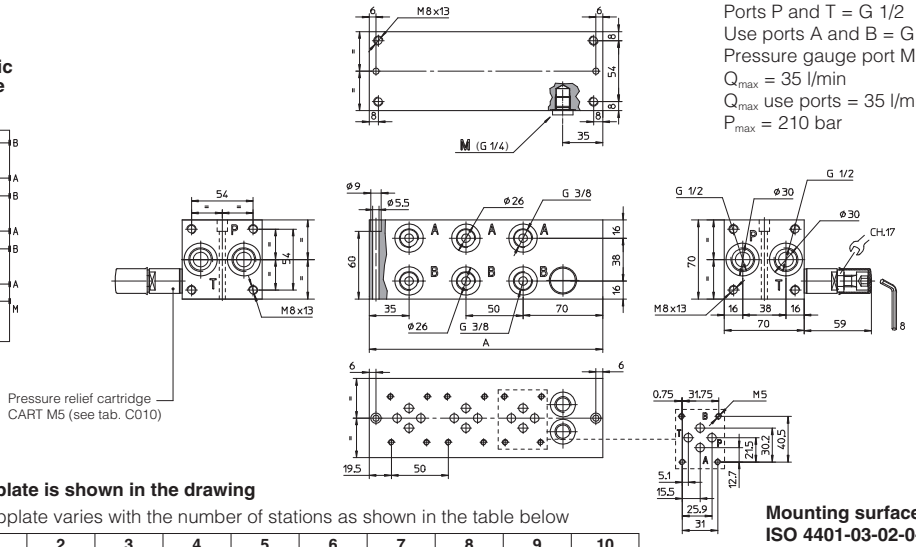
The lenght of the subplate varies with the number of stations as shown in the table below

Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	70	120	170	220	270	320	370	420	470	520
Mass [Kg]	1	1,4	2	2,6	3,2	3,8	4,4	5	5,6	6,2

6 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*/M/*-AL [mm]

Hydraulic scheme





Ports P and T = G 1/2
Use ports A and B = G 3/8
Pressure gauge port M = G1/4 (plugged)
Q_{max} = 35 l/min
Q_{max} use ports = 35 l/min
P_{max} = 210 bar

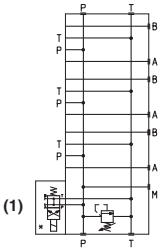
The 3-stations subplate is shown in the drawing

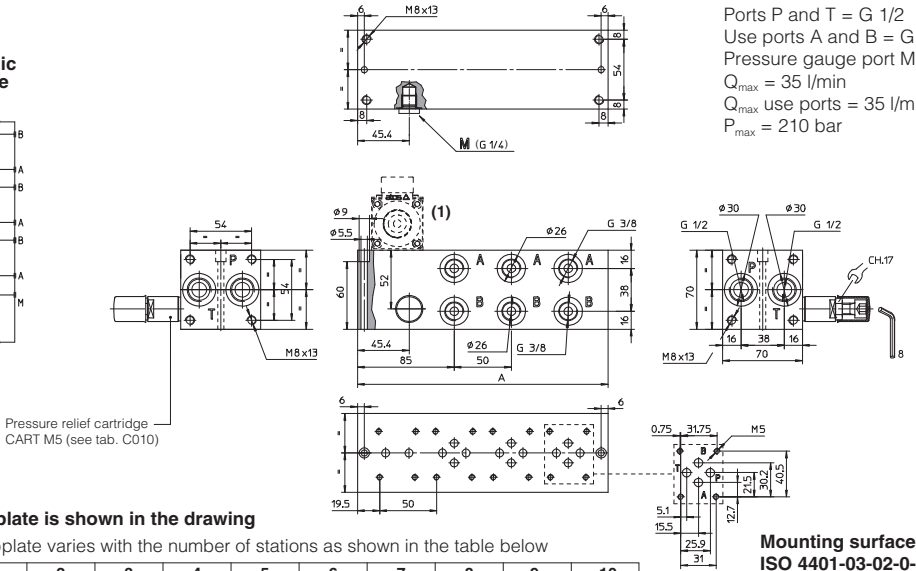
The lenght of the subplate varies with the number of stations as shown in the table below

Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	105	155	205	255	305	355	405	455	505	555
Mass [Kg]	1,1	1,5	2,1	2,7	3,3	3,9	4,5	5,1	5,7	6,3

7 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*/MH/*-AL [mm]

Hydraulic scheme





Ports P and T = G 1/2
Use ports A and B = G 3/8
Pressure gauge port M = G1/4 (plugged)
Q_{max} = 35 l/min
Q_{max} use ports = 35 l/min
P_{max} = 210 bar

The 3-stations subplate is shown in the drawing

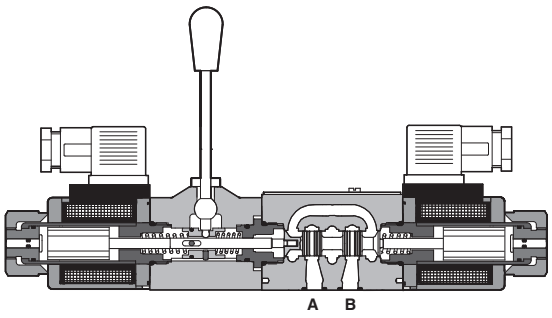
The lenght of the subplate varies with the number of stations as shown in the table below

Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	120	170	220	270	320	370	420	470	520	570
Mass [Kg]	1,2	1,6	2,2	2,8	3,4	4	4,6	5,2	5,8	6,4

(1) The venting directional valve in the dashing line must be ordered separately

Auxiliary hand levers for solenoid valves

direct operated on-off and proportional, ISO 4401 size 06



DHE-0711/MV

Auxiliary hand levers for direct operated on-off solenoid valves size 06, type DHI, DHE, DHA and proportional valves size 06, type DHZO, DHZE, DHZA and QVHZO.

This option allows to operate the valves in absence of electrical power supply, i.e. during commissioning, maintenance or in case of emergency.

It is available with two different configurations depending to the installation requirements:
MV = lever positioned vertically (perpendicular to the valve axis)
MO = lever positioned horizontally (parallel to the valve axis)

When the valve is electrically operated the hand lever remains stopped in its rest position

The hand lever execution does not affect the performances of the original valves.

1 **MODEL CODE FOR ON-OFF DIRECTIONAL VALVES** (for the details, see indicated tech. table)

DHE - 0	63	1/2	/	MV	-	X	24 DC	**	/*

Directional control valves size 06
DHI-0= for AC and DC supply, with **cURus** certified solenoids - see table E010
DHE-0 = for AC and DC supply, high performances, with **cURus** certified solenoids - see table E015
DHA-0 = ex-proof - see table EX010

Valve configuration: **61 - 63 - 71**

Available spools: **0 - 0/2 - 1 - 1P - 1/2 - 1/2P - 3 - 3P - 4 - 7**

Options, hand lever configuration:
MO = horizontal hand lever (not for DHA)
MV = vertical hand lever
AMO = horizontal hand lever installed at the side of port B (not for DHA)
AMV = vertical hand lever installed at the side of port B

Only for DHI and DHE:
00 = solenoids without coils, for DHI valve
00-AC = AC solenoids without coils, for DHE valve
00-DC = DC solenoids without coils, for DHE valve
X = without connector

Voltage code: see relevant tech. table

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

(1) For DHA model code see table E120 (Multicertification) or E125 (UL)

2 **MODEL CODE FOR PROPORTIONAL DIRECTIONAL VALVES AND FLOW CONTROL VALVES** (for the details, see indicated tech.table)

DHZO	-	A	-	0	71	-	S5	/	MV	/*	**	/*

Directional proportional valves size 06
DHZO = see table F160
DHZE = see table F150
DHZA = ex-proof - see table FX010

Flow control valves size 06
QVHZO = see tab F410

A = without position transducer **(2)**

Valve size
0 = ISO 4401 size 06 (for DHZ*)
06 = ISO 4401 size 06 (for QVHZO)

Valve configuration (only DHZ*): **51, 53, 71, 73**

Options:
MO = horizontal hand lever (not for DHA, DHZA)
MV = vertical hand lever
BMO = horizontal hand lever installed at the side of port A (not for DHZA, QVHZO)
BMV = vertical hand lever installed at the side of port A (not for QVHZO)
O = Horizontal cable entrance (only for DHZA)
Y = External drain (only for DHZA, DHZO)

Spool size (for DHZ*): **S3 - S5 - D3 - D5 - L3 - L5**
Max regulated flow (for QVHZO): **3-12-18-36-45** l/min

Coil option: see relevant tech. table

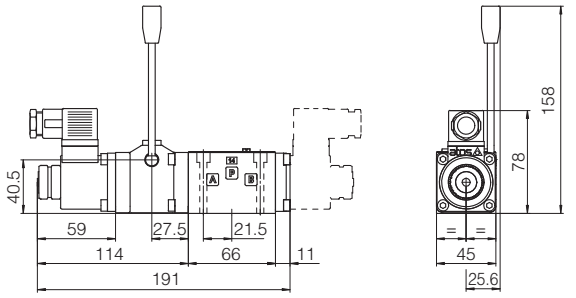
Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

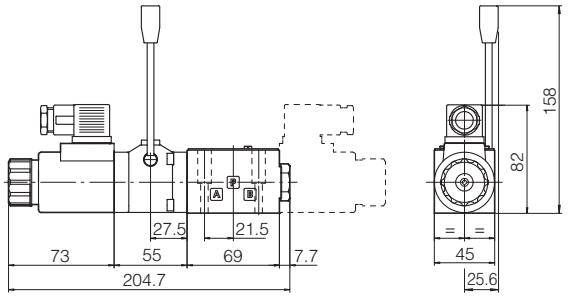
3 LEVER CHARACTERISTICS

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

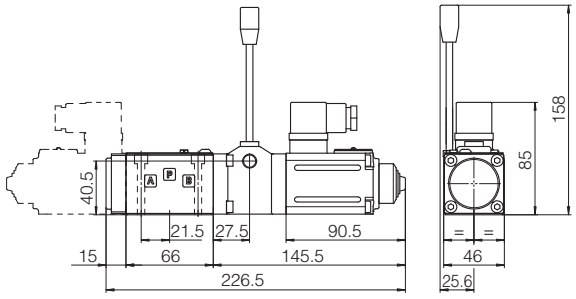
4 INSTALLATION DIMENSIONS [mm]



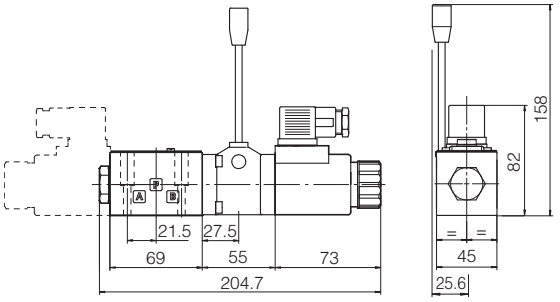
DHI-06*/MV Mass: 2,4 kg (single solenoid)
DHI-07*/MV (dotted line) Mass: 2,7 kg (double solenoid)



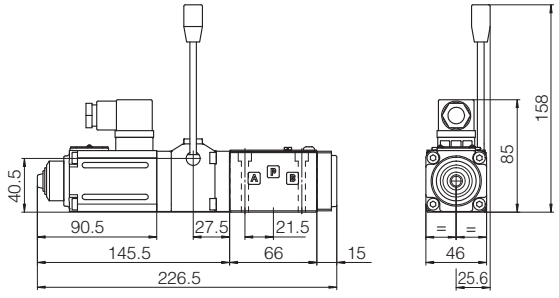
DHE-06*/MV Mass: 2,7 kg (single solenoid)
DHE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



DHZO-A-05*/MV Mass: 2,8 kg (single solenoid)
DHZO-A-07*/MV (dotted line) Mass: 3,5 kg (double solenoid)

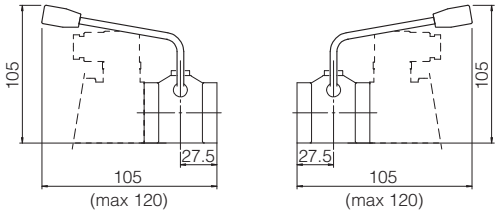


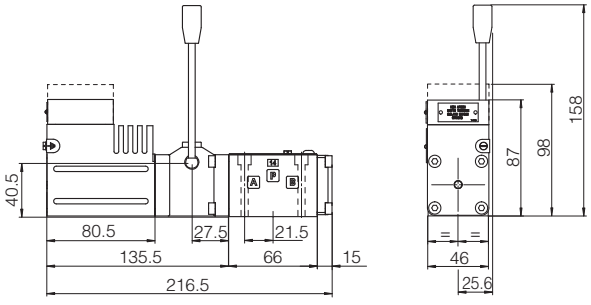
DHZE-05*/MV Mass: 2,7 kg (single solenoid)
DHZE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



QVHZO-A-06*/MV Mass: 3,2 kg

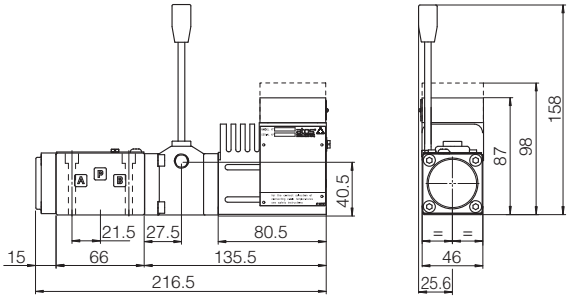
Horizontal hand lever device /MO, /AMO





DHA/*-06*/MV Mass: 3,4 kg
DHA/UL-*-06*/MV (dotted line)

Note: see tech. table FX010 for DHA/MV models



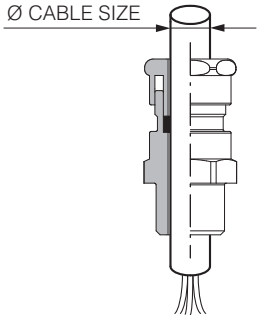
DHZA/*-06*/MV Mass: 3,4 kg
DHZA/UL-*-06*/MV (dotted line)

Note: see tech. table FX100 for DHZA/MV models

Cable glands and plugs for ex-proof valves

Multicertified ATEX, IECEx, EAC

1 MULTICERTIFIED CABLE GLAND FOR NON-ARMOURED CABLES - Group II (surface plants)

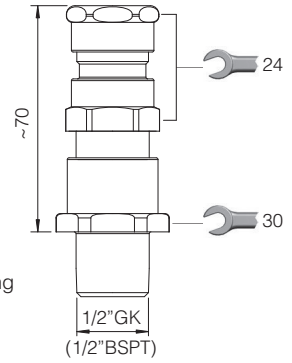
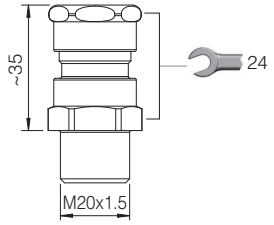
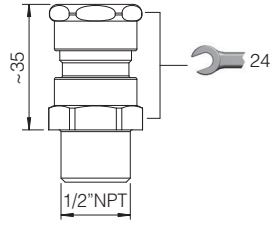
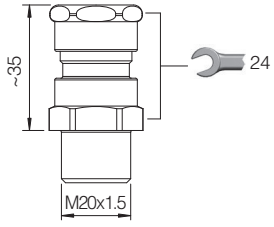


Cable glands for use with non-armoured plastic insulated cables
Flameproof **Exd IIC Gb**, Increased Safety **Exe IIC Gb** and Dust **Extb IIIC Db II 2 GD**, suitable for use in Zone 1, Zone 2, Zone 21, Zone 22.
Construction and Test Standards: IEC/EN 60079-0, IEC/EN60079-1, IEC/EN 60079-7 and IEC/EN 60079-31.
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529 and NEMA 4X
Deluge Protection to DTS01
Operating Temperature Range: -60 °C to +100 °C

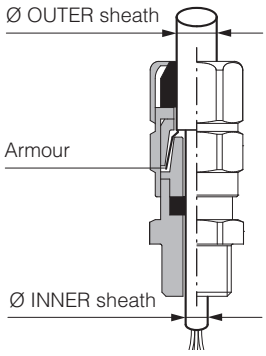
Material: Nickel Plated Brass or AISI 316
Cable glands are marked ATEX, IECEx and EAC

The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
PAMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 06 ATEX0056X - IECEx BAS 06.0013X Item type: 501-421 **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAMC/M  Tightening torque: **20 Nm**	**IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31	**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAMC/NPT  Tightening torque: **20 Nm**	**EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves with "NPT" threaded connection (solenoid and LVDT transducer)
PAXMC/M  Tightening torque: **20 Nm**		**Material:** Stainless steel AISI 316 **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** 6,5 to 11,9 mm	On-off ex-proof stainless steel valves type "X" and "XS"

2 MULTICERTIFIED CABLE GLAND FOR ARMOURED CABLES - Group II (surface plants)

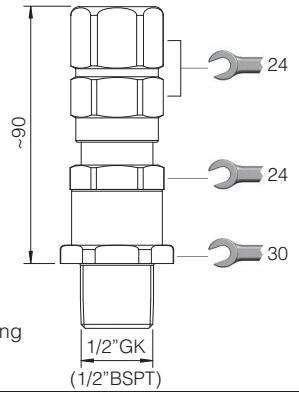
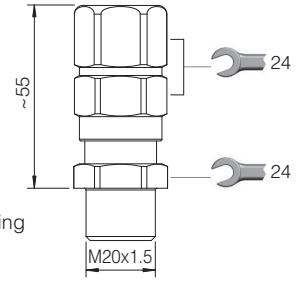
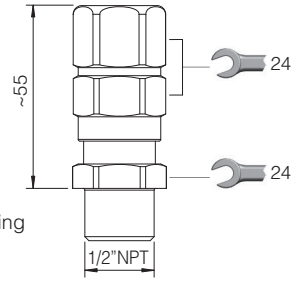
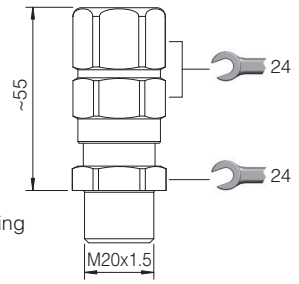


Cable glands for use with single wire armour 'W', wire braid 'X', steel tape armour 'Z', plastic insulated cables.
Flameproof **Exd IIC Gb**, Increased Safety **Exe IIC Gb**, Dust **Extb IIIC Db** and **ExnR IIC Gc II 2 / 3GD**, suitable for use in Zone 1, Zone 2, Zone 21, Zone 22.
Construction and Test Standards: IEC/EN 60079-0, IEC/EN 60079-1, IEC/EN 60079-7, IEC/EN 60079-15 and IEC/EN 60079-31.
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529 and NEMA 4X
Deluge Protection to DTS01.
Operating Temperature Range: -60 °C to +80 °C

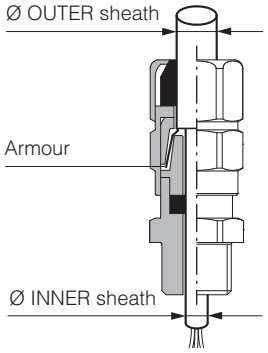
Seal on the cable inner sheath
Outer deluge seal to prevent moisture ingress to the cable armour / braid
Cable retention, low smoke
Material: Nickel Plated Brass or AISI 316
Cable glands are marked ATEX, IECEx and EAC

The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
PAAMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 06 ATEX0056X - IECEx BAS 06.0013X Item type: 501-453RAC CE Ex **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 IECEx **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 EAC **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAAMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAAMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "NPT" threaded connection (solenoid and LVDT transducer)
PAAXMC/M  Tightening torque: **20 Nm**		**Material:** Stainless steel AISI 316 **Threaded connection:** M20x1,5 UNI-4535 (6H/6g) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off ex-proof stainless steel valves type "X" and "XS"

3 MULTICERTIFIED CABLE GLAND FOR ARMOURED CABLES - Group I (Mining)

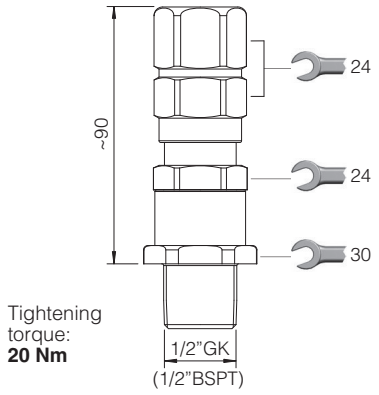
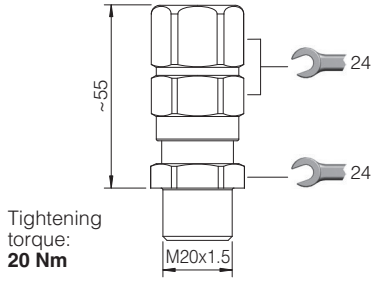
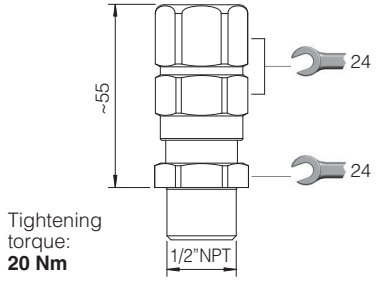


Cable glands for use with single wire armour 'W', wire braid 'X', steel tape armour 'Z', plastic insulated cables.
Flameproof **Exd I M2** and Increased Safety **Exe I M2**, suitable for use in Mines
Construction and Test Standards: IEC/EN 60079-0, IEC/EN 60079-1 and IEC/EN 60079-7
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529
Operating Temperature Range: -60 °C to +80 °C

Seal on the cables inner sheath
Cable retention, low smoke
Material: Nickel Plated Brass
Cable glands are marked ATEX, IECEx and EAC

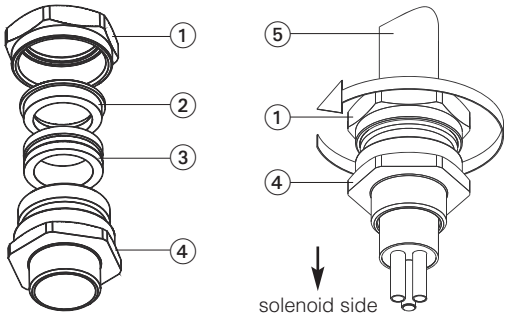
The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
PAAMMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 08 ATEX0331X - IECEx BAS 08.0112X Item type: 453RAC CE Ex **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 IECEx **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 EAC **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAAMMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAAMMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "NPT" threaded connection (solenoid and LVDT transducer)

4 CABLE GLAND ASSEMBLY

Cable glands PAMC/* and PAXMC/M for non-armoured cables

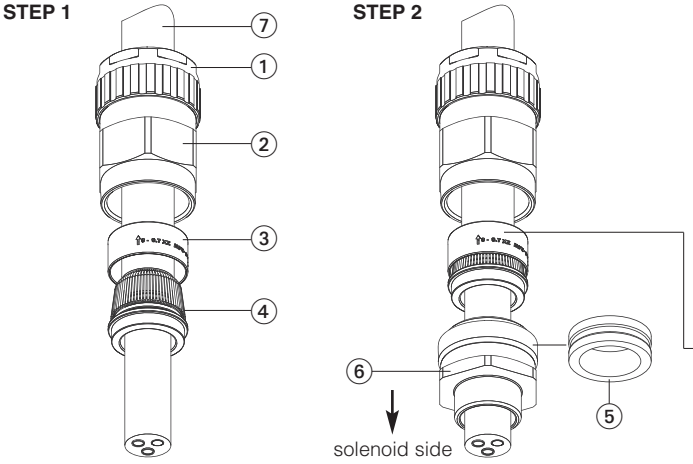


Assembling procedure

Unscrew the Back-nut ① from Entry ④
Push the electric cable ⑤ though the cable gland
Connect the cable wires to the solenoid terminal board
Screw-in the Entry ④ into the solenoid cable entrance lock it at relevant tightening torque specified in section 1
Lock the Back-nut ① using a wrench until a resistance is felt between internal seal ③ and the cable
Turn the Back-nut ① through a further half turn to ensure the complete inner sealing

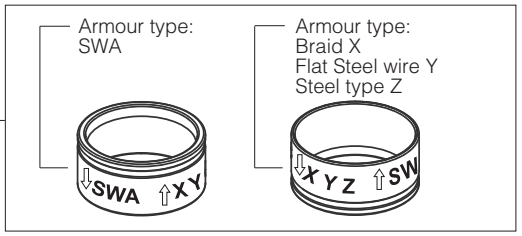
① Back-nut
② Compression Spigot
③ Seal
④ Entry
⑤ Electric cable (non-armoured)

Cable glands PAAMC/*, PAAXMC/M and PAAMMC/* for armoured cables



① Back-nut
② Middle-nut
③ Reversible Armour Clamping Ring (RAC)
④ Armour Spigot
⑤ Inner Seal
⑥ Entry (with captive deluge seal), if required
⑦ Electric cable (armour type SWA, Braid X, Flat Steel wire Y, Steel type Z)

Reversible Armour Clamping ring (RAC) orientation



Note: the arrow corresponding to the correct armour type (SWA or X, Y, Z) must be orinted towards the ex-proof solenoid

Assembling procedure

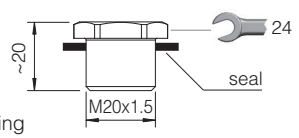
STEP 1

Unscrew Back-nut ① from Middle-nut ② and Entry ⑥ , push the cable through the Armour Spigot ④
Spread the armour over the Armour spigot ④ until the end of the armour is up against the shoulder of the armour cone
Position the Armour clamping ring ③ paying attention to its correct orientation depending to the armour type (see above)
Remove the Inner seal ⑤ from the Entry ⑥ , place the Entry ⑥ over the Armour Spigot ④
Move the sub-assembly ① + ② to meet the Entry ⑥ , connect the cable wires to the solenoid terminal board
Screw-in the Entry ⑥ into the solenoid cable entrance and lock it at relevant tightening torque specified in section 2 and 3
Hand tighten the Middle-nut ② to the Entry ⑥ and turn a further half turn with a wrench
Unscrew the Middle-nut ② and visually inspect that the armour has been successfully clamped between the armour spigot ④ and the armour clamping ring ③. If the armour is not correctly clamped, repeat the assembly

STEP 2

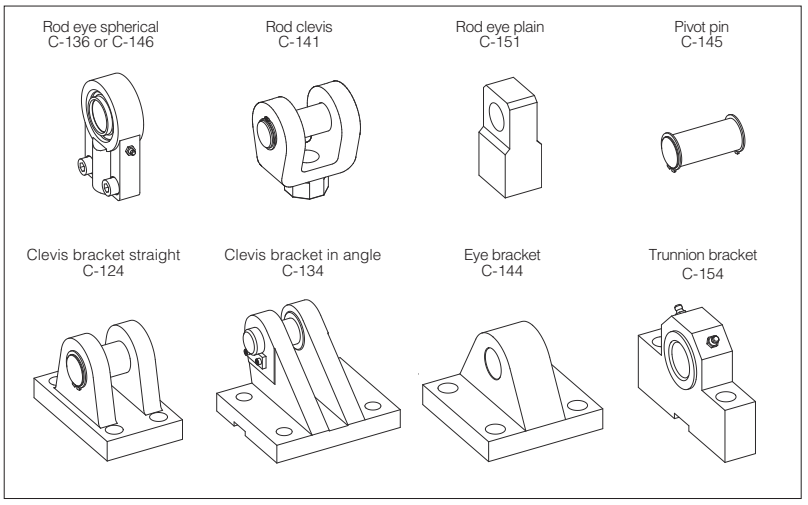
Re-assemble Middle-nut ② onto the components ③ + ④ + ⑤ + ⑥ paying attention to the correct orientation of the reversible armour Clamping ring ③ , tighten up the Middle-nut ② by hand first and then using a wrench a further 1 to 2 turns until fully tight
Hand tighten the Back-nut ① then tighten a further full turn using a wrench
Ensure that the Middle-nut ② does not rotate when tightening the Back-nut ①
Ensure that the deluge seal is compressed into correct position

5 THREADED PLUG

THREADED PLUG CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
ZMX-T  Tightening torque: **20 Nm**	**ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535	Proportional ex-proof valves with on-board driver

Attachments for hydraulic cylinders

to ISO 6982, ISO 8132 and ISO 8133



SWC Cylinders Designer

Software for assisted selection of Atos cylinders & servocylinders codes, including cylinder's sizing, full technical information, 2D & 3D drawings in several CAD formats.

Available for download at www.atos.com

The table at side shows the Atos range of standard rod attachments and brackets: they are available for each cylinder bore. See section 2 for possible combinations. Stainless steel attachments are available on request.

1 MODEL CODE

C	-	141	12	-	V
Standard attachment		**Rod attachments**: **136**= Rod eye spherical **146**= Rod eye spherical **141**= Rod clevis **151**= Rod eye plain **145**= Pivot pin **Brackets:** **124** = Clevis bracket straight **134** = Clevis bracket in angle **144**= Eye bracket **154**= Trunnion bracket	**Bore** size/rod diameter [mm]		**Painting** see sect. 5

2 POSSIBLE COMBINATIONS

Ø Rod	Rod attachments codes					Ø Bore	Brackets codes			
	(b)									
12 **18** opt.**H**(a)	NA	C-14612	C-14112	C-15112	C-14512	**25**	NA	C-13425	C-14425	C-15425
14 **22** opt.**H**(a)	C-13616	C-14614	C-14114	C-15114	C-14514	**32**	NA	C-13432	C-14432	C-15432
18 **22** opt.**H**(a) **28** opt.**H**	C-13618	C-14618	C-14118	C-15118	C-14518	**40**	C-12422 (c)	C-13440	C-14440	C-15440
22 **28** opt.**H**(a) **36** opt.**H**	C-13622	C-14622	C-14122	C-15122	C-14522	**50**	C-12428 (c) C-12436 (d)	C-13450	C-14450	C-15450
28 **36** opt.**H**(a) **45** opt.**H**	C-13628	C-14628	C-14128	C-15128	C-14522	**63**	C-12436 (c) C-12445 (d)	C-13463	C-14463	C-15463
36 **45** opt.**H**(a) **56** opt.**H**	C-13636	C-14636	C-14136	C-15136	C-14536	**80**	C-12445 (c) C-12456 (d)	C-13480	C-14480	C-15480
45 **56** opt.**H**(a) **70** opt.**H**	C-13645	C-14645	C-14145	C-15145	C-14545	**100**	C-12456 (c) C-12470 (d)	C-134100	C-144100	C-154100
56 **70** opt.**H**(a) **90** opt.**H**	C-13656	C-14656	C-14156	C-15156	C-14556	**125**	C-12470 (c) C-12490 (d)	C-134125	C-144125	C-154125
70 **90** opt.**H**(a) **110** opt.**H**	C-13670	C-14670	C-14170	C-15170	C-14570	**160**	C-12490 (c) C-124100 (d)	C-134160	C-144160	C-154160
90 **110** opt.**H**(a) **140** opt.**H**	C-13690	C-14690	C-14190	C-15190	C-14590	**200**	C-124100 (c)	C-134200	C-144200	C-154200

Notes:

(**a**) Option **H** : light male thread, for details see table B137 or B140

(**b**) C-136 is also available for rods 110, 140, 180 and 220. See section 3

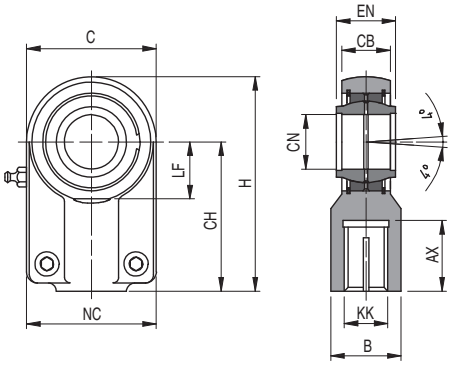
(**c**) For S mounting styles in CN cylinder

(**d**) For S mounting styles in CC cylinder

B800

3 DIMENSIONS [mm]

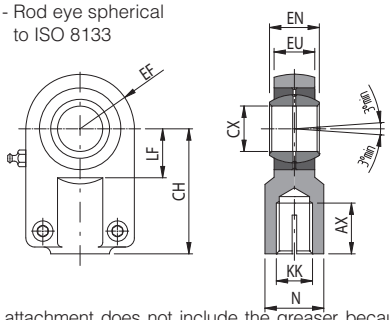
C-136 - Rod eye spherical
to ISO 6982 and 8132



Notes:
(1) This attachment does not include the greaser because it is selflubricated
(2) Dynamic loads has to be considered when the cylinders work with oscillatory motions or push-pull loads in high frequencies
(3) Attachment not compliant with ISO standard

Code	KK	AX min	B max	C max	CB max	CH js13	CN H7	EN h12	H	LF min	NC	Mass [kg]	Max load [kN] (2) Dynamic	Static	Screws torque
C-13616 (1)	M12x1,25	17	19	33	11	38	12	12	54	13	32	0,11	10,8	24,5	6 Nm
C-13618	M14x1,5	19	22	41	14	44	16	16	64	16,5	40	0,2	17,6	36,5	10 Nm
C-13622	M16x1,5	23	28	50	17,5	52	20	20	75	20,5	47	0,35	30	48	25 Nm
C-13628	M20x1,5	29	31	64	22	65	25	25	96	25,5	54	0,62	48	78	25 Nm
C-13636	M27x2	37	38	80	28	80	32	32	118	30	66	1,15	67	114	49 Nm
C-13645	M33x2	46	47	100	34	97	40	40	146	39	80	2,18	100	204	49 Nm
C-13656	M42x2	57	58	126	42	120	50	50	179	47	96	3,96	156	310	86 Nm
C-13670	M48x2	64	70	145	53,5	140	63	63	211	58	114	6,8	255	430	210 Nm
C-13690	M64x3	86	91	184	68	180	80	80	270	74	148	13	400	695	410 Nm
C-13690A (3)	M72x3	91	100	185	72	195	90	90	296	91	160	19,1	490	750	410 Nm
C-136110	M80x3	96	110	228	85,5	210	100	100	322	94	178	25	610	1.060	710 Nm
C-136110A (3)	M90x3	106	125	235	88	235	110	110	364	106	190	32	655	1.200	710 Nm
C-136140	M100x3	113	135	320	105	260	125	125	405	116	200	46	950	1.430	710 Nm
C-136180	M125x4	126	165	400	133	310	160	160	488	145	250	82,5	1.370	2.200	710 Nm
C-136220	M160x4	161	215	500	165	390	200	200	620	190	320	168	2.120	3.650	1500Nm

C-146 - Rod eye spherical
to ISO 8133

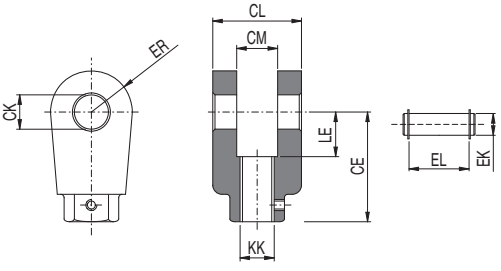


Notes:
(1) This attachment does not include the greaser because it is selflubricated
(2) Dynamic loads has to be considered when the cylinders work with oscillatory motions or push-pull loads in high frequencies
(3) Not compliant with ISO 8133

Code	KK	AX min	CH js13	CX	EF max	EN	EU max	LF min	N max	Mass [kg]	Max load [kN] (2) Dynamic	Static	Screws torque
C-14612 (1)	M10x1,25	15	42	$12^{\ 0}_{-0,008}$	18	$10^{\ 0}_{-0,12}$ (3)	8,5	16	19	0,12	10,8	17	10 Nm
C-14614 (1)	M12x1,25	17	48	$16^{\ 0}_{-0,008}$	23	$14^{\ 0}_{-0,12}$ (3)	11,5	20	22	0,22	21,1	28,5	10 Nm
C-14618 (1)	M14x1,5	19	58	$20^{\ 0}_{-0,01}$	28	$16^{\ 0}_{-0,12}$ (3)	13,5	25	28	0,43	30	42,5	25 Nm
C-14622	M16x1,5	23	68	$25^{\ 0}_{-0,01}$	33	$20^{\ 0}_{-0,12}$ (3)	18	30	31	0,67	48	67	25 Nm
C-14628	M20x1,5	29	85	$30^{\ 0}_{-0,01}$	41	$22^{\ 0}_{-0,12}$ (3)	20	35	37	1,25	62	108	49 Nm
C-14636	M27x2	37	105	$40^{\ 0}_{-0,012}$	51	$28^{\ 0}_{-0,12}$ (3)	24	45	47	2,16	100	156	49 Nm
C-14645	M33x2	46	130	$50^{\ 0}_{-0,012}$	61	$35^{\ 0}_{-0,12}$ (3)	31	58	57	3,9	156	245	86 Nm
C-14656	M42x2	57	150	$60^{\ 0}_{-0,015}$	80	$44^{\ 0}_{-0,15}$	39	68	69	7,15	245	380	210 Nm
C-14670	M48x2	64	185	$80^{\ 0}_{-0,015}$	102,5	$55^{\ 0}_{-0,15}$	48	92	91	15	400	585	410 Nm
C-14690	M64x3	86	240	$100^{\ 0}_{-0,02}$	120	$70^{\ 0}_{-0,20}$	57	116	110	27,3	610	865	710 Nm

C-141 - Rod clevis
to ISO 8133

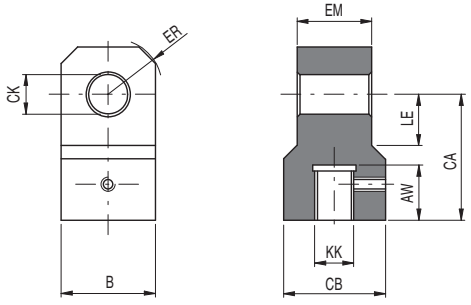
C-145 - Pivot pin



Note: Pivot pin C-145* is included in the supply

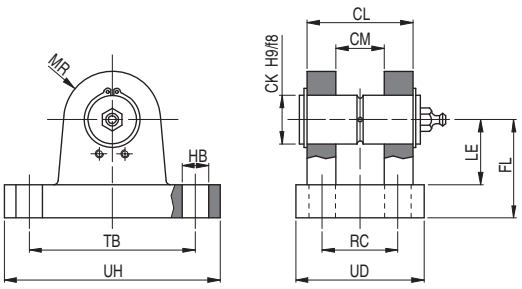
Code	KK	CE JS13	CK H9	CL max	CM A13	EK f8	EL min	ER max	LE min	Mass [kg]	Max load **static** [kN]
C-14112 C-14512	M10x1,25	32	10	26	12	10	29	12	13	0,1	8
C-14112 C-14512	M12x1,25	36	12	34	16	12	37	17	19	0,18	12,5
C-14118 C-14518	M14x1,5	38	14	42	20	14	45	17	19	0,23	20
C-14122 C-14522	M16x1,5	54	20	62	30	20	66	29	32	0,9	32
C-14128 C-14522	M20x1,5	60	20	62	30	20	66	29	32	0,91	50
C-14136 C-14536	M27x2	75	28	83	40	28	87	34	39	1,92	80
C-14145 C-14545	M33x2	99	36	103	50	36	107	50	54	4,92	125
C-14156 C-14556	M42x2	113	45	123	60	45	129	53	57	6,53	200
C-14170 C-14570	M48x2	126	56	143	70	56	149	59	63	10,11	320
C-14190 C-14590	M64x3	168	70	163	80	70	169	78	83	19,2	500

C-151 - Rod eye plain
to ISO 8133



Code	KK	AW min	B	CA JS13	CB max	CK H9	EM h13	ER max	LE min	Mass [kg]	Max load **static** [kN]
C-15112	M10x1,25	14	18	32	18	10	12	12	13	0,08	8
C-15114	M12x1,25	16	22	36	22	12	16	17	19	0,15	12,5
C-15118	M14x1,5	18	25	38	20	14	20	17	19	0,22	20
C-15122	M16x1,5	22	35	54	30	20	30	29	32	0,5	32
C-15128	M20x1,5	28	40	60	30	20	30	29	32	1,1	50
C-15136	M27x2	36	50	75	40	28	40	34	39	1,5	80
C-15145	M33x2	45	70	99	50	36	50	50	54	2,5	125
C-15156	M42x2	56	100	113	65	45	60	53	57	4,2	200
C-15170	M48x2	63	116	126	90	56	70	59	63	11,8	320
C-15190	M64x3	85	160	168	110	70	80	78	83	17	500

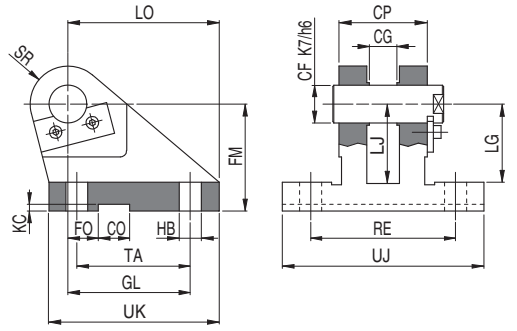
C-124 - Clevis bracket straight
to ISO 8132



Note: Pivot pin and seeger are included in the supply
Supplied with threaded holes for pivot pin locking plate (not included)

Code	CK H9	CL h16	CM A13	FL JS12	HB H13	LE min	MR max	RC JS14	TB JS14	UD max	UH max	Mass [kg]	Max load static [kN]
C-12414	12	28	12	34	9	22	12	20	50	40	70	0,31	8
C-12418	16	36	16	40	11	27	16	26	65	50	90	0,59	12,5
C-12422	20	45	20	45	11	30	20	32	75	58	98	0,9	20
C-12428	25	56	25	55	13,5	37	25	40	85	70	113	1,6	32
C-12436	32	70	32	65	17,5	43	32	50	110	85	143	2,8	50
C-12445	40	90	40	76	22	52	40	65	130	108	170	5	80
C-12456	50	110	50	95	26	65	50	80	170	130	220	10,1	125
C-12470	63	140	63	112	33	75	63	100	210	160	270	15,4	200
C-12490	80	170	80	140	39	95	80	125	250	210	320	30	320
C-124100	100	210	100	180	45	120	100	160	315	260	400	60,2	500

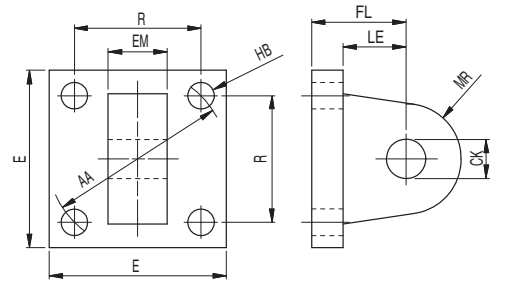
C-134 - Clevis bracket in angle
to DIN 24556 or ISO 8133 with additional machining for dimension CO



Notes:
Pivot pin with locking plate is included in the supply
(1) Not compliant with ISO 8133

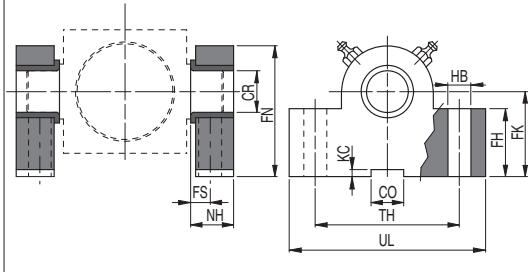
Code	CF H9 (1)	CG +0,1/+0,3	CO H9	CP h14	FM js13	FO	GL JS13	HB H13	KC	LG	LJ min	LO max	RE js13	SR max	TA js13	UJ max	UK max	Mass [kg]	Max load static [kN]
C-13425	12	10	10	30	40	16	46	9	3,3	28	29	56	55	12	40	75	60	0,52	8
C-13432	16	14	16	40	50	18	61	11	4,3	37	38	74	70	16	55	95	80	1,05	12,5
C-13440	20	16	16	50	55	20	64	13,5 (1)	4,3	39	40	80	85	20	58	120	90	1,72	20
C-13450	25	20	25	60	65	22	78	15,5 (1)	5,4	48	49	98	100	25	70	140	110	2,72	32
C-13463	30	22	25	70	85	24	97	17,5 (1)	5,4	62	63	120	115	30	90	160	135	5,15	50
C-13480	40	28	36	80	100	24	123	22	8,4	72	73	148	135	40	120	190	170	9,3	80
C-134100	50	35	36	100	125	35	155	30	8,4	90	92	190	170	50	145	240	215	18,3	125
C-134125	60	44	50	120	150	35	187	39	11,4	108	110	225	200	60	185	270	260	35	200
C-134160	80	55	50	160	190	35	255	45	11,4	140	142	295	240	80	260	320	340	63	320
C-134200	100	70	63	200	210	35	285	48	12,4	150	152	335	300	100	300	400	400	109	500

C-144 - Eye bracket
to ISO 8133



Code	CK H9	AA	E max	EM h13	FL js13	HB H13	LE min	MR max	R js13	Mass [kg]	Max load static [kN]
C-14425	10	40	40	12	23	5,5	13	12	28,3	0,3	8
C-14432	12	47	46	16	29	6,6	19	17	33,2	0,45	12
C-14440	14	59	65	20	29	9	19	17	41,7	0,9	20
C-14450	20	74	79	30	48	13,5	32	29	52,3	1,3	32
C-14463	20	91	91	30	48	13,5	32	29	64,3	1,9	50
C-14480	28	117	118	40	59	17,5	39	34	82,7	4	80
C-144100	36	137	132	50	79	17,5	54	50	96,9	6,25	125
C-144125	45	178	174	60	87	24	57	53	125,9	11,4	200
C-144160	56	219	215	70	103	30	63	59	154,9	20,8	320
C-144200	70	269	256	80	132	33	82	78	190,2	38,8	500

C-154 - Trunnion bracket
(for cylinders whit mounting styles G,H and L)
to ISO 8132

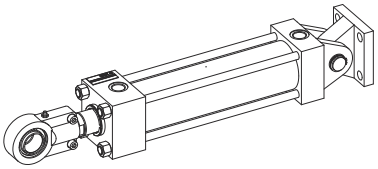


Note: The code includes two trunnion brackets
(1) To ISO 8133

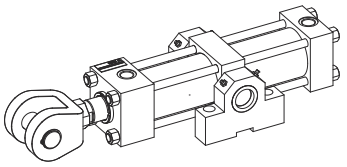
Code	CR H7	CO N9	FH max	FK JS12	FN max	FS js13	HB H13	KC 0/+0,3	NH max	TH js13	UL max	Mass [kg]	Max load static [kN]
C-15425	12	10	25	34	50	8	9	3,3	17	40	63	0,46	8
C-15432	16	16	30	40	60	10	11	4,3	21	50	80	0,83	12,5
C-15440	20	16	38	45	70	10	11	4,3	21	60	90	1,21	20
C-15450	25	25	45	55	80	12	13,5	5,4	26	80	110	2,15	32
C-15463	32	25	52	65	100	15	17,5	5,4	33	110	150	4,63	50
C-15480	40	36	60	76	120	16	22	8,4	41	125	170	7,78	80
C-154100	50	36	75	95	140	20	26	8,4	51	160	210	14,3	125
C-154125	63	50	85	112	180	25	33	11,4	61	200	265	23,4	200
C-154160	80	50	112	140	220	31	39	11,4	81	250	325	53,1	320
C-154200 (1)	100	63	150	200	300	42	52	12,4	101	320	410	112	500

4 EXAMPLES OF ATTACHMENTS

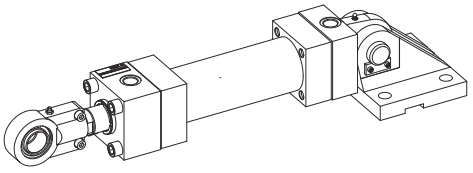
CK - mounting style **C** with rod eye **C-136** and bracket **C-144**



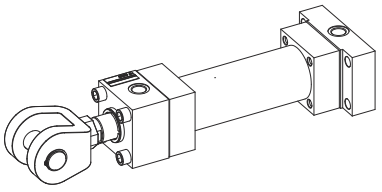
CK - mounting style **L** with rod clevis **C-141** and bracket **C-154**



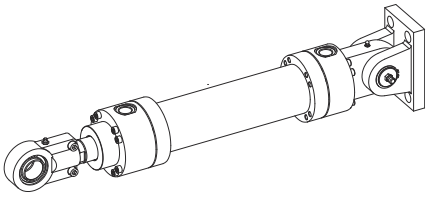
CH - mounting style **S** with rod eye **C-136** and bracket **C-134**



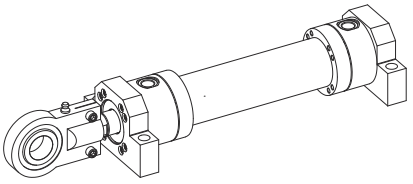
CH - mounting style **P** with rod clevis **C-141**



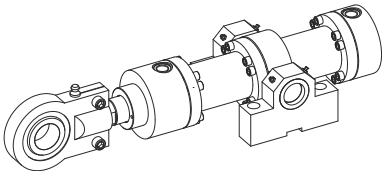
CN - mounting style **S** with rod eye **C-136** and bracket **C-124**



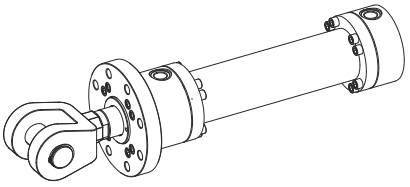
CN - mounting style **E** with rod eye **C-146**



CC - mounting style **L** with rod eye **C-146** and bracket **C-154**



CC - mounting style **A** with rod clevis **C-141**



5 SURFACE TREATMENT

Some attachments are provided with additional surface treatment to increase the corrosion resistance (24h in neutral salt spray), see table below for details. All the attachments, except pivot pin C-145, can be supplied with standard painting RAL 9007 (200h in neutral salt spray) selecting option **-V**, special painting are available on request.

Code	Surface treatment	Code	Surface treatment
 C-136 or C-146	No treatment	 C-124	No treatment
 C-141	No treatment	 C-134	No treatment
 C-151	Black phosphate	 C-144	Black phosphate
 C-145	Black phosphate	 C-154	No treatment

6 GENERAL INFORMATION

INDEX

GENERAL INFORMATION

Basics for electrohydraulics in hazardous environments

1 HAZARDOUS ENVIRONMENTS

"Hazardous Environments" are areas where flammable liquids, gases, vapors or combustible dust exist in sufficient quantities to produce explosions or fire.

Oil & gas, chemical, mining and power plants are highly-sensitive environments where the presence of a potentially explosive atmosphere can accidentally or permanently occur.
In these environments an accidental failure or a wrong operation could cause the ignition of the surrounding explosive atmosphere with fatal consequences for human and goods safety, therefore all electrohydraulic equipment operating in these areas must be suitable for hazardous environments and must be certified according to international standards.

The purpose of this document is to provide general information about worldwide certifications for hazardous environments and relevant classifications

Typical hazardous environments can be found in the following sectors:

Presence of Gas and Vapors		**Presence of Combustible Dust**	
	Oil & Gas Offshore drilling		Feed industry Grain handling and storage
	Oil refineries Power plants Chemical plants LNG plants		Chemical & fertilizers Pharmaceutical
	Petroleum & LNG vessels		Wood & paper
	Aerospace industry		Metal processing
	Coal mines		Recycling operations

2 CERTIFICATIONS

Equipment with electrical parts designed for hazardous environments must be certified by third parties (notified bodies) in compliance with international standards for explosion protection.

There are several certifications concerning explosive environments and they are governed by local laws of the countries where they are applied.

In all certifications the basic principles for explosion protection are strictly regulated by severe international standards for explosion protection, as European norms EN60079 or North American NEC500 and 505.
These norms impose specific construction criteria and protection methods for the machinery and components to be used in potentially explosive areas.

ATOS CERTIFICATIONS
see section 3 for details

ATEX Europe

IECEx international

Russia

North America

PESO India

China

Canada

Brazil

Korea

WORLDWIDE CERTIFICATIONS

The following map shows the main certifications with the relative countries where they are most widely applied.
International certification IECEx is recognized worldwide even in countries where local certifications exist.

3 CERTIFICATIONS FOR ATOS EX PROOF AND INTRINSICALLY SAFE COMPONENTS

Atos ex-proof and Intrinsically safe components are certified with major international certifications, as listed in the following.

Note: see technical table of each specific Atos component to verifiy the available certifications

MULTICERTIFICATION

Multicertifications is a great plus offered by Atos, where the same component is provided with the following certifications:

ATEX Directive 2014/34/EU, equipment and protective system intended for use in potentially explosive atmosphere
It defines the manufacturing criteria and the safety requirements of the equipment used in potentially explosive environments for presence of gas or flammable dusts, within the European Union.
The Directive provides the classification and marking of components to EN 60079 harmonized norms.

IECEx International Electrotechnical Commission Explosive
International program for the safety of the equipment installed in a potentially explosive atmosphere, required to access international markets. IECEx provides certification of conformity for electrical equipment and machinery to be used in potential explosive environments and it is based on IEC 60079 standards. The objective of the IECEx is to facilitate international trade of equipment for use in explosive atmospheres.

EAC Eurasian Certification
It is applicable to the Customs Union Territory Including Russia, Kazakhstan, Belarus, Armenia and Kyrgyzstan
It indicates the compliance with the Customs Union Technical Regulation TP TC 012/2011 “safety of equipment intended for use in explosive atmospheres” and it acknowledges the whole ATEX Directive 2014/34/EU.

PESO Petroleum and Explosive Safety Organization (earlier known as CCoE)
It approves products distributed within Indian territory for suitability in usage at petroleum or in any place with potentially explosive atmosphere. It is based on harmonized norms and international standards under ATEX and IECEx.
Atos multicertified ex-proof valves for gas group II are also certified Peso.

cULus North American Certification
It is a widely recognized certification across North America (US and Canada).
It provides certification of conformity for equipment and machinery installed in locations where explosion or fire hazards exist due to the presence of flammable gases, combustible dust, or ignitable fibers. It is based on NEC standards

MA safety certificate of approval for mining products
Chinese authority for certification of components operating in chinese coal mines.
It acknowledges the harmonized norms and international standards under ATEX and IECEx.

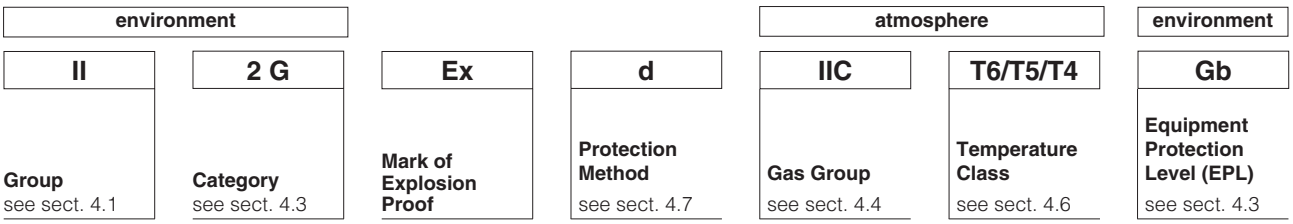
The following sections describe the various classifications related to hazardous environments according to certifications available for Atos components.
The classification is marked on the nameplate of each certified component to state its conformity to the specific hazardous environment and explosive atmosphere.

See section 4 for classifications to **ATEX, IECEx, EAC, PESO**

See section 5 for classifications to **cULus**

4 CLASSIFICATIONS TO ATEX, IECEx, EAC, PESO

The classifications reported in the following sections are those established by the EN and IEC standards related to ATEX and IECEx.
EAC and PESO certifications acknowledge the same classification system of ATEX and IECEx.
An example of classification present on the component nameplate iso shown in the following:



Once the user has classified the area in which the component is intended to be placed, he will be able to define the level of protection of the component.

The evaluation of the risk and consequentially the level of protection required by the equipment passes through two main classifications:

A- Environment: the classification is referred to the location in which the product is intended to be placed
Environment is further classified in **Group** and **Zone**.

B- Atmosphere: the classification is referred to the type of explosive substance present in the atmosphere
Atmosphere is further classified in **Gas Group**, **Dust Group** and **Temperature**.

A- ENVIRONMENT

4.1 Group classification

Explosive environments are classified into **Group I** for underground mines, and **Group II** for surface areas

4.2 Zone classification - The Zone classification is not reported on the component nameplate
Explosive environments are classified into **Zone**, identified **0, 1, 2** for **Gas**, and **20, 21, 22** for **Dust**, depending on the time and frequency the explosive substance is present: Zone 2 and 22 are less dangerous than 0, 1 or 20, 21.
Components certified for Zone 0 (or 20) may also be used in Zone 1, 2 (or 21, 22).

4.3 Safety level required: Category and EPL

The Zone is directly linked with the safety level required; a zone with higher risk requires a higher safety level. There are two different classifications: **Category** and **EPL**

Category: ATEX classifies the safety required level into **Category 1, 2, 3** accompanied with letter **G** for gas and letter **D** for Dust: Category 1G (or 1D) are safer than 2G, 3G (or 2D, 3D).
Components certified for Category 1 may also be used where Category 2 or 3 is needed.
For Group I the classification is **Category M1** or **M2** with M1 safer than M2.

EPL: IECEx classifies the safety level required into **Equipment Protection Level (EPL) a, b, c** anticipated by letter **G** for gas and **D** for dust depending on the safety level required: Category Ga (or Da) are safer than Gb, Gc (or Db, Dc).

Components certified for EPL Ga (or Da) may also be used where EPL Gb, Gc (or Db, Dc) is needed.

Environment classification

Explosive Atmosphere	Group see 4.1	Zone see 4.2	Safety level required see 4.3		Atos component
			Category	EPL	
Gas (mining)	I	-	M1	-	
	I	-	M2		① ③
Gas (surface)	II	0	1G	Ga	④
		1	2G	Gb	② ⑤
		2	3G	Gc	② ⑤
Dust	II	20	1D	Da	
	II	21	2D	Db	② ⑤
		22	3D	Dc	② ⑤

HIGHER PROTECTION

① Atos ex-proof (mining) ② Atos ex-proof (gas & dust) ③ Atos intrinsically safe (mining) ④ Atos intrinsically safe (gas)

⑤ Pumps and cylinders

B- ATMOSPHERE

4.4 Gas Group classification

The classification is based on the minimum ignition energy of the explosive atmosphere in which a component may be installed.
The **Gas Groups** are identified **IIA, IIB, IIC** depending on the dangerousness of the substances: group IIA is less dangerous than group IIB and IIC. Components certified for Gas Group IIC may also be used in less dangerous Groups IIB and IIA

4.5 Dust group classification

The classification is based on nominal dimensions and electrical resistivity of particles.
The **Dust Groups** are identified **IIIA, IIIB** and **IIIC**, depending on the dangerousness of the substances: group IIIC contains smaller and less electrically resistive substances than group IIIB and IIIA. Components certified for Dust Group IIIC may also be used in less dangerous Groups IIIB and IIIA.

4.6 Temperature class

Based on their maximum surface temperature, the components are classified into **Temperature Classes T1** to **T6** for Gas, whereas for Dust the max surface temperature is directly reported in **°C**. The maximum surface temperature of the component must be lower than the ignition temperature of the surrounding explosive atmosphere.
Components certified with Temperature Class T6 may also be used in lower Classes T5 to T1

Atmosphere and Temperature class

Gas Group	Gas type					
IIC	Hydrogen	Acetylene				Carbon disulphide
IIB	City gas Acrylic Nitrile	Ethylene	Ethyl glycol Carbon hydrogen	Ethyl ether		
IIA	Ammonia Methane Ethane Propane	Ethanol n-Butane	Petrol Diesel fuel Fuel oil n-Hexane	Acetal-dehyde		
Temperature class	**T1** < 450°C	**T2** < 300°C	**T3** < 200°C	**T4** < 135°C	**T5** < 100°C	**T6** < 85°C

HIGHER PROTECTION

HIGHER PROTECTION

Note: the Temperature class may change depending on the max ambient temperature where the component is installed. In this case two or three different T are reported on the components nameplate (i.e. T6/T5/T4). See technical table of each specific Atos component for Temperature class.

Dust Group	Dust type
IIIC	Conductive dust
IIIB	Non conductive dust
IIIA	Flammable fibers

HIGHER PROTECTION

For dust explosion proof, the max surface temperature is directly shown (e.g. T85°C)

4.7 Protection method

The ignition of the surrounding explosive atmosphere can be prevented adopting for the component a proper protection method.
The protection method is directly linked to the design and manufacturing characteristics of the component.
The table below reports the **Code** related to the protection method adopted along with the relative **Zone** of application.

HIGHER PROTECTION ← HIGHER PROTECTION

Protection principle	Protection method	Code		Zone						Atos component
				Gas			Dust			
				0	1	2	20	21	22	
Prevents transmission of the explosion outside	Flameproof enclosure	Ex d	da	X	X	X	X	X	X	
			db		X	X				① ②
			dc			X				
Dust explosion proof	Protection by enclosure	Ex t	ta				X	X	X	
			tb					X	X	②
			tc						X	
Low current / voltage supply	Intrinsically safe	Ex i	ia	X	X	X				③ ④
			ib		X	X				
			tc			X				
Non-electrical	Construction safety Control of igniction sources Protection by liquid immersion	Ex h	c b k		X	X		X	X	⑤

① Atos ex-proof (mining) ② Atos ex-proof (gas & dust) ③ Atos intrinsically safe (mining) ④ Atos intrinsically safe (gas)

⑤ Pumps and cylinders

4.8 Painting

According to EN60079-0 the valves can be coated with a non-metallic material (i.e. painting), observing the maximum thickness:

Group IIC < 0,2 mm max
Group IIB < 0,3 mm max
Group IIA < 0,3 mm max

5 CLASSIFICATIONS TO cULus

The classification of explosive environments in cULus certification is regulated by NEC Standards (National Electric Code) and it is based on NEC 500 and NEC 505 articles.

NEC 500 covers the requirements for the classification system in Classes I, II, II and Divisions 1 and 2.

NEC 505 covers the requirements for the classification system in Zones (Zone 0, 1, and 2) as alternative to the NEC 500.

An example of classification present on the component nameplate is shown in the following:

NEC 500

Class I	Division I	Groups C & D	T6/T5
see sect. 5.1	see sect. 5.3	**Gas Groups** see sect. 5.2	**Temperature Class** see sect. 5.5

NEC 505

Class I	Zone I	Groups IIA & IIB	T6/T5
see sect. 5.1	see sect. 5.4	**Gas Groups** see sect. 5.2	**Temperature Class** see sect. 5.5

5.1 Class classification - NEC 500 and NEC 505

Location where explosive substances are present in the atmosphere are classified as:
Class I where flammable vapors and gases may be present
Class II and **Class III** where combustible dust and easily ignitable fibers may be present

5.2 Group classification

NEC 500: based on the ignition temperatures and explosion pressure, NEC 500 classifies gases and dust into Groups, identifying **Group A, B, C, D** for **Gases** and **Group E, F, G** for **Dusts**. Group D (or G) is less dangerous than Groups A, B, C (or E, F).
Components certified with Group A (or E) may also be used in lower Group B to D (or F to G).

NEC 505: the Gas Groups have the same classifications as per IECEx, as reported in the following table for comparison with NEC 500.

Explosive atmosphere	Typical hazard material	Class	Group		Atos component
			NEC 500	NEC 505	
Gases, vapors and liquids	Acetylene	Class I	A	IIC	
	Hydrogen, Butadiene, Ethylene Oxide, Propylene Oxide	Class I	B	IIC or IIB+H2	
	Ethylene, Formaldehyde, Cyclopropane, Ethyl Ether, etc	Class I	C	IIB	①
	Methane, Butane, Petrol, Natural gas, Propane, Gasoline	Class I	D	IIA	
Dusts	Metallic dusts (conductive and explosive)	Class II	E	IIIC	
	Coal dusts (some are conductive and all are explosive)	Class II	F	IIIC	
	Grain dust	Class II	G	IIIB	
Solid combustible, fibres and particles	Textile products, wood, paper, cotton processing (easily flammable, but does not risk to be explosive)	Class III	-	IIIA	

HIGHER PROTECTION

① Atos ex-proof

5.3 Division classification – only for NEC 500 Standard

Each of the three Classes described in section 5.1 is further subdivided into two Divisions:

Division 1 includes explosive substances that are continuously, intermittently or periodically present in the atmosphere.
The ignitable concentrations of above substances exist under normal conditions or it is caused by frequent maintenance or by equipment failure.

Division 2 includes explosive substances present under “unusual” circumstances.
Above substances are normally contained into sealed containers or into closed systems from which they can only escape through accidental rupture or breakdowns of such containers.

The installation and requirements for **Division 1** are more restrictive than for **Division 2**.
Components certified with Division 1 may also be used when Division 2 is required.

5.4 Zone classification – only for NEC 505 Standard

NEC 505 Standard introduces the Zone classification:

Zone 0 defines locations in which an explosive gas is present continuously or for long periods during normal operation.

Zone 1 defines locations in which ignitable concentrations of gas exist under normal operation or it is caused by frequent maintenance or equipment failure.

Zone 2 defines the area in which an explosive gas is not likely to occur or it will exist only for a short time

Component certified with Zone 0 may be used when Zone 1 is required.

The following table reports a comparison between Division classification to NEC 500 and Zone classification to NEC 505 Standards.

	Continuous Hazard	**Intermittent hazard**	**Hazard under abnormal conditions**
NEC 500	Division 1 ①		Division 2
NEC 505	Zone 0 (Zone 20 dust)	Zone 1 (Zone 21 dust) ①	Zone 2 (Zone 22 dust)

① Atos ex-proof /UL

5.5 Temperature classes

The temperature classes designate the maximum operating temperatures of the equipment surface which must not exceed the ignition temperature of the surrounding atmosphere.
The temperature class is marked on the component nameplate.

Products certified with temperature class T6 may also be used in lower classes T5 to T1

Code	**Max surface Temperature**		**Atos component**
	[°C]	**[°F]**	
T6	85	185	①
T5	100	212	②
T4A	120	248	
T4	135	275	③
T3C	160	320	
T3B	165	329	
T3A	180	356	
T3	200	392	④
T2D	215	419	
T2C	230	446	
T2B	260	500	
T2A	280	536	
T2	300	572	
T1	450	842	

HIGHER PROTECTION

Note:

the Temperature class may change depending on the max ambient temperature where the component is installed. In this case two different T are reported on the components nameplate (i.e. T6/T5).
See technical table of each specific Atos component for Temperature Class.

① Atos ex-proof ON-OFF - Tamb up to +55°C

② Atos ex-proof ON-OFF - Tamb from +55°C to +70°C

③ Atos ex-proof proportionals - Tamb up to +55°C

④ Atos ex-proof proportionals - Tamb from +55°C to +70°C

6 ATEX vs. cULus (NEC)

The following tables report a comparison between ATEX and cULus (NEC) classification systems.

Note: due to the different nature Atex and cULus systems, the direct comparison is not fully applicable.
The comparison is just to be used as a general reference for transition from one system to the other.

6.1 Comparison concerning the classification of hazardous environments due to the presence of Gas or Dust

Gas

ATEX	Zone 0	Zone 1	Zone 2
cULus (NEC 505)	Zone 0	Zone 1	Zone 2
cULus (NEC 500)	Class I, Division I		Class I, Division 2

Dust

ATEX	Zone 20	Zone 21	Zone 22
cULus (NEC 505)	Zone 20	Zone 21	Zone 22
cULus (NEC 500)	Class II, Division I		Class II, Division 2

6.2 Comparison concerning the classification of Gas Groups

	Gas type			
	Propane	**Ethylene**	**Hydrogen**	**Acetylene**
ATEX	IIA	IIB	IIC	IIC
cULus (NEC 505)	IIA	IIB	IIC	IIC
cULus (NEC 500)	D	C	B	A

Note: the direct comparison concerning Dust Group is not possible since the classification criteria between ATEX and cULus are consistently different

6.3 Comparison concerning the Temperature Classes for Gas Group II

ATEX	**cULus (NEC 505)**	**cULus (NEC 500)**	**Max surface temperature [°C]**	**Max surface temperature [°F]**
T6	T6	T6	85	185
T5	T5	T5	100	212
		T4A	120	248
T4	T4	T4	135	275
		T3C	160	320
		T3B	165	329
		T3A	180	356
T3	T3	T3	200	392
		T2D	215	419
		T2C	230	446
		T2B	260	500
		T2A	280	536
T2	T2	T2	300	572
T1	T1	T1	450	842

7 ATOS COMPONENTS EXEMPTED FROM CERTIFICATION AND MARKING

Atos hydraulic components made only by mechanical parts and not equipped with electrical functions are exempted from certification because their functioning does not generate dangerous conditions for the explosive environment.

The safe application of these components in hazardous environments is justified by following analysis:

- All the internal parts of the components are separated and insulated from the external environment by means of pressure-proof seals. The internal volumes are filled by the hydraulic fluid, thus there are no volumes which can be saturated by the external explosive atmosphere.
- The operation of mechanical parts does not produce potential sources of ignition of the explosive gas mixture.
- The functioning of the mechanical parts does not create conditions as overheating which may cause the explosion of the surrounding atmosphere.

The following components are included in this range:

- On-off pressure control valves (without solenoid pilot) type CART-*, ARE, ARAM, AGAM, AGIR, AGIS, AGIU, REM
- Flow control valves type QV, AQFR
- Check valves type DB, DR, ADR, ADRL, AGRL, AGRLE
- Modular valves type HMP, HM, KM, HS, KS, HG, KG, JPG, HC, KC, JPC, HQ, KQ,JPQ,HR, KR, JPR (modular fast/slow valves type DHQ and pressure switch type MAP, cannot be used in potentially explosive atmosphere)
- On off Mechanical, Hydraulic, Pneumatic operated valves
- On-off ISO cartridges, type SC LI and ISO functional covers without solenoid pilot valve.

8 INGRESS PROTECTION (IP)

The “Ingress Protection” identifies the environmental protection of a device defined in IEC Standard 60529.
The IP classification system designates, by means of two digits, the degree of protection provided by a device against ingress of dust and water.

FIRST	DEGREE OF PROTECTION AGAINST SOLID OBJECTS	SECOND	DEGREE OF PROTECTION AGAINST WATER	Atos component
0	Non-protected	**0**	Non-protected	
1	Protected against a solid object with diameter greater than 50 mm	**1**	Protected against water dripping vertically, such as condensation	
2	Protected against a solid object with diameter greater than 12 mm	**2**	Protected against dripping water when tilted up to 15°	
3	Protected against a solid object with diameter greater than 2.5 mm	**3**	Protected against water spraying at an angle of up to 60°	
4	Protected against a solid object with diameter greater than 1.0 mm	**4**	Protected against water splashing from any direction	
5	Dust-protected. Prevents ingress of dust sufficient to cause harm	**5**	Protected against jets of water from any direction	
6	Dust tight. No dust ingress	**6**	Protection against heavy seas or powerful jets of water	① ②
		7	Protected against harmful ingress of water when immersed between a depth of 150 mm to 1 meter	①
		8	Protected against submersion. Suitable for continuous immersion in water	

① Atos ex-proof multicertification (mining / surface) = IP66/67 ② Atos intrinsically safe = IP66

The ingress protection of cULus certified components is “Raintight enclosure, UL approved”

8.1 Comparison between IEC and NEMA standards

An equivalent classification of the enclosures degrees of protection, for the USA market, is defined according to NEMA Standard.
Note: the direct comparison is not possible since the classification criteria are consistently different between IEC and NEMA.
The comparison is just to be used as a general reference for transition from one system to another.

NEMA	1	2	3	3X	3R	3RX	3S	3SX	4	4X	5	6	6P	12	12K	13
IEC (IP)	20	22	55		24		55		66		53	67	68	54		

Summary of Atos ex-proof components

multicertified to **ATEX, IECEx, EAC, PESO**

Atos ex-proof components are electrohydraulic equipment for industrial and mobile applications, designed to operate in hazardous environments in presence of flammable liquids, gases, vapors or combustible dust.

They are certified by independent notified bodies in conformity to **ATEX, IECEx, EAC** and **PESO** standards.

1 PRODUCTS RANGE

1.1 PROPORTIONAL and ON-OFF VALVES

The certification for proportional and on-off valves is relevant to solenoids, on-board electronic drivers and transducers.
These components are engineered and manufactured according to protection method **Ex-d** (code **Ex-t** for dust environements), where internal parts are sealed inside a ruggedized **flameproof enclosure**, granting high protection to the risk of explosion, see section 2

The mechanical parts likes body, spools, etc, are strictly derived from highly engineered standard components.
They are not involved in the certification since their functioning does not represent a potential risk for the explosive environment.

Product Category	Component	Driver	Environment	Multicertification				Marking
				ATEX	IECEx	EAC	PESO	
Proportional valves	Servoproportional directionals High preformance directionals Directional valves High performance pressure valves Pressure valves Flow valves	on-board	Gas & Dust	X	X			see sect. 4
		off-board	Gas & Dust	X	X	X	X (only Gas)	see sect. 5
			Mining	X	X			see sect. 7
Axis controls	Servoproportional directionals	on-board	Gas & Dust	X	X			see sect. 4
On-off valves	Directional valves Pressure relief valves	-	Gas & Dust	X	X	X	X (only Gas)	see sect. 6
			Mining	X	X			see sect. 8

1.2 PUMPS and CYLINDERS

Hydraulic components without electrical parts are also subject to the requirements of ATEX Directive 2014/34/EU, but the certification is not mandatory (it can be performed on voluntary basis).

PVPCA variable displacement axial piston pumps, PFEA fixed displacement vane pumps and CKA hydraulic cylinders, are ATEX certified to **Ex-h** protection.The protection method Ex-h combines the characteristics of construction safety (Ex-c), control of ignition source (Ex-b) and protection by liquid immersion (Ex-k)

Product Category	Component	Environment	Certification	Marking
Pumps	PVPCA - variable displacement piston pumps PFEA - fixed displacement vane pumps	Gas & Dust	ATEX	see sect. 9
Cylinder	CKA - hydraulic cylinders CKAM - hydraulic servocylinders	Gas & Dust	ATEX	see sect. 10

2 FLAMEPROOF ENCLOSURE - Ex-d

Technical characteristics

It is characterized by a strong mechanical construction, capable of withstanding the overpressure caused by a potential internal explosion and preventing the spread of flames to the external environment. It permits to dissipate the heat generated by the solenoid and driver power, in order to limit the surface temperature within certified classes (T6, T5, etc), to avoid the self-ignition of the surrounding flammable atmosphere.
The rugged design of the flameproof enclosure, combined with IP66/67 ingress protection, makes the ex-proof valves suited for application in harsh environments.

Electrical wiring

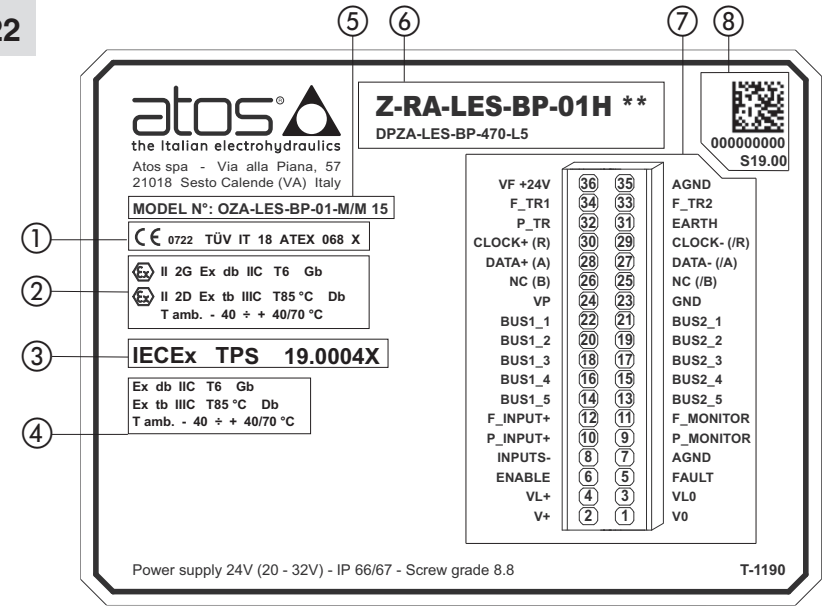
The electrical wiring to the terminal board of ex-proof solenoids, on-board digital drivers and transducers must be performed using ex-proof certified cable glands, see tech. table KX600.
Electric cables must be approved for the specific temperature class reported on the ex-proof component's nameplate, refer to specific tech. table of ex-proof valves for cable temperature.

3 NAMEPLATE MARKING

The ex-proof certified components are provided with a specific nameplate reporting the certificate number, the notified body and the classification according to the relevant certification.
The classification identifies the protection method and the compatibility of the ex-proof component for a specific hazardous environment.
The following sections provide a detailed description of the nameplate marking for component categories.

Driver nameplate marking to ATEX and IECEx

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22



① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ Code of solenoid
⑥ Code of on-board driver and related proportional valve
⑦ Electronic connections
⑧ Qr code and driver serial number

ATEX / IECEX classification - for Gas group II

II 2 G	Ex	d	IIC	T6/T5/T4	Gb
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C **T4** ≤ 135°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone1)

ATEX / IECEX classification - for Dust

II 2 D	Ex	tb	IIIC	T85/T100/T135	Db
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **tb** Protection by enclosure	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T85** ≤ 85°C **T100** ≤ 100°C **T135** ≤ 135°C	**Equipment Protection Level** **Db** High protection (Dust, Zone21)

RELATED DOCUMENTATION

Servoproportional directional - zero overlap with LVDT transducer

FX150 DLHZA-TES, DLKZA-TES - direct, sleeve execution
FX135 DHZA-TES, DKZA-TES - direct
FX235 DPZA-LES, piloted
FX380 LIQZA-LES, 3-way cartridge

High performance directional - positive overlap with LVDT transducer

FX130 DHZA-TES, DKZA-TES - direct
FX230 DPZA-LES - piloted
FX360 LIQZA-LES, 2-way cartridge

Directional valves - positive overlap without transducer

FX110 DHZA-AES, DKZA-AES - direct
FX210 DPZA-AES - piloted

High performance pressure valves - with pressure transducer

FX030 RZMA-RES, AGMZA-RES - relieft
FX060 RZGA-RES, AGRCZA-RES - reducing
FX320 LIMZA-RES, LIRZA-RES, LICZA-RES - relief, reducing, compensator

Pressure valves - without transducer

FX020 RZMA-AES, AGMZA-AES - relief
FX050 RZGA-AES, AGRCZA-AES - reducing
FX080 DHRZA-AES - reducing
FX310 LIMZA-AES - relief
LIRZA-AES - reducing
LICZA-AES - compensator

Flow valves, pressure compensated

FX430 QVHZA-TES, QVKZA-TES - with LVDT transducer
FX410 QVHZA-AES, QVKZA-AES - without transducer

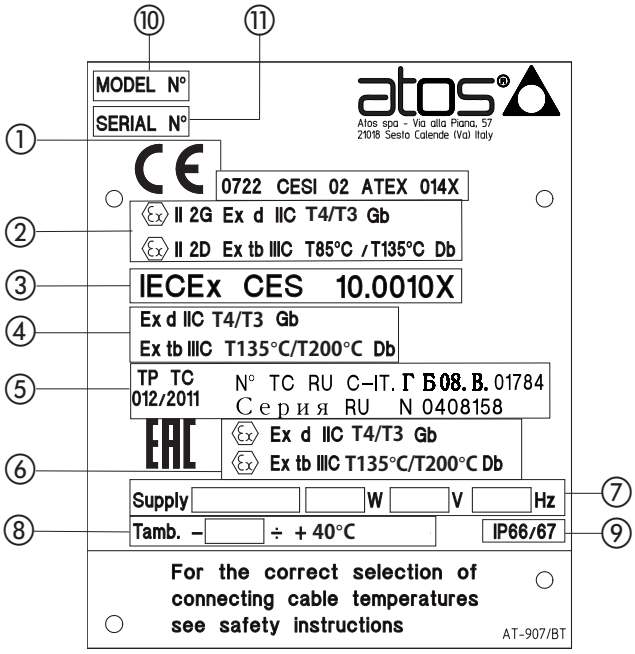
Servoproportional valves with on-board axis controller

FX610 DLHZA-TEZ, DLKZA-TEZ – direct, sleeve execution
FX620 DHZA-TEZ, DKZA-TEZ - direct
FX630 DPZA-LEZ - piloted

Solenoid nameplate marking to ATEX, IECEx, EAC and PESO

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22

① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ EAC notified body and certificate number
⑥ Marking according to EAC
⑦ Power supply characteristics
⑧ Ambient temperature
⑨ Ingress protection:
-IP66 = no dust ingress, protection against heaving seas or powerful jets of water
-IP67 = no dust ingress, protection to water immersion
⑩ Solenoid model code
⑪ Solenoid serial number



Note: PESO certificate number is not reported on the component nameplate, it is reported in the components technical table.
The certificate can be downloaded from www.atos.com

ATEX / IECEX / EAC / PESO classification - for Gas group II

II 2 G	Ex	d	IIC	T4 / T3	Gb
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T4** ≤ 135°C **T3** ≤ 200°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone1)

ATEX / IECEx / EAC classification - for Dust

II 2 D	Ex	tb	IIIC	T135 / T200	Db
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **tb** Protection by enclosure	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T85** ≤ 135°C **T135** ≤ 200°C	**Equipment Protection Level** **Db** High protection (Dust, Zone21)

RELATED DOCUMENTATION

Servoproportional directional - zero overlap with LVDT transducer
FX140 DLHZA-T DLKZA-T - direct, sleeve execution
FX370 LIQZA-L, 3-way cartridge

High performance directional - positive overlap with LVDT transducer
FX120 DHZA-T, DKZA-T - direct
FX220 DPZA-T - piloted
FX350 LIQZA-L, 2-way cartridge

Directional valves - positive overlap without transducer
FX100 DHZA-A, DKZA-A - direct
FX200 DPZA-A - piloted

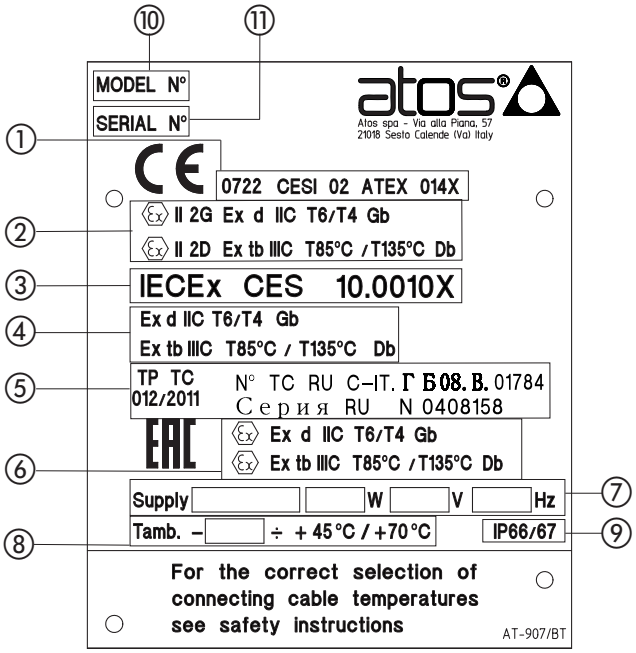
Pressure valves - without pressure transducer
FX010 RZMA-A, HZMA-A, AGMZA-A - relief
FX040 RZGA-A, AGRCZA-A, HZGA-A, KZGA-A - reducing
FX070 DHRZA-A - reducing
FX300 LIMZA-A - relief
LIRZA-A - reducing
LICZA-A - compensator

Flow valves, pressure compensated
FX420 QVHZA-T, QVKZA-T - with LVDT transducer
FX400 QVHZA-A, QVKZA-A - without transducer

Nameplate marking to ATEX, IECEx, EAC and PESO

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22

① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ EAC notified body and certificate number
⑥ Marking according to EAC
⑦ Power supply characteristics
⑧ Ambient temperature
⑨ Ingress protection:
-IP66 = no dust ingress, protection against heaving seas or powerful jets of water
-IP67 = no dust ingress, protection to water immersion
⑩ Solenoid model code
⑪ Solenoid serial number



Note: PESO certificate number is not reported on the component nameplate, it is reported in the components technical table.
The certificate can be downloaded from www.atos.com

ATEX / IECEX / EAC / PESO classification - for Gas group II

II 2 G	Ex	d	IIC	T6 / T4	Gb
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T4** ≤ 135°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone1)

ATEX / IECEx / EAC classification - for Dust

II 2 D	Ex	tb	IIIC	T85 / T135	Db
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **tb** Protection by enclosure	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T85** ≤ 85°C **T135** ≤ 135°C	**Equipment Protection Level** **Db** High protection (Dust, Zone21)

RELATED DOCUMENTATION

Directional valves

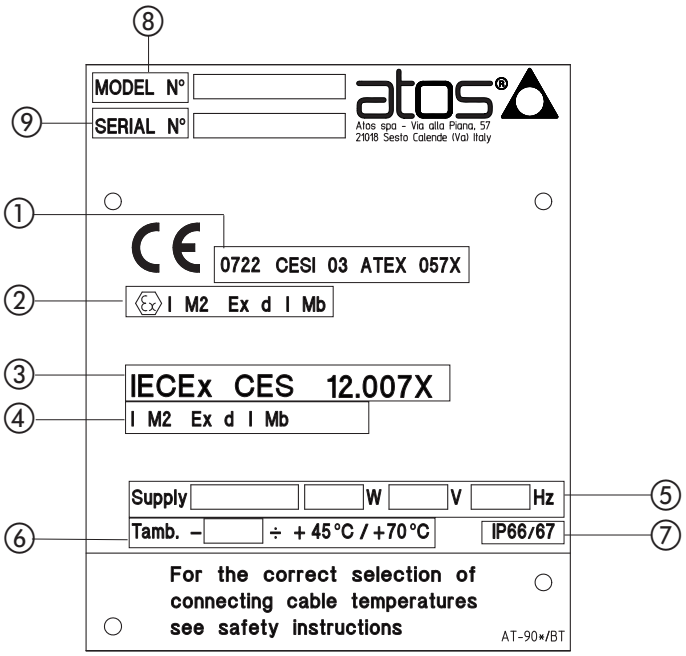
EX010 DHA - direct, spool type
EX020 DLAH, DLAHM - direct, poppet type
CART-LAH, CART-LAHM - cartridge screw-in, direct, poppet type
EX030 DPHA – piloted, spool type
EX050 LIDEW-AO, LIDBH-AO - piloted ISO cartridges and functional covers

Pressure relief valves

CX070 AGAM-AO, ARAM-AO - piloted, with solenoid valve for venting

Nameplate marking to ATEX and IECEx

Gas - group I M2 - Mining



1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. IECEx notified body and certificate number
4. Marking according to IECEx Scheme
5. Power supply characteristics
6. Ambient temperature
7. Ingress protection:
   - -IP66 = no dust ingress, protection against heaving seas or powerful jets of water
   - -IP67 = no dust ingress, protection to water immersion
8. Solenoid model code
9. Solenoid serial number

ATEX, IECEx classification - for Gas group I - Mining

I M2	Ex	d	I	Mb
Equipment Group **I** mines **Equipment Category** **M2** High Protection	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection (de-energized with gas presence)

RELATED DOCUMENTATION

Servoproportional directional - zero overlap with LVDT transducer

FX140 DLHZA/M-T DLKZA/M-T – direct, sleeve execution

High performance directional - positive overlap with LVDT transducer

FX120 DHZA/M-T, DKZA/M-T – direct

Directional valves - positive overlap without transducer

FX100 DHZA/M-A, DKZA/M-A - direct
FX200 DPZA/M-A - piloted

Pressure valves - without pressure transducer

FX010 RZMA/M-A, HZMA/M-A, AGMZA/M-A - relief
FX040 RZGA/M-A, AGRCZA/M-A, HZGA/M-A, KZGA/M-A - reducing
FX070 DHRZA/M-A - reducing
FX300 LIMZA/M-A - relief
LIRZA/M-A - reducing
LICZA/M-A - compensator

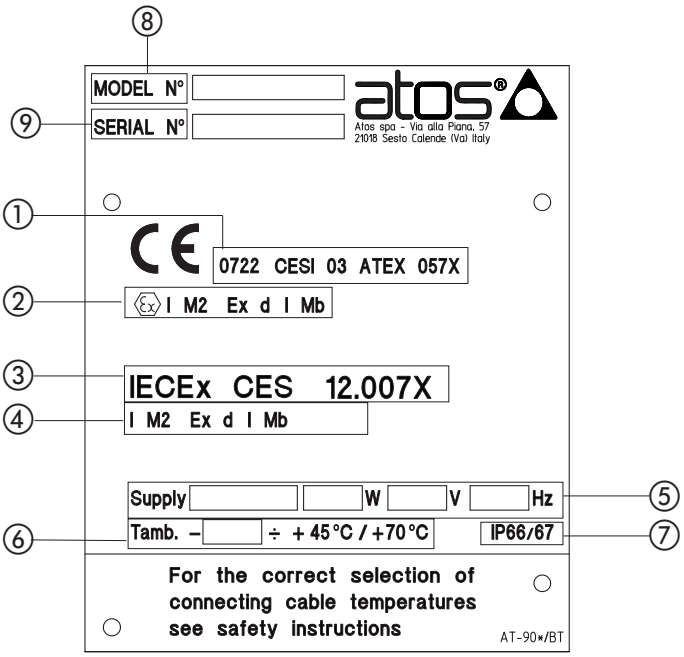
Flow valves, pressure compensated

FX420 QVHZA/M-T, QVKZA/M-T - with LVDT transducer
FX400 QVHZA/M-A, QVKZA/M-A - without transducer

Nameplate marking to ATEX and IECEx

Gas - group I M2 - Mining

① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ Power supply characteristics
⑥ Ambient temperature
⑦ Ingress protection:
-IP66 = no dust ingress, protection against heaving seas or powerful jets of water
-IP67 = no dust ingress, protection to water immersion
⑧ Solenoid model code
⑨ Solenoid serial number



ATEX, IECEx classification - for Gas group I - Mining

I M2	Ex	d	I	Mb
Equipment Group **I** mines **Equipment Category** **M2** High Protection	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection (de-energized with gas presence)

RELATED DOCUMENTATION

Directional valves

EX010 DHA/M - direct, spool type
EX020 DLAH/M, DLAHM/M - direct, poppet type
CART-LAH/M, CART-LAHM/M - cartridge screw-in, direct, poppet type
EX030 DPHA/M - piloted, spool type
EX050 LIDEW-AO/M, LIDBH-AO/M - piloted ISO cartridges and functional covers

Pressure relief valves

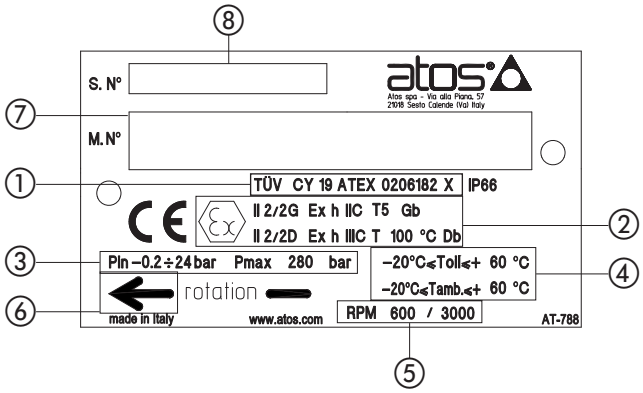
CX070 AGAM-AO/M, ARAM-AO/M - piloted, with solenoid valve for venting

Nameplate marking to ATEX and IECEx

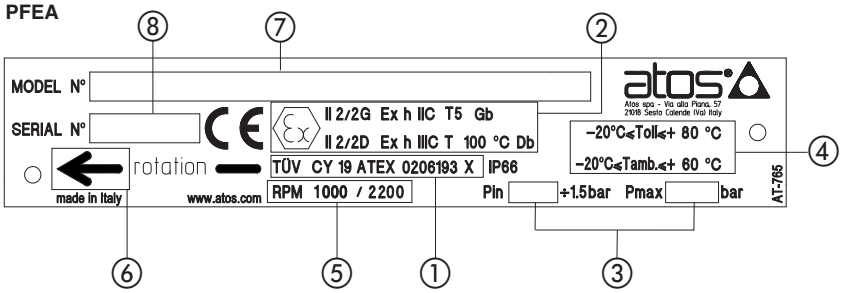
Gas - group II 2/2G - Zone 1, 2
Dust - group II 2/2D - Zone 21, 22

PVPCA

① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ Inlet pressure and max delivery pressure
④ Oil and Ambient temperature range
⑤ Rotation speed referred to function with mineral oil for other fluid consult Atos technical office
⑥ Direction of rotation
⑦ Pump model code
⑧ Pump serial number



PFEA



ATEX classification - for Gas group II

II 2/2 G	Ex	h	IIC	T5	Gb
Equipment Group **II** industrial **Equipment Category** **2/2** (1) **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **h** Protection including c=constructional safety b=control of ignition source k=protection by liquid immersion	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T5** ≤ 100°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone 1)

ATEX classification - for Dust

II 2/2 D	Ex	h	IIIC	T100	Db
Equipment Group **II** industrial **Equipment Category** **2/2** (1) **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **h** Protection including c=constructional safety b=control of ignition source k=protection by liquid immersion	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T100** ≤ 100°C	**Equipment Protection Level** **Db** High protection (Dust, Zone 21)

(1) Equipment of category 2 to be associated with a device (electric motor) of category 2

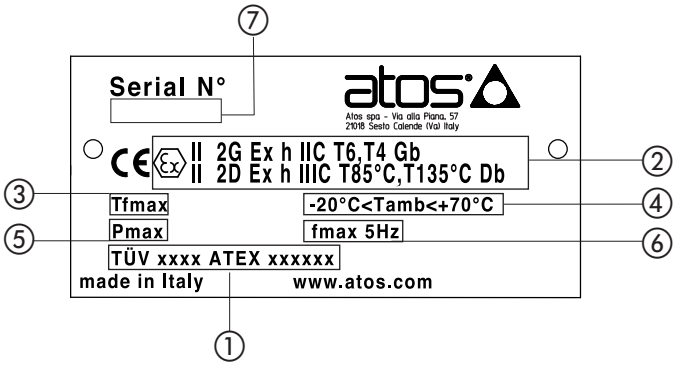
RELATED DOCUMENTATION

AX010	PVPCA - variable displacement axial piston pumps PFEA - fixed displacement vane pumps

Nameplate marking to ATEX and IECEx

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22

① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ Max fluid temperature
④ Ambient temperature range
⑤ Max working pressure
⑥ Max working frequency
⑦ Cylinder serial number



ATEX - for Gas group II

II 2 G	Ex	h	IIC	T6 / T4	Gb
Equipment Group **II** industrial **Equipment Category** **2** High protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **h** Protection including c=constructional safety b=control of ignition source k=protection by liquid immersion	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T4** ≤ 135°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone 1)

ATEX - for Dust

II 2 D	Ex	h	IIIC	T85 / T135	Db
Equipment Group **II** industrial **Equipment Category** **2** High protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **h** Protection including c=constructional safety b=control of ignition source k=protection by liquid immersion	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T85** ≤ 85°C **T135** ≤ 135°C	**Equipment Protection Level** **Db** High protection (Dust, Zone 21)

RELATED DOCUMENTATION

BX500 CKA - cylinders
CKAM - servocylinders with ex-proof digital position transducer

Summary of Atos ex-proof components certified to cULus

Atos cULus ex-proof components are electrohydraulic equipment for industrial and mobile applications, designed to operate in hazardous environments in presence of flammable liquids, gases, vapors or combustible dust.

They are certified by **UL** Underwriters Laboratories in conformity to **UL 1203, UL429, CSA C22.2** and relevant **NEC** standards.

1 PRODUCTS RANGE

Atos cULus certified ex-proof components range includes proportional valves and on-off valves.
The **UL** certification covers all electrical parts of solenoids and LVDT transducers.
These components are engineered and manufactured according to protection method **Ex d**, where internal parts are sealed inside a ruggedized **flameproof enclosure**, granting high protection to the risk of explosion, see section 2

The mechanical parts likes body, spools, etc, are strictly derived from highly engineered standard components.
They are not involved in the certification since their functioning does not represent a potential risk for the explosive environment.

Product Category	Component	Driver	Environment	cULus certification		Marking
				NEC 500	NEC 505	
Proportional valves	Servoproportional directionals High preformance directionals Directional valves High performance pressure valves Pressure valves Flow valves	off-board	Gas	Class I Division I Groups C & D	Class I Zone 1 Groups IIA & IIB	see sect. 4
On-off valves	Directional valves Pressure relief valves	-	Gas			see sect. 5

2 FLAMEPROOF ENCLOSURE - Ex d

Technical characteristics

It is characterized by a strong mechanical construction, capable of withstanding the overpressure caused by a potential internal explosion and preventing the spread of flames to the external environment. It permits to dissipate the heat generated by the solenoid in order to limit the surface temperature within certified classes (T6, T5, etc), to avoid the self-ignition of the surrounding flammable atmosphere.
The rugged design of the flameproof enclosure makes the ex-proof valves suited for application in harsh environments.

Electrical wiring

The electrical wiring to the terminal board of ex-proof solenoids and LVDT transducers must be performed using **UL** certified cable glands, or conduit pipe.
Electric cables must be **UL** approved for the specific temperature class reported on the ex-proof component's nameplate, refer to specific tech. table of ex-proof valves for cable temperature.

3 NAMEPLATE MARKING

Atos cULus certified ex-proof components are provided with a specific nameplate reporting the **UL** certificate number and the classification according to the relevant **NEC 500** and **NEC 505** standards.
The classification identifies the compatibility of the ex-proof component for a specific hazardous environment.
The following sections provide a detailed description of the nameplate marking for proportional and on-off valves.

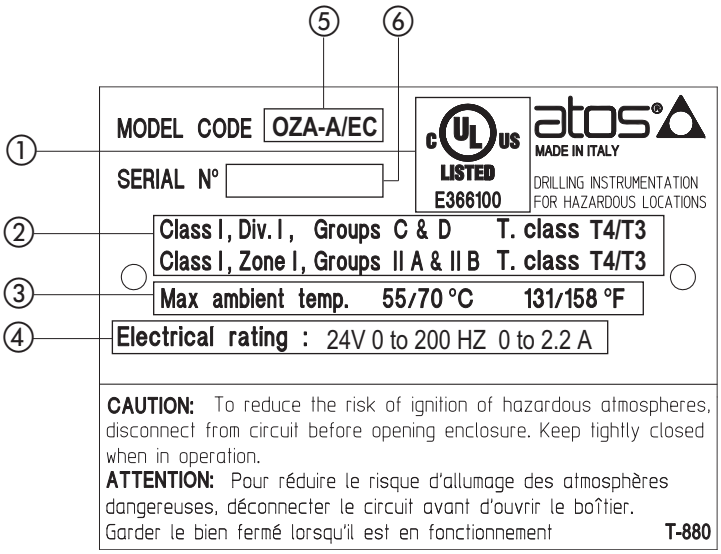
3.1 cULus Listed logo

This type of UL logo indicates compliance with both Canadian and U.S. requirements.
Atos ex-proof components are marked with **cULus Listed** logo stating that they have been investigated by UL Underwriters laboratory in accordance with following standards:

-**UL 1203** Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for use in Hazardous (classified) locations
-**UL 429** Standard for Electrically Operated valves
-**CSA C22.2 No. 139-13** Electrically Operated Valves

Solenoid nameplate marking to NEC 500 and NEC 505

Class I, Division I, Groups C & D
Class I, Zone 1, Groups IIA & IIB



① cULus marking and certificate number
② Marking according to NEC 500 and NEC 505 standards
③ Ambient temperature
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number

NEC 500 classification

Class I	Division I	Groups C & D	T4/T3
Class I Equipment for flamable Gas and Vapors	**Division I** Explosive substances continuosly or intermittently present in the atmosphere	**Gas Group** **C** Methane, Butane, Petrol, etc. **D** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T4** ≤ 135°C **T3** ≤ 200°C

NEC 505 classification

Class I	Zone 1	Groups IIA & IIB	T4/T3
Class I Equipment for flamable Gas and Vapors	**Zone 1** Location where explosive substance are continuosly present	**Gas Group** **IIA** Methane, Butane, Petrol, etc. **IIB** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T4** ≤ 135°C **T3** ≤ 200°C

RELATED DOCUMENTATION

Servoproportional directional - zero overlap with LVDT transducer
FX140 DLHZA/UL-T DLKZA/UL-T - direct, sleeve execution

High performance directional - positive overlap with LVDT transducer
FX120 DHZA/UL-T, DKZA/UL-T - direct

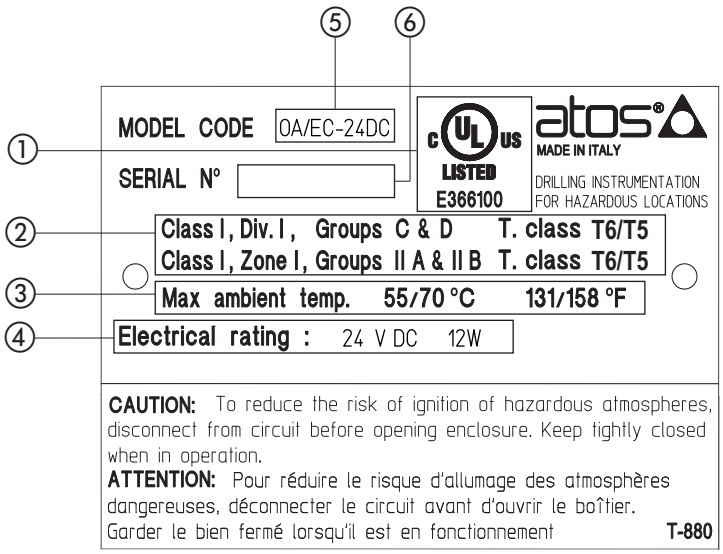
Directional valves - positive overlap without transducer
FX100 DHZA/UL-A, DKZA/UL-A - direct
FX200 DPZA/UL-A - piloted

Pressure valves - without pressure transducer
FX010 RZMA/UL-A, HZMA/UL-A, AGMZA/UL-A - relief
FX040 RZGA/UL-A, AGRCZA/UL-A, HZGA/UL-A, KZGA/UL-A - reducing
FX070 DHRZA/UL-A - reducing
FX300 LIMZA/UL-A - relief
LIRZA/UL-A - reducing
LICZA/UL-A - compensator

Flow valves, pressure compensated
FX420 QVHZA/UL-T, QVKZA/UL-T - with LVDT transducer
FX400 QVHZA/UL-A, QVKZA/UL-A - without transducer

Solenoid nameplate marking to NEC 500 and NEC 505

Class I, Division I, Groups C & D
Class I, Zone 1, Groups IIA & IIB



1. cULus marking and certificate number
2. Marking according to NEC 500 and NEC 505 standards
3. Ambient temperature
4. Power supply characteristics
5. Solenoid model code
6. Solenoid serial number

NEC 500 classification

Class I	Division I	Groups C & D	T6/T5
Class I Equipment for flamable Gas and Vapors	**Division I** Explosive substances continuosly or intermittently present in the atmosphere	**Gas Group** **C** Methane, Butane, Petrol, etc. **D** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C

NEC 505 classification

Class I	Zone 1	Groups IIA & IIB	T6/T5
Class I Equipment for flamable Gas and Vapors	**Zone 1** Location where explosive substance are continuosly present	**Gas Group** **IIA** Methane, Butane, Petrol, etc. **IIB** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C

RELATED DOCUMENTATION

Directional valves

EX010 DHA/UL - direct, spool type
EX020 DLAH/UL, DLAHM/UL - direct, poppet type
CART-LAH/UL, CART-LAHM/UL - cartridge screw-in, direct, poppet type
EX030 DPHA/UL – piloted, spool type
EX050 LIDEW-AO/UL, LIDBH-AO/UL - piloted ISO cartridges and functional covers

Pressure relief valves

CX010 AGAM-AO/UL, ARAM-AO/UL - piloted, with solenoid valve for venting

Summary of Atos ex-proof components certified to MA

Atos MA certified ex-proof components are electrohydraulic equipment designed to operate in hazardous environments of chinese underground mines with presence of methane-air atmosphere or coal dust.

They are certified by an independent notified body in conformity to Chinese Mining Products Safety Approval and Certification Center - **MA Center**.

Official notification by MA Center states that the product under consideration meets the applicable Regulations for the Implementation of the Law of the People's Republic of China on Safety in Mines.

1 PRODUCTS RANGE

Atos MA certified ex-prof range includes on-off solenoid directional valves, direct type.
Atos Sh extended range includes on-off solenoid directional valves, direct & piloted type, plus pressure relief with solenoid pilot.

The MA certification is relevant to the on-off solenoids.
They are engineered and manufactured according to protection method **Ex d**, where internal parts are sealed inside a ruggedized **flameproof enclosure**, granting high protection to the risk of explosion, see section 2 .

The mechanical parts likes body, spools, etc, are strictly derived from highly engineered standard components.
They are not involved in the certification since their functioning does not represent a potential risk for the explosive environment.

Product Category	Component	Environment	MA Certification		Marking
On-off valves	Directional valves, direct & piloted Pressure relief valves	Gas	Ex d I Mb		see sect. 4

2 FLAMEPROOF ENCLOSURE - Ex d

Technical characteristics

It is characterized by a strong mechanical construction, capable of withstanding the overpressure caused by a potential internal explosion and preventing the spread of flames to the external environment. It permits to dissipate the heat generated by the solenoid and driver power, in order to limit the surface temperature, to avoid the self-ignition of the surrounding flammable atmosphere.
The rugged design of the flameproof enclosure, makes the ex-proof valves suited for application in harsh environments.

Electrical wiring

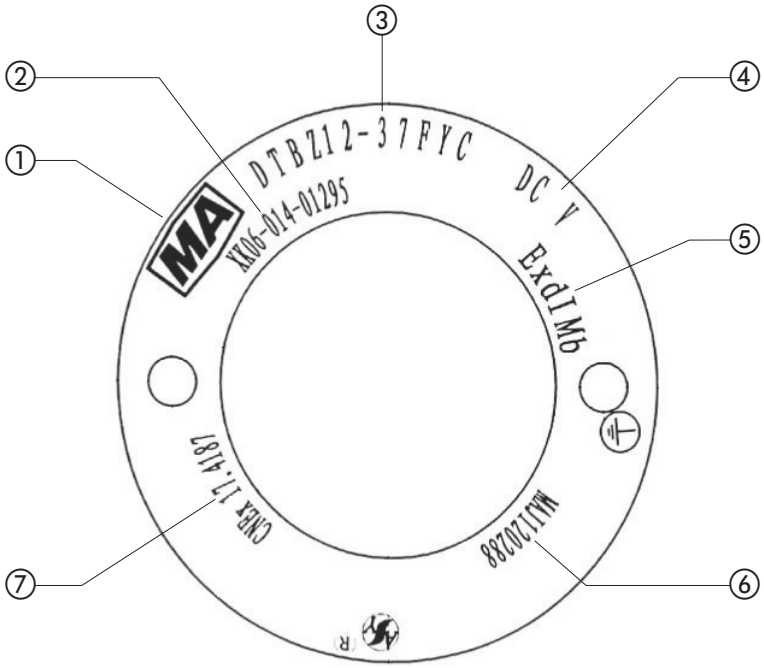
The MA certified ex-proof solenoids are provided with a built-in cable gland for the electrical wiring to the terminal board.

3 NAMEPLATE MARKING

Atos MA certified ex-proof components are provided with a specific nameplate reporting the MA certificate number, the notified body and the classification according to the MA certification.
The classification identifies the protection method and the compatibility of the ex-proof component for mining hazardous environment.
The following section provides a detailed description of the nameplate marking.

Nameplate marking to MA

Gas - group I Mb - Mining



① MA logo
② License
③ Solenoid model code
④ Power supply characteristics
⑤ MA classification for Mining
⑥ MA certificate number
⑦ Notified body and certificate number

MA classification - for Gas group I - Mining

Ex	d	I	Mb
Mark of Explosion Proof	**Protection Method** **d** Flameproof enclosure	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection

RELATED DOCUMENTATION

Directional valves

EX015 DHA/MA - DKA/MA direct, spool type

Directional valves (1)

SHX121 SDHA/MA, SDKA/MA - direct, spool type
SHX121 DPHA/MA - piloted, spool type

Pressure relief valves (1)

SHX121 SAGAM/MA - piloted, with solenoid valve for venting

(1) Atos Sh products range, see www.atos.com

Summary of Atos intrinsically safe components

certified to **ATEX** or **IECEx**

Atos intrinsically safe components are electrohydraulic equipment for industrial and mobile applications, designed to operate in hazardous environments of surface plants or underground mining with presence of flammable liquids, gases, or vapors.

They are designed to grant a very high protection, superior to ex-proof components, and suitable for hazardous environments classified **Zone 0** with high risk of explosion.

They are certified by independent notified bodies in conformity to **ATEX** or **IECEx** standards.

1 PRODUCTS RANGE

Atos intrinsically safe range includes on-off directional valves, pressure relief with solenoid pilot valve and power supply barriers.

1.1 On-off valves

The core of intrinsically safe valves is represented by the intrinsically safe solenoid.
It is engineered, manufactured and certified according to the intrinsically safe protection method **Ex i**, based on the principle of limiting the energy in the electric circuits.
The "intrinsically safe" circuit is virtually unable to produce electrical surges or thermic effects able to cause explosion in hazardous environments also in presence of break-down situations.
The Intrinsically safe equipment cannot release a sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous mixture".
The intrinsically safe solenoids are designed to operate with a very low current and they must be powered by certified intrinsically safe power supply barriers.

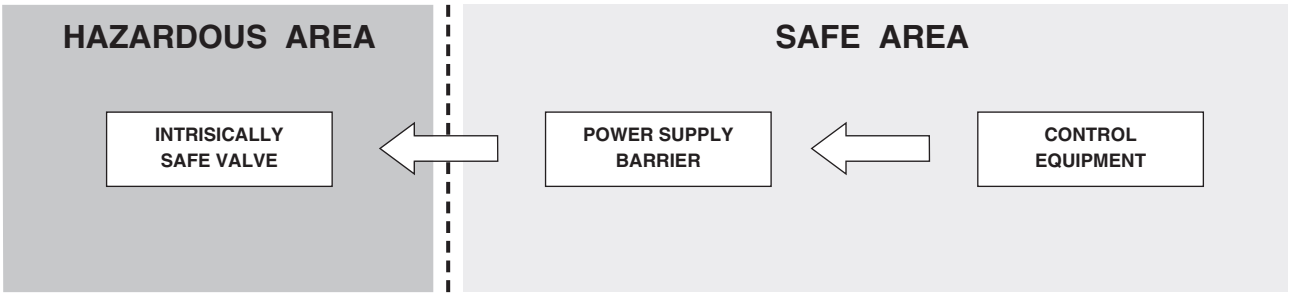
The mechanical parts of the valve likes body, spools, etc, are strictly derived from highly engineered standard components.
They are not involved in the certification since their functioning does not represent a potential risk for the explosive environment.

Product Category	Component	Environment	Certification				Marking
			ATEX Group II	IECEx Group II	ATEX Group I	IECEx Group I	
On-off valves	Directional valves Pressure relief valves	Gas	X				see sect. 3
				X			see sect. 4
		Mining			X		see sect. 5
						X	see sect. 6
Electronics	Power supply bariers	Gas & Dust	X	X			see sect. 7

1.2 Power supply barriers

The electric power supply to the intrinsically safe valves must be operated through electronic devices, to be located outside the hazardous environment.
These devices are usually called “safety barriers” because they limit the electric current to the intrinsically safe solenoid within the classified range, also in case of short circuit.

Atos barriers type Y-BXNE 412 are galvanic isolated electronic devices, designed in compliance with European Norms EN60079-0, EN60079-11 and ATEX certified with **Ex i** protection method – see tech table **GX010**
They ensure the optimized functioning of the Atos intrinsically safe valves up to the max operating limits.



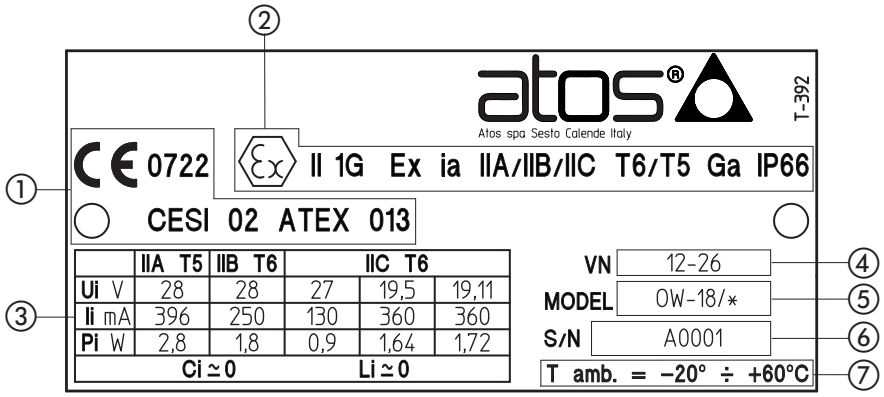
2 NAMEPLATE MARKING

Atos intrinsically safe components are provided with a specific nameplate reporting the ATEX or IECEx certificate number, the notified body and the classification according to the ATEX or IECEx certifications.
The classification identifies the protection method and the compatibility of the intrinsically safe component for a specific hazardous environment.
The following sections provide a detailed description of the nameplate marking for the intrinsically safe valves.

Nameplate marking to ATEX

Gas - group II 1G - Zone 0, 1, 2

① ATEX notified body and certificate nember
② Marking according to ATEX directive
③ Electric characteristics
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number
⑦ Ambient temperature



ATEX classification - for Gas group II

II 1G	Ex	ia	IIA / IIB / IIC	T6 / T5	Ga
Equipment Group **II** Industrial **Equipment Category** **1** Very high protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0)	**Gas Group** **IIA** Ammonia, Methane, Ethane, Propane, etc. **IIB** Citygas, Ethylene, Ethyl glycol, etc. **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C	**Equipment Protection Level** **Ga** Very high protection (Gas Zone 0)

RELATED DOCUMENTATION

Directional valves

EX100 DHW - direct, spool type
EX120 DLWH - direct, poppet type
EX130 DPHW - piloted, spool type
EX150 LIDEW-WO, LIDBH-WO - piloted ISO cartridges and functional covers

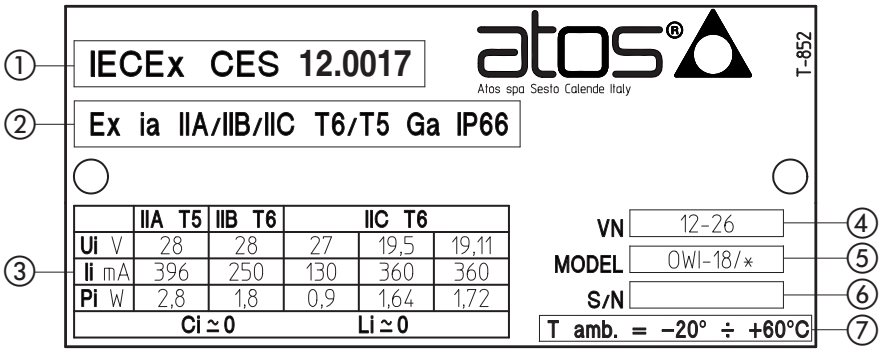
Pressure relief valves

CX030 AGAM-WO, ARAM-WO - piloted, with solenoid valve for venting

Nameplate marking to IECEx

Gas - group II 1G - Zone 0, 1, 2

① IECEx notified body and certificate nember
② Marking according to IECEx scheme
③ Electric characteristics
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number
⑦ Ambient temperature



IECEx classification - for Gas group II

Ex	ia	IIA / IIB / IIC	T6 / T5	Ga
Mark of Explosion Proof	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0)	**Gas Group** **IIA** Ammonia, Methane, Ethane, Propane, etc. **IIB** Citygas, Ethylene, Ethyl glycol, etc. **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C	**Equipment Protection Level** **Ga** Very high protection (Gas Zone 0)

RELATED DOCUMENTATION

Directional valves

EX100 DHW/IE - direct, spool type
EX120 DLWH/IE - direct, poppet type
EX130 DPHW/IE - piloted, spool type
EX150 LIDEW/IE-WO, LIDBH/IE-WO - piloted ISO cartridges and functional covers

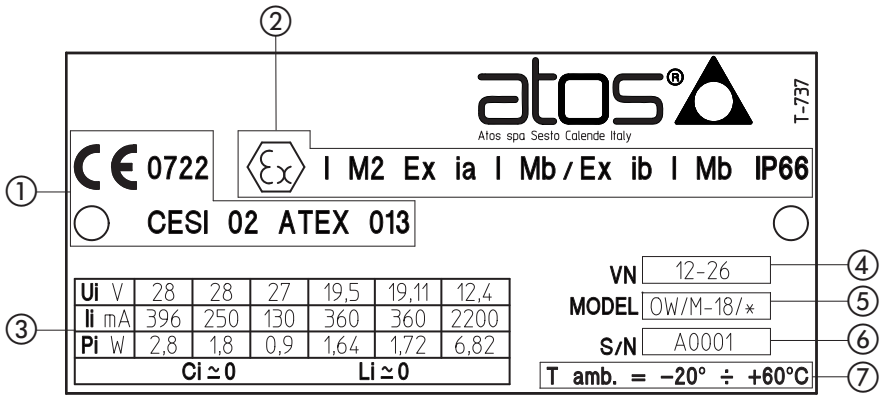
Pressure relief valves

CX030 AGAM/IE-WO, ARAM/IE-WO - piloted, with solenoid valve for venting

Nameplate marking to ATEX

Gas - group I M2 - Mining

① ATEX notified body and certificate nember
② Marking according to ATEX directive
③ Electric characteristics
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number
⑦ Ambient temperature



ATEX classification - for Gas group I - Mining

I M2	Ex	ia, ib	I	Mb
Equipment Group **I** Mines **Equipment Category** **M2** High protection	**Mark of Explosion Proof**	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0) **ib** Intrinsicaly safe (Gas Zone 1 and 2)	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection (de-energized with gas presence)

RELATED DOCUMENTATION

Directional valves

EX100 DHW/M - direct, spool type
EX120 DLWH/M - direct, poppet type
EX130 DPHW/M - piloted, spool type
EX150 LIDEW/M-WO, LIDBH/M-WO - piloted ISO cartridges and functional covers

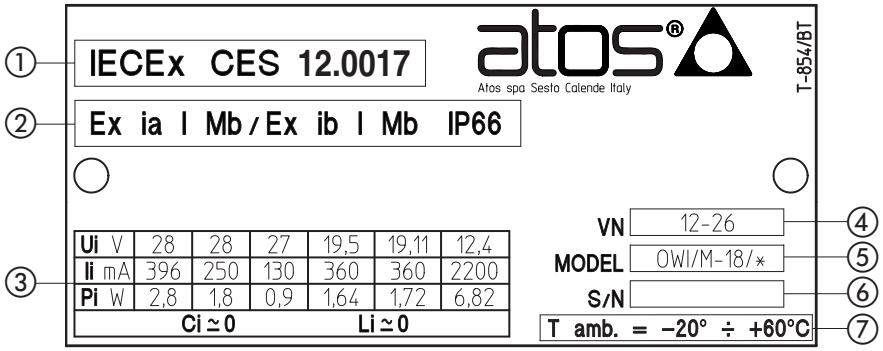
Pressure relief valves

EX030 AGAM/M-WO, ARAM/M-WO - piloted, with solenoid valve for venting

Nameplate marking to IECEx

Gas - group I Mb - Mining

① IECEx notified body and certificate nember
② Marking according to IECEx scheme
③ Electric characteristics
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number
⑦ Ambient temperature



IECEx classification - for Gas group I - Mining

Ex	ia, ib	I	Mb
Mark of Explosion Proof	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0) **ib** Intrinsicaly safe (Gas Zone 1 and 2)	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection (de-energized with gas presence)

RELATED DOCUMENTATION

Directional valves

EX100 DHW//IEM - direct, spool type
EX120 DLWH/IEM - direct, poppet type
EX130 DPHW/IEM - piloted, spool type
EX150 LIDEW/IEM-WO, LIDBH/IEM-WO - piloted ISO cartridges and functional covers

Pressure relief valves

EX030 AGAM/IEM-WO, ARAM/IEM-WO - piloted, with solenoid valve for venting

Gas - group II 1G - Zone 0, 1, 2
Dust - group II 1D - Zone 20, 21, 22

ATEX and IECEx classification - for Gas group II

II 1G	Ex	ia	IIB / IIC
Equipment Group **II** Industrial **Equipment Category** **1** Very high protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0)	**Gas Group** **IIB** Citygas, Ethylene, Ethyl glycol, etc. **IIC** Hydrogen & Acetylene

ATEX and IECEx classification - for Dust group II

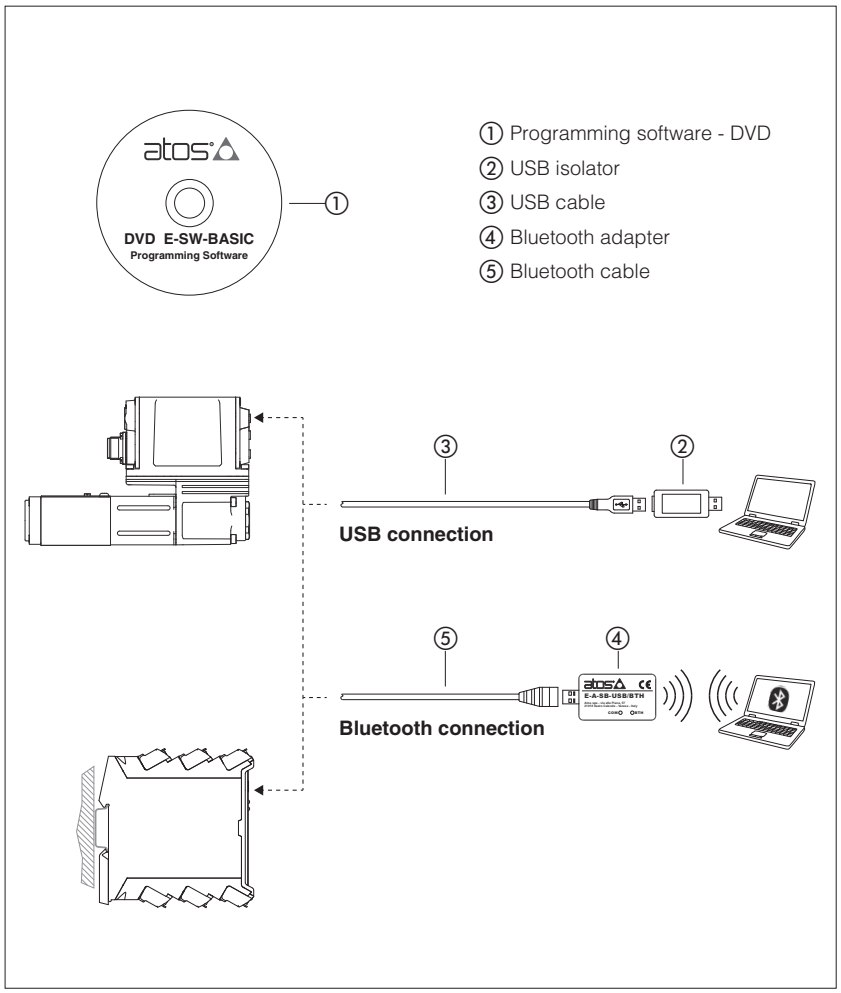
II 1D	Ex	ia D
Equipment Group **II** Industrial **Equipment Category** **1** Very high protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **ia D** Intrinsicaly safe (Dust Zone 20)

RELATED DOCUMENTATION

GX010 Y-BXNE Power supply barrier

Programming tools for digital electronics

Atos PC software, USB adapters, cables and terminators



The E-SW and Z-SW programming software are supplied in DVD format and can be easily installed on a desktop or a notebook computer. The intuitive graphic interface allows:

- set up valve's functional parameters
- verify the actual working conditions
- identify and quickly solve fault conditions
- adapt the factory preset parameters to the application requirements
- store the customized setting into the valve
- archive the customized setting into the PC

The graphic interface is organized in pages related to different specific groups of functions and parameters.

The software automatically recognizes the connected valve model and adapts the displayed parameter groups, according to the selected access level.

The software is available in different versions according to the driver and controller communication interfacing.

Fieldbus communication software includes also dedicated manuals and configuration files for user self management of the Atos electronics, using a fieldbus master.

Features:

- automatic valve recognition
- multilevel graphic interface
- numeric parameters settings (scale, bias, ramp, linearization, dither, etc.)
- real-time parameters modification
- diagnostic and monitor signals
- preset data storing into the digital driver and controller
- internal oscilloscope function
- internal database of customized preset

DVD contents:

- software installer
- user and fieldbus communication manuals
- fieldbus configuration files

1 PROGRAMMING SOFTWARE

Valve functional parameters can be easily set up with Atos E-SW / Z-SW programming software using proper connection to the digital driver/controller.

E - SW	-	BASIC	/	*	-	*

E-SW= for valve drivers

Supported valve drivers communication:

BASIC	= NP (USB)	PS (Serial)	IR (Infrared)
FIELDBUS	= BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

Supplies:
- = first supply
N = next supply

Option:
PQ = for valve drivers with alternated P/Q controls SP, SF, SL

Note: E-SW-*/PQ software supports also valve drivers without P/Q control

Z - SW	-	FULL	-	*

Z-SW= for axis controllers

Supported axis controllers communication:

FULL	= NP (USB)	PS (Serial)	
	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

Supplies:
- = first supply
N = next supply

1.1 Programming software versions

Different software versions are available according to the valve drivers / axis controllers type to be connected and communication interface.

Note: E-SW / Z-SW software are supplied in DVD format; E-SW-BASIC software can be free downloaded from the Atos website

Free programming software, web download:

E-SW-BASIC Software can be downloaded upon web registration at www.atos.com; service and DVD not included.
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area.
The software remains active for 10 days from the installation date and then it stops until the user inputs the Activation Code.

DVD first supply of programming software, to be ordered separately:

E-SW-BASIC
E-SW-BASIC/PQ
E-SW-FIELDBUS
E-SW-FIELDBUS/PQ
Z-SW-FULL
Software has to be activated via web registration at www.atos.com; 1 year service included.
Upon web registration user receive via email the Activation Code (software license) and login data to access personal Atos Download Area.
The software remains active for 10 days from the installation date and then it stops until the user inputs the Activation Code.

DVD next supplies of programming software, to be ordered separately:

E-SW-BASIC-N
E-SW-BASIC/PQ-N
E-SW-FIELDBUS-N
E-SW-FIELDBUS/PQ-N
Z-SW-FULL-N
Only for supplies after the first; service not included, web registration not allowed.
Software has to be activated with Activation Code received upon first supply web registration.

Notes: the software BASIC, FIELDBUS and FULL are NOT interchangeable and must be ordered separately;
programming software FIELDBUS and FULL can program digital electronics through USB communication port for all industrial and ex-proof versions of drivers/controllers

1.2 DVD contents

Include software installer, user manuals and fieldbus configuration files:
EDS for BC - GSD for BP - XML for EH - XDD for EW - EDS for EI - GSDML for EP

1.3 Atos Download Area

Direct access to latest releases of programming software, manuals, USB drivers and fieldbus configuration files at www.atos.com
Software and USB drivers can be easily installed following the instruction contained in the “info.txt” files.
An automatic mailing message will inform all the registered users whenever a new software upgrade is available.

1.4 E-SW / Z-SW minimum PC requirements

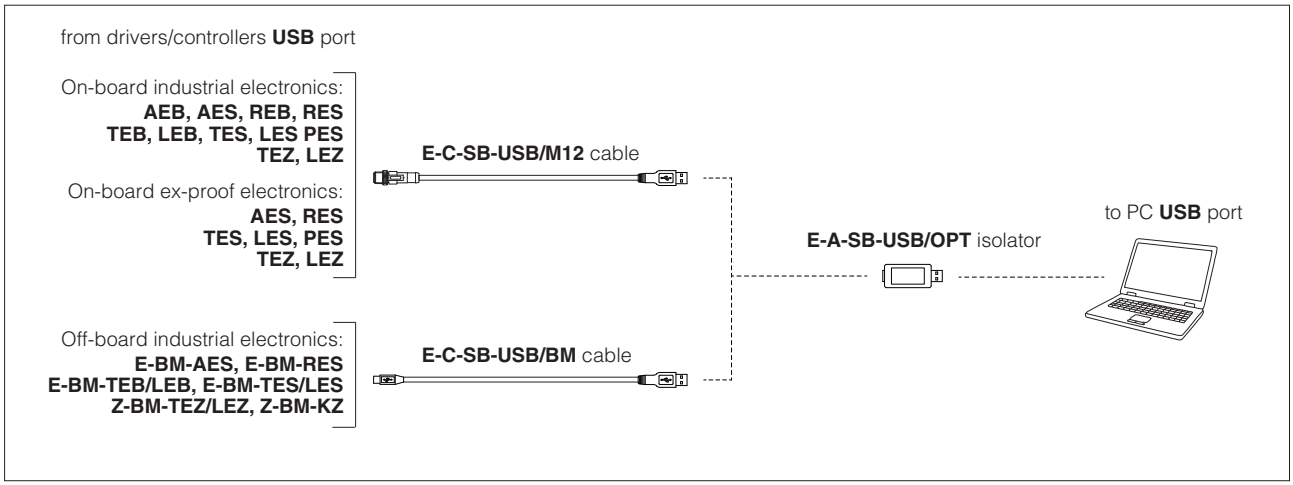
Personal Computer	Pentium® processor 1GHz or equivalent	**Memory**	512 MB RAM + Hard Disk with 250MB free space
Operating System	Windows XP SP3	**Device**	DVD reader
Monitor Resolution	1024 x 768	**Interface**	Serial RS232 port (only for PS) or USB port

2 USB connection - ISOLATOR AND CABLE

E-SW / Z-SW software permit valve's parameterization through USB port.

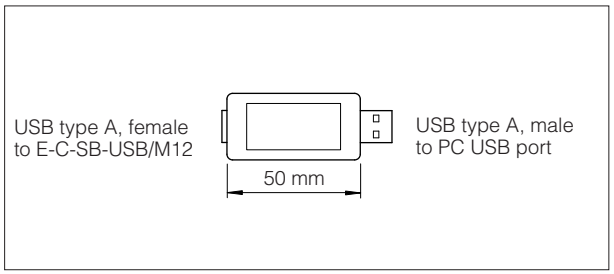
2.1 Connection tools by driver/controller type

Isolator and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: **E-KIT-USB**



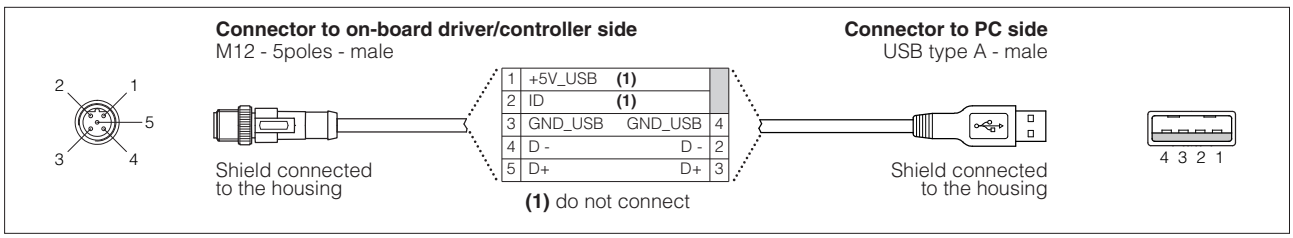
WARNING: drivers/controllers USB port is not isolated! Use of USB isolator adapter is highly recommended for PC protection: wrong earthing connections may cause high potential difference between GNDs, generating high currents that could damage the PC connected to drivers/controllers.

2.2 E-A-SB-USB/OPT - isolator adapter

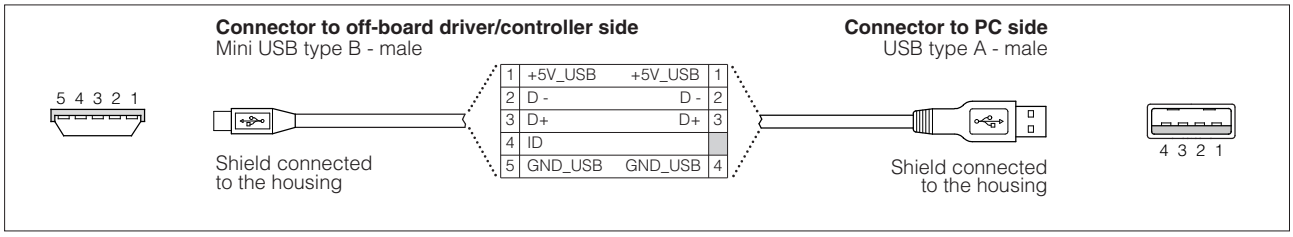


- USB 2.0 Full speed (12 MBps)
- electrical isolation 1 kV
- temperature range, -40° ÷ +50° (relative humidity 25% ÷ 75%)
- external power supply not required (power 400 mA output, 5 V ±10%)
- MTBF >1,2 million hours (MIL standard)

2.3 E-C-SB-USB/M12 - 4 m cable - only for on-board industrial and ex-proof electronics



2.4 E-C-SB-USB/BM - 3 m cable - only for off-board industrial electronics

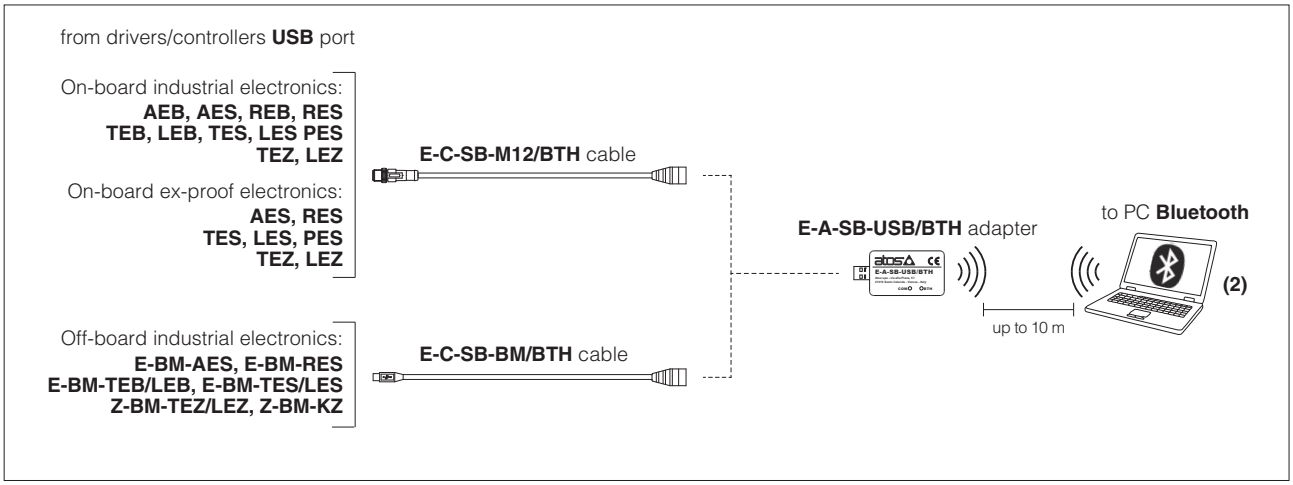


3 BLUETOOTH connection - ADAPTER AND CABLE

E-SW / Z-SW software permit valve's parameterization through Bluetooth **(1)**.

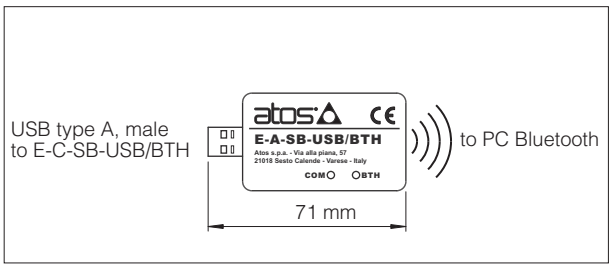
3.1 Connection tools by driver/controller type

Adapter and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: **E-KIT-BTH**



(1) Bluetooth adapter is not compatible with E-BM-AES and E-BM-RES drivers
(2) If PC has not built-in Bluetooth, use standard USB to Bluetooth dongle compatible with E-A-SB-USB/BTH specification (please refer to STARTUP-BTH guide)

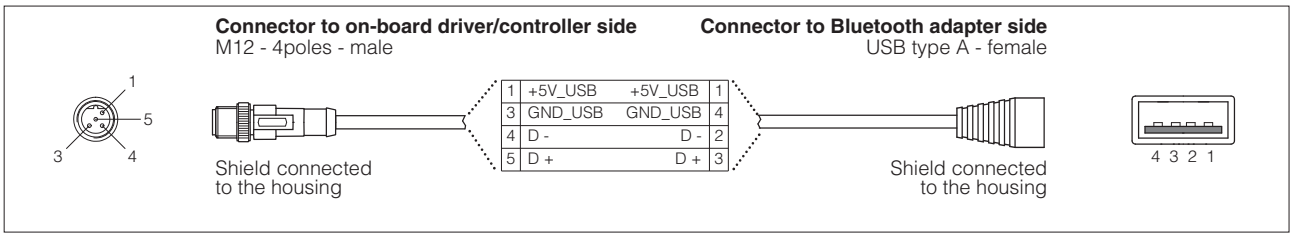
3.2 E-A-SB-USB/BTH - Bluetooth adapter



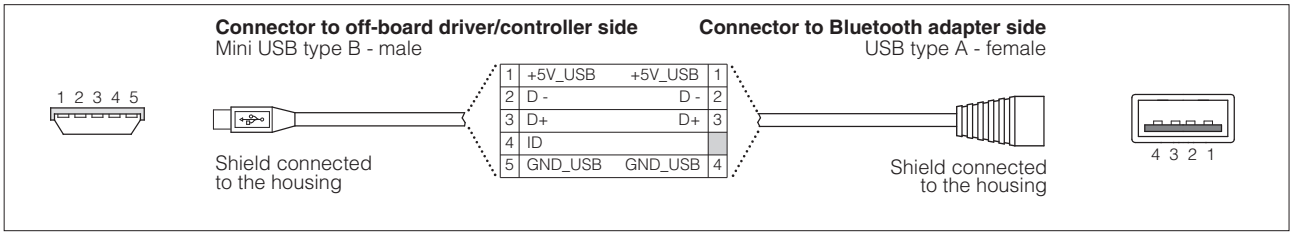
- USB male connector, type A
- type of radio interface: Bluetooth Class 2
- temperature range, -20 ÷ +70 °C (storage -40 ÷ +70 °C)
- external power supply not required (from Atos drivers/controllers only)
- protocol: Bluetooth Classic Version 2.x , 3.x supporting Serial Port Profile (SPP Profile)
- max RF transmission power: Class 2 Output Power (+1.5 dBm typical)
- frequency: 2.402 GHz to 2.480 GHz
- LEDs indicate the actual working condition
- IP20 protection degree

WARNING: Bluetooth adapter is available only for European, USA and Canadian markets!
Bluetooth adapter is certified according to RED (Europe), FCC (USA) and ISED (Canada) directives

3.3 E-C-SB-M12/BTH - 0,4 m cable - only for on-board industrial and ex-proof electronics



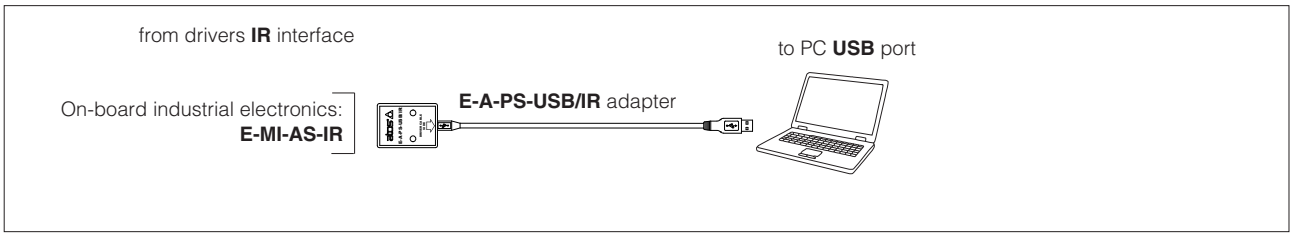
3.4 E-C-SB-BM/BTH - 0,2 m cable OTG - only for off-board industrial electronics



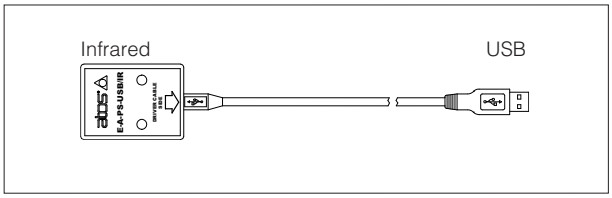
4 IR infrared - USB COMMUNICATION ADAPTER - only for **E-MI-AS-IR** drivers

The adapter have to be connected to the USB communication port of PC to activate the IR infrared communication interface towards Atos digital electrohydraulics.

4.1 Connection tools by driver type



4.2 **E-A-PS-USB/IR** - 3 m adapter

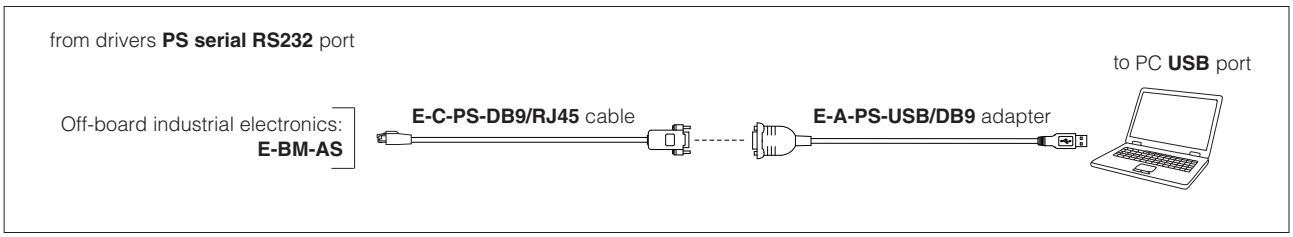


- direct infrared communication with the driver
- USB male connector, type A
- plug-in format for direct infrared connection on the driver
- transmission rate 9,6 kbit/s
- external power supply not required (USB supply)

5 PS serial RS232 - USB COMMUNICATION ADAPTER AND CROSS CABLES - only for **E-BM-AS** drivers

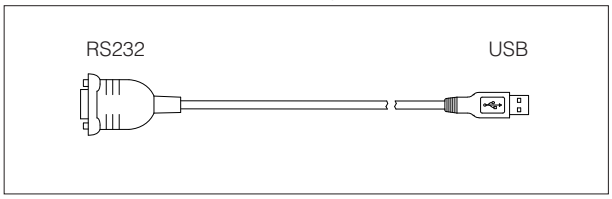
The adapter have to be connected to the USB communication port of PC to activate the PS serial RS232 communication interface towards Atos digital electrohydraulics. The cross cables connect the relevant connector of the USB adapter with the communication port of the digital drivers.

5.1 Connection tools by driver type



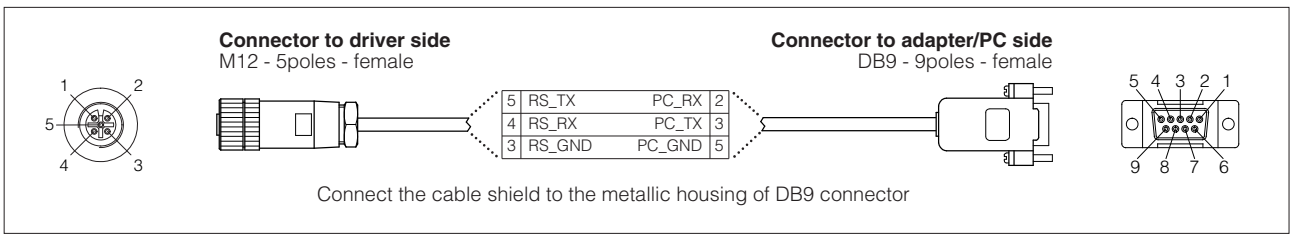
Note: the adapter is not required if PC is already equipped with a serial RS232 communication port

5.2 **E-A-PS-USB/DB9** - 0,45 m adapter

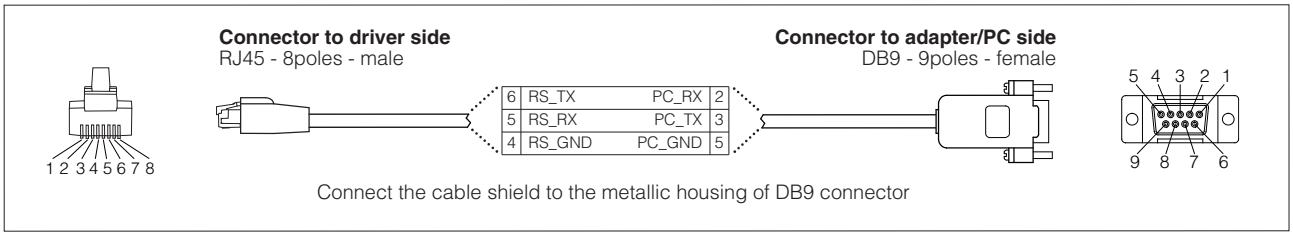


- DB9 male connector according to serial RS232 specification
- USB male connector, type A
- transmission rate from 1,6 kbit/s up to 225 kbit/s
- external power supply not required (USB supply)

5.3 **E-C-PS-DB9/M12** - 4 m cable

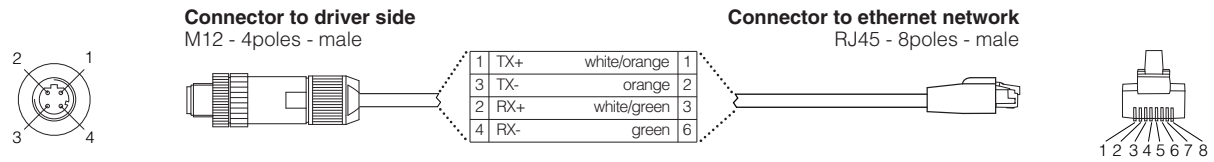


5.4 **E-C-PS-DB9/RJ45** - 2,5 m cable



6 ETHERNET CABLE WIRING DIAGRAM - only for EH, EW, EI and EP

Typical ethernet cable wiring diagram from industrial M12 connectors to standard RJ45 ethernet connectors.



Connect the cable shield to the metallic housing of M12 connector

7 FIELDBUS TERMINATORS - only for BC and BP

For TES, LES, PES, TEZ, LEZ series 40 or higher in BC and BP executions, the fieldbus terminator has to be used.

Note: fieldbus terminators not available for ex-proof electronics

E - TRM	-	BC	-	M12	/	5PM

Terminator

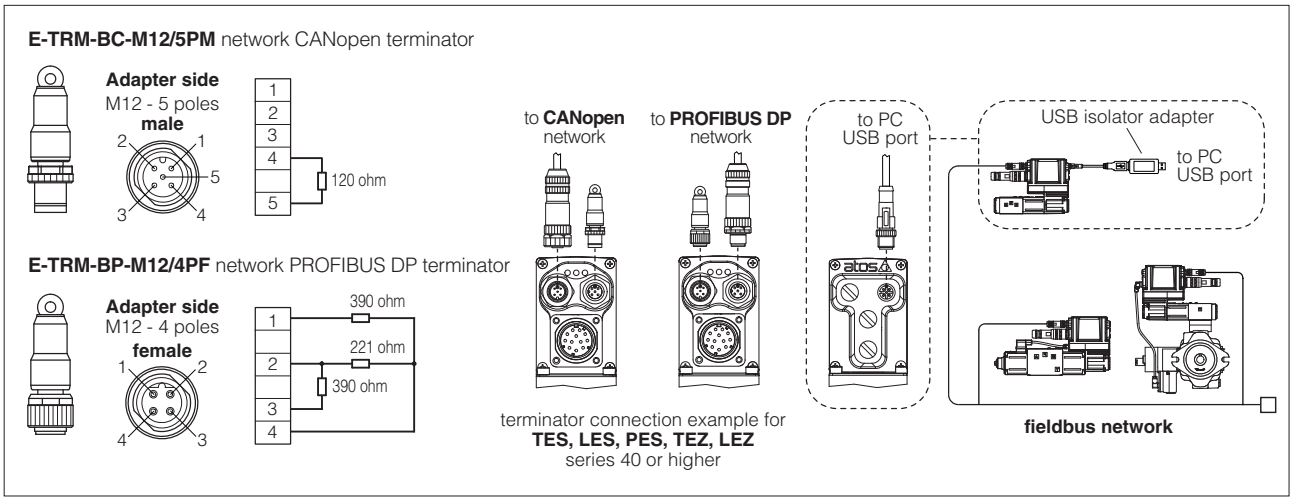
Fieldbus interfaces:
BC = CANopen
BP = PROFIBUS DP

Connector:
M12 = from M12 output fieldbus connector, drivers/controllers

Connector:
5PM = to BC executions, drivers/controllers
4PF = to BP executions, drivers/controllers

7.1 M12 - terminators for fieldbus network

The fieldbus terminators are required when output fieldbus connector has to be used as network end point.



8 FIRMWARE UPDATE

It is possible to update the firmware of the following digital drivers and controllers, using proper USB communication port.
The firmware update is allowed starting from electronics series listed into the table or higher series:

Industrial electronics

E-RI-AEB s10 E-RI-AES s40	E-RI-REB s10 E-RI-RES s10	E-BM-AES s10 E-BM-RES s10	E-RI-TEB s10 E-RI-LEB s10	E-BM-TEB s10 E-BM-LEB s10	E-RI-TES s40 E-RI-LES s40	E-BM-TES s10 E-BM-LES s10	E-RI-TES-S s40 E-RI-LES-S s40	E-BM-TES-S s10 E-BM-LES-S s10	E-RI-PES-S s40
Z-RI-TEZ s40 Z-RI-LEZ s40	Z-BM-KZ s10	Z-BM-TEZ s10 Z-BM-LEZ s10							

Ex-proof electronics

E-RA-AES s40	E-RA-RES s40	E-RA-TES s40 E-RA-LES s40	E-RA-TES-S s40 E-RA-LES-S s40
Z-RA-TEZ s40 Z-RA-LEZ s40	Z-RA-TEZ-S s40 Z-RA-LEZ-S s40		

9 RECCOMENDED TOOLS SELECTION

9.1 Industrial and ex-proof electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
IR	E-MI-AS-IR	11	E-SW-BASIC		E-A-PS-USB/IR	
PS	E-BM-AS	10 or higher		E-C-PS-DB9/RJ45	E-A-PS-USB/DB9	
NP	E-BM-AES, E-BM-RES	10 or higher		E-C-SB-USB/BM	E-A-SB-USB/OPT	
	E-BM-TEB, E-BM-LEB, E-BM-TES, E-BM-LES **(1)**	10 or higher				
	AEB, REB **(1)**	10 or higher		E-C-SB-USB/M12		
	TEB, LEB **(1)**	10 or higher				
	TES, LES **(1)**	40 or higher				
	TES, LES, PES with SP, SF, SL options **(1)**	40 or higher	E-SW-BASIC/PQ			
	E-BM-TES, E-BM-LES with SP, SF, SL options **(1)**	10 or higher		E-C-SB-USB/BM		
	TEZ, LEZ **(1)**	40 or higher	Z-SW-FULL	E-C-SB-USB/M12		
	Z-BM-KZ, Z-BM-TEZ, Z-BM-LEZ **(1)**	10 or higher		E-C-SB-USB/BM		
BP **BC** **EH**	E-BM-AES, E-BM-RES	10 or higher	E-SW-FIELDBUS	E-C-SB-USB/BM	E-A-SB-USB/OPT	
	RES **(1)**	10 or higher		E-C-SB-USB/M12		
	AES **(1)**	40 or higher				
BC **BP** **EH** **EW** **EI** **EP**	E-BM-TES, E-BM-LES **(1)**	10 or higher	E-SW-FIELDBUS	E-C-SB-USB/BM	E-A-SB-USB/OPT	
	TES, LES **(1)**	40 or higher		E-C-SB-USB/M12		
	E-BM-TES, E-BM-LES with SP, SF, SL options **(1)**	10 or higher	E-SW-FIELDBUS/PQ	E-C-SB-USB/BM		
	TES, LES, PES with SP, SF, SL options **(1)**	40 or higher		E-C-SB-USB/M12		
	TEZ, LEZ **(1)**	40 or higher	Z-SW-FULL	E-C-SB-USB/M12		
	Z-BM-KZ, Z-BM-TEZ, Z-BM-LEZ **(1)**	10 or higher		E-C-SB-USB/BM		

(1) Drivers/controllers compatible with Bluetooth adapter E-A-SB-USB/BTH (see 3.1)

9.2 Phase out industrial electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
IR	E-MI-AS-IR	10	E-SW-IR		E-A-PS-USB/IR	
PS	AES	30	E-SW-BASIC	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31				
	TES, LES, PES with SP, SF, SL options	31	E-SW-BASIC/PQ			
	TEZ, LEZ	10	Z-SW-FULL			
	Z-ME-KZ-PS	10 or higher		E-C-PS-DB9/DB9		
BP	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BP-DB9/M12		E-TRM-BP-DB9/DB9
	TES, LES, PES with SP, SF, SL options	31	E-SW-FIELDBUS/PQ			
	TEZ, LEZ	10	Z-SW-FULL		E-A-PS-USB/DB9	
	Z-ME-KZ-PS/BP	10 or higher		E-C-PS-DB9/DB9	E-A-PS-USB/DB9	
BC	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BC-DB9/M12	E-A-BC-USB/DB9	E-TRM-BC-DB9/DB9
	TES, LES, PES with SP, SF, SL options	31	E-SW-FIELDBUS/PQ			
	TEZ, LEZ	10	Z-SW-FULL			
EH	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	

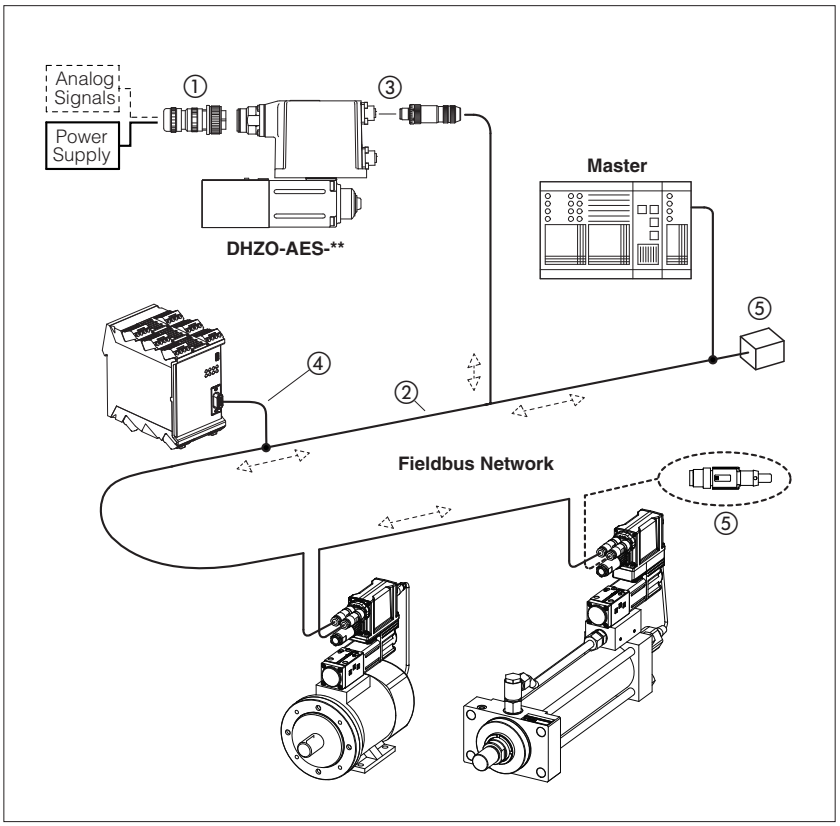
9.3 Phase out ex-proof electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
PS	AES	30	E-SW-BASIC	E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31				
BP	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BP-DB9/RA	E-A-BP-USB/DB9	E-TRM-BP-DB9/DB9
BC	AES	30		E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BC-DB9/RA	E-A-BC-USB/DB9	E-TRM-BC-DB9/DB9

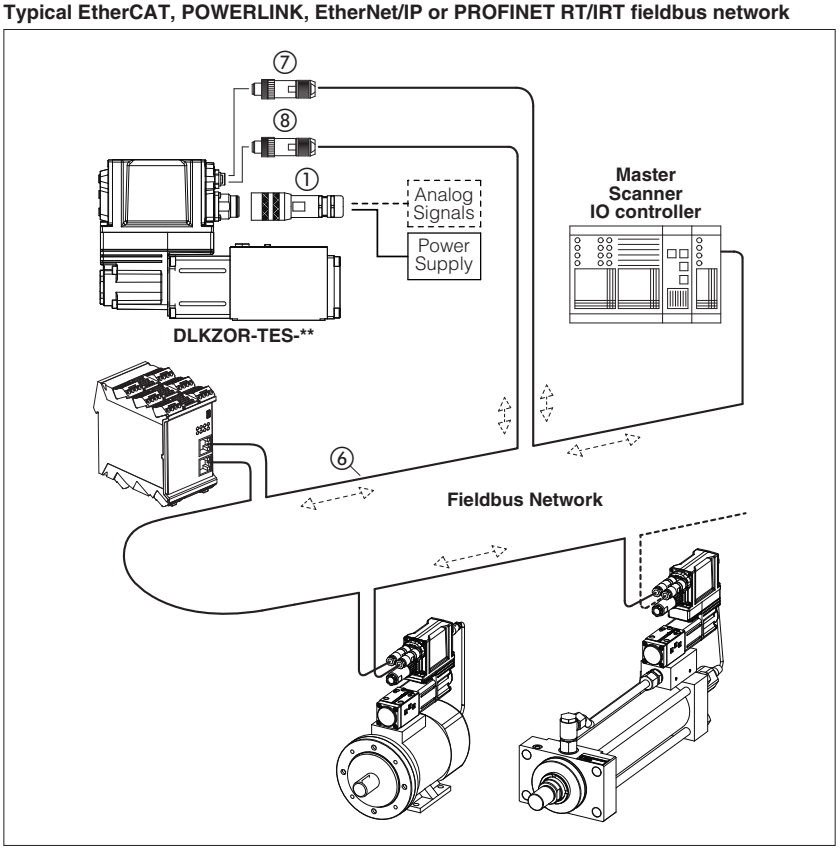
Fieldbus features

BC (CANopen), BP (PROFIBUS DP), EH (EtherCAT),
EW (POWERLINK), EI (EtherNet/IP), EP (PROFINET RT/IRT)

Typical CANopen or PROFIBUS DP fieldbus network



Typical EtherCAT, POWERLINK, EtherNet/IP or PROFINET RT/IRT fieldbus network



Fieldbus communication interfaces are available for digital proportional drivers and controllers, granting several plus:

- more information available for machine operation to enhance its performances
- improved accuracy and robustness of digital transmitted information
- costs reduction due to simpler and standardized wiring solutions
- costs reduction due to fast and simple installation and maintenance
- direct integration into machine's communication networks

These executions allow to operate proportional valves and pumps through fieldbus or using the analog signals on main connector ①.

Fieldbus distributed-control

Fieldbus communication allows to share all the available information of the digital drivers and controllers (reference, monitor, etc).
This distributed-control design allows to implement powerful machines functionalities for tuning, diagnostic, maintenance, etc.

CANopen and PROFIBUS DP networks consist of a common cable (2 twisted wire, ②) for digital communication: several devices (node ③) can be connected to this main cable by means of short cable branches ④.
The two endpoints of the main cable must be terminated with specific devices (terminator, ⑤) to dissipate the communication signal's energy thus preventing interferences and degradations of fieldbus transmission.

EtherCAT, POWERLINK, EtherNet/IP and PROFINET RT/IRT networks consist in a Ethernet common cable (4 twisted wire, ⑥) for digital communication. All slave, adapter and IO device have always the double connector for signal input ⑦ and signal output ⑧.
The main Ethernet cable starting from the master, scanner and IO controller has to be connected to the slave, adapter and IO device input connector.
The slave, adapter and IO device output connector has to be connected to the next slave, adapter and IO device input connector.

1 CANopen features for digital drivers and controllers in BC execution

Physical

Serial input format	Industrial field-bus with optical insulation type CAN-Bus ISO11898
Transmission rate	Transmission rates from 10 Kbit/s to 1 Mbit/s
Max node	32 per segment without repeater; 127 per segment with repeater

Communication Protocol

Data Link Layer	DS301 V4.2.0 - based on CAN standard frame with 11-bit identifier
Device Profile	DS408 - Fluid Power Technology (EN50325-4)
Device type	Slave

Startup and configuration (as per DS301+DSP305)

Boot up process	Minimum boot-up
Node setting	LSS (Layer Setting Services) SDO E-SW-FIELDBUS and Z-SW-FULL programming software
Baudrate setting	LSS (Layer Setting Services), SDO
Baudrate	10 / 20 / 50 (default) / 125 / 250 / 500 / 1000Kbit/s

Fieldbus communication diagnostic (as per DS301)

Device Error	Emergency
Network Error	Node Guarding Heartbeat

Real-time communication (as per DS301 + DS408)

RPDO	4 mappable PDOs to the drivers: AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES 4 mappable PDOs to the controllers: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
TPDO	4 mappable PDOs from the drivers: AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES 4 mappable PDOs from the controllers: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
R(T)PDO types	Event Triggered, Remotely requested, Sync(cyclic) and Sync(acyclic)

Non real-time communication (as per DS301 + DS408)

SDO	1 SDO (1 Server + 1 Client)

Standard references

ISO 11898
Road Vehicles – Interchange of digital information controller area network (CAN) for High-speed communication

EN50325-4
Industrial communication subsystem based on ISO 11898 (CAN) for controller device interfaces

CiA DS301
CANopen – Application Layer and Communication Profile for Industrial Systems

CiA DR303-1
Cabling and connector pin assignment

CiA DSP305
CANopen – Layer Setting Services and Protocol

CiA DS408
CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.2

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or CANopen master device

Configuration file

EDS (Electronic Data Sheet), enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-BC and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-BC and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

2 PROFIBUS DP features for digital drivers and controllers in BP execution

Physical

Serial input format	Industrial field-bus with optical insulation type PROFIBUS-DP RS485 European fieldbus standard (lev.1 – EN50170-part 2)
Transmission rate	Transmission rates from 9,6 Kbit/s to 12 Mbit/s
Max node	32 per segment without repeater; 126 node with repeater

Communication Protocol

Data Link Layer	PROFIBUS DPV0 - IEC 61158 (type 3)
Device Profile	PROFIBUS-DP Profile for Fluid Power Technology
Device type	Slave

Startup and configuration

Boot up process	SAP 61 for sending parameter setting data SAP 62 for checking configuration data
Node setting	SAP 55 E-SW-FIELDBUS and Z-SW-FULL programming software
Baudrate setting	Automatic
Baudrate	9,6 / 19,2 / 45,45 / 93,75 / 187,5 / 500 / 1500 / 3000 / 6000 / 12000 Kbit/s

Fieldbus communication diagnostic

Device error	SAP 60

Real-time communication

PZD	Process data area of PPO telegram by Data Exchange, default SAP: cyclic transmission of standard Profibus frame **Standard electronics - drivers** *PPO type 3, 113, 213, 230 for:* AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES *PPO type 5, 115, 214, 240 for:* TES, BM-TES, LES, BM-LES, PES with alternated P/Q control **Note:** PPO type 213, 230, 214, 240 are customizable by user **Standard electronics - controllers** *PPO type 1, 111, 121, 123 for:* TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ *PPO type 1, 101, 103, 111, 121, 123, 223, 227 for:* TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ with alternated P/Q control **Note:** PPO type 223, 227 are customizable by user
Cyclic mode	standard, sync and freeze

Non real-time communication

PKW	Parameter data area of PPO telegram by Data Exchange, default SAP: acyclic transmission of standard Profibus frame

Standard references

PROFIBUS profile
PROFIBUS Profile,
Fluid Power Technology,
Edition Oct. 2001

VDMA profile
Fluid Power Technology,
Proportional Valves and
Hydrostatic Transmissions, ver 1.1

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or PROFIBUS DP master device

Configuration file

GSD (General Station Description) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-BP and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-BP and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

3 EtherCAT features for digital drivers and controllers in EH execution

Physical

Serial input format	Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2
Transmission rate	2 x 100 Mbit/s (Fast Ethernet, Full-Duplex)
Max node	65535 slaves
Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x88A4 according to IEEE 802.3
Cable length	0,2 - 100m (between two slave devices)
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	Line, tree and star
Termination	Device internally

Communication Protocol

Data Link Layer	EtherCAT use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2
Device Profile	CANopen over EtherCAT (CoE) DS408 - Fluid Power Technology EN 50325-4
Device type	Slave
Supported protocol	CANopen SDO Mailbox-Interface “CoE” Network Management PDO PDO Watchdog Cycle time min 1 msec

Startup and configuration (as per DS301+DSP305)

Node setting	Automatic position addressing Device node addressing
Baudrate	100 Mbit/s (Automatic)

Fieldbus communication diagnostic (as per DS301)

Device Error	Emergency

Real-time communication (as per DS301 + DS408)

RPDO	4 PDOs messages to the driver and controller (up to 32 byte for each PDO)
TPDO	4 PDOs messages from the driver and controller (up to 32 byte for each PDO)
R(T)PDO types	Remotely requested

Non real-time communication (as per DS301 + DS408)

SDO	1 SDO (1 Server + 1 Client)

Standard references

ISO 11898
Road Vehicles – Interchange of digital information controller area network (CAN) for High-speed communication

EN 50325-4
Industrial communication subsystem based on ISO 11898 (CAN) for controller device interfaces

CiA DS301
CANopen – Application Layer and Communication Profile for Industrial Systems

CiA DSP305
CANopen – Layer Setting Services and Protocol

CiA DS408
CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.1

IEC 61076-2-101
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-2
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61784-2
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or EtherCAT master device

Configuration file

XML (Extensible Markup Language) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EH and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EH and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

4 POWERLINK features for digital drivers and controllers in EW execution

Physical

Serial input format	Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2
Transmission rate	2 x 100 Mbit/s (Fast Ethernet, Half-Duplex)
Max node	239 slaves
Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x88AB according to IEEE 802.3
Integrated Hub	
Cable length	0,2 - 100m (between two slave devices)
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	Line, tree, star, daisy chain, ring structure or any combination of these topologies
Ethernet Hub	Integrated with 2 ports: - one led for Link/Activity indicator (on each port) - one bicolor led Status/Error indicator

Communication Protocol

Data Link Layer	POWERLINK use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2
Comm. Profile	EPSG DS 301 v1.2
Device Profile	CANopen over Ethernet based on DS408 - Fluid Power Technology
Device type	Slave - supported features: - Ethernet POWERLINK v2.0 - Ring Redundancy - Support PollRsponse Chaining - Support Multiplexing - Cycle time min 200 µsec - SDO Multiple Parameter Read/Write

Startup and configuration (as per EPSG DS301 + EPSG DS 302-A/B/C/D/E)

Node setting	E-SW-FIELDBUS and Z-SW-FULL programming software
Baudrate	100 Mbit/s (Automatic)

Fieldbus communication diagnostic

Custom parameters mappable on TPDO for emergency diagnosis

Real-time communication (as per EPSG DS301 + DS408)

RPDO	1 PDO message to the driver (max number of of mapping parameters is Device specific)
TPDO	1 PDO message from the driver (max number of of mapping parameters is Device specific)

Standard references

EPSG DS301
Ethernet POWERKLINK
Communication Profile Specification v 1.2

EPSG DS302-A/B/C/D/E
Ethernet POWERKLINK
Part A: High Availability v1.1
Part B: Multiple ASnd v1.0
Part C: PollResponse Chaining v1.0
Part D: Multiple PReq/PRes v1.0
Part E: Dynamic Node Allocation v1.0

EPSG DS311
Ethernet POWERKLINK
XML Device Description v 1.0

CiA DS408
CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.1

IEC 61076-2-101
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-2
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61784-2
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

IEC 61784-3
Industrial communication networks
- Profiles -
Part 3: Functional safety fieldbuses - General rules and profile definitions

IEC 61158-300/400/500/600
Industrial communication networks
- Fieldbus specifications -
Part 300: Data Link Layer service definition
Part 400: Data Link Layer protocol specification
Part 500: Application Layer service definition
Part 600: Application Layer protocol specification

ISO 15745-1
Industrial automation systems and integration - Open systems application integration framework -
Part 1: Generic reference description

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or POWERLINK master device

Configuration file

XDD (XML Device Description) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EW and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EW and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

5 EtherNet/IP features for digital drivers and controllers in EI execution

Physical

Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x08E1 according to IEEE 802.3
Transmission rate	10/100 Mbit Full/Half-Duplex
Integrated	2-port switch
Cable length	max 100m
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	Device Level Ring (DLR), linear, star structure
Ethernet switch	integrated with two ports
Led indicator	2 led for Link/Activity indicator (on each port) and 1 bicolor led for Status/Error indicator

Communication Protocol

ODVA CIP Object Model

ODVA CIP Object library for Generic Device Profile

- Identity Object (0X01)
- Message Router Object (0x02)
- Assembly Object (0x04)
- Connection Manager Object (0x06)
- Parameter Object (0x0F)
- DLR Object (0x47)
- QoS Object (0x48h)
- Port Object (0xF4)
- TCP/IP Object (0xF5)
- Ethernet Link Object (0xF6)

Valve parameters accessible via Vendor Specific Object 0xA2

IP address setting (range 0.0.0.0 - 255.255.255.255):

- TCP/IP Object (0xF5)
- DHCP
- Auxiliary USB communication + Atos Software

I/O Adapter and Explicit Message Server device type

Cyclic data transmission via Implicit Messages (transport class 1)

- Minimum RPI for Implicit Messages 1ms
- Total number of supported class 1 connections: 4
- Up to 5 parameters and 20 bytes for each connection
- Trigger types: Cyclic CoS

Acyclic data transmission via Connected and Unconnected Explicit Messages (transport class 3)

- Minimum RPI for Explicit Messages 100ms
- No. of simultaneous Class 3 connections: 6

Standard references

IEC 61918
Industrial communication networks
- Installation of communication networks in industrial premises

IEC 61076-2-101
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-1
Industrial communication networks
- Fieldbus specification -
Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series

IEC 61158-2
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61784-1
Industrial communication networks
- Profiles -
Part 1: Fieldbus profile

IEC 61784-2
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

IEC 61784-3
Industrial communication networks
- Profiles -
Part 3: Functional safety fieldbuses - General rules and profile definitions

IEC 61784-5-2
Industrial communication networks
- Profiles -
Part 5-2: Installation of fieldbuses - Installation profiles for CPF 2

ISO 15745-4
Industrial automation systems and integration - Open systems application integration framework -
Part 4: Reference description for Ethernet-based control systems

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or EtherNet/IP scanner device

Configuration file

EDS (Electronic Data Sheet) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EI and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EI and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

6 PROFINET RT/IRT features for digital drivers and controllers in EP execution

Physical

Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x8892 according to IEEE 802.3
Transmission rate	100 Mbit Full-Duplex
Integrated	2-port switch
Cable length	max 100m
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	line, star, tree and ring structure
Ethernet switch	integrated with two ports
Led indicator	2 led for Link/Activity indicator (on each port) and 1 bicolor led for Status/Error indicator

Communication Protocol

Data Link Layer	PROFINET use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2
Device type	IO device - supported features: - complies with PROFINET IO conformance Class A, B, C - Acyclic parameter Channel - Real Time (RT) and Isochronous Real Time (IRT) communication - Up to 8 input/output parameters for real time data exchange - PROFINET specific diagnostic support - Media Redundancy Protocol (MRP) - DCP Discovery and Configuration Protocol supported - Identification & Maintenance (I&M) - Cycle time min: 1 msec [RT] , 250 µsec [IRT]

Startup and configuration

Address setting	IP Address and Station Name are assigned automatically by IO controller (e.g. Discovery and Configuration Protocol)
Baudrate	100 Mbit/s (Automatic)

Fieldbus communication diagnostic

Custom parameters mappable on real time communication for emergency diagnosis

Real-time communication

Modular config	for drivers: AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES up to 5 input parameters for real time data exchange up to 5 output parameters for real time data exchange for controllers: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ up to 8 input parameters for real time data exchange up to 8 output parameters for real time data exchange

Standard references

IEC 61918
Industrial communication networks
- Installation of communication networks in industrial premises

IEC 61076-2-101
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-1
Industrial communication networks
- Fieldbus specification -
Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series

IEC 61158-2
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61158-5-10
Industrial communication networks
- Fieldbus specification -
Part 5-10: Application layer service definition – Type 10 elements

IEC 61784-1
Industrial communication networks
- Profiles -
Part 1: Fieldbus profile

IEC 61784-2
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

IEC 61784-5-3
Industrial communication networks
- Profiles -
Part 5-3: Installation of fieldbuses - Installation profiles for CPF 3

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or PROFINET controller.

Configuration file

GSDML (Electronic Data Sheet) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

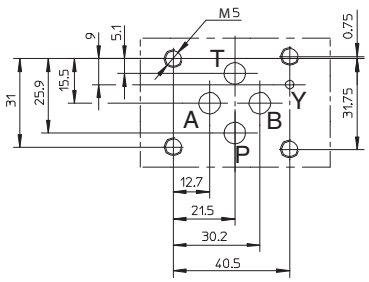
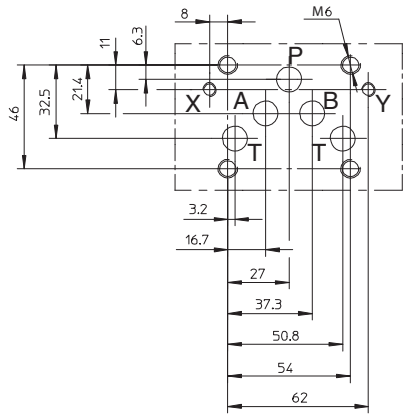
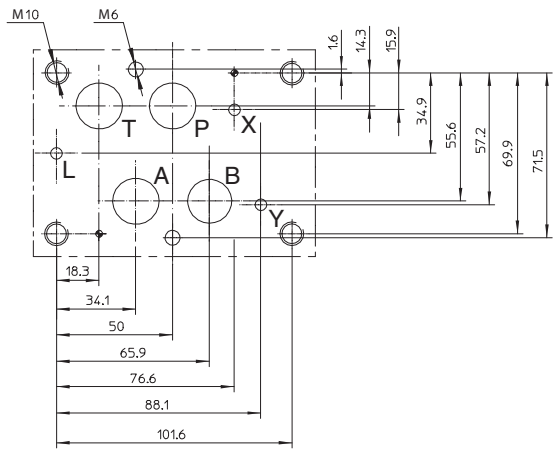
Manuals

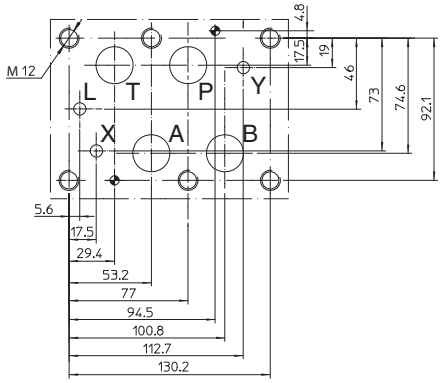
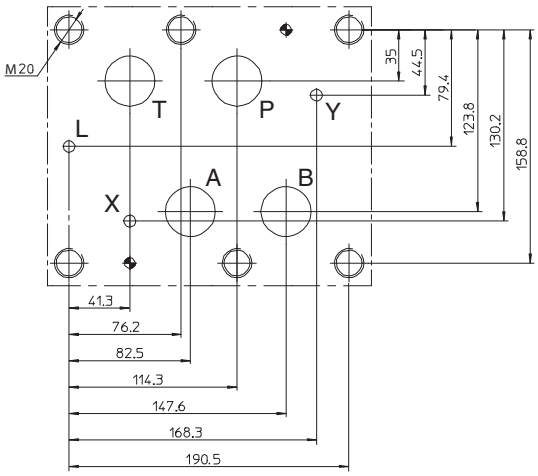
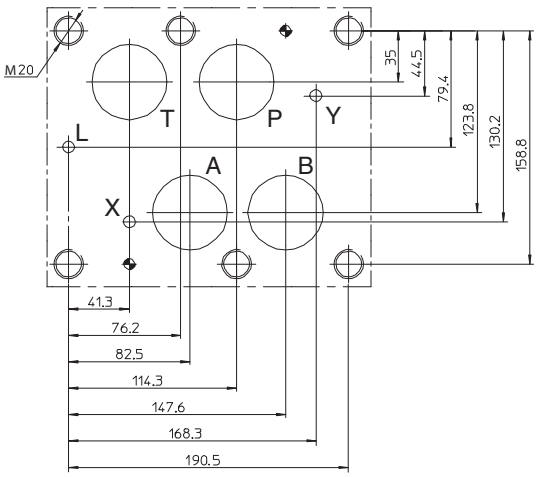
E-MAN-S-EP and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EP and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

Mounting surfaces for electrohydraulic valves

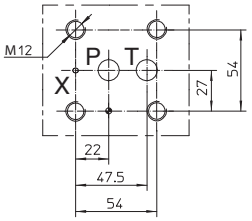
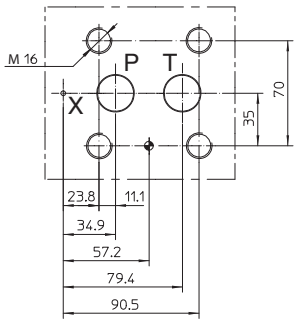
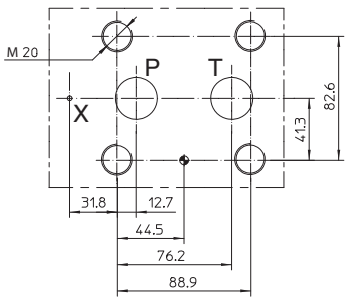
ISO standard, for directional, pressure and flow control valves plus pressure switches

1 **ISO 4401: 2005 - for directional, pressure and flow control valves**

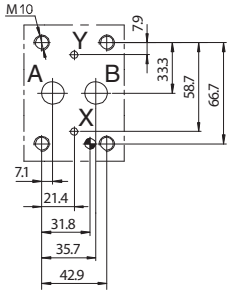
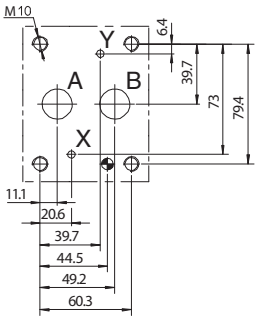
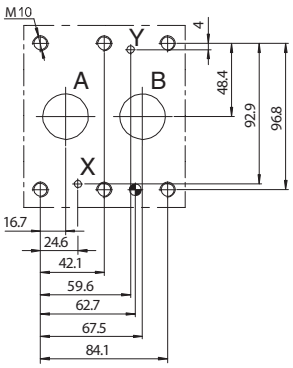
Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	**ex-proof**
 **Y port only for 4401-03-03-0-05**	**4401-03-02-0-05** P, A, B, T = Ø 7,5 max without Y port	DH* DLOH / DLOK DLEH / DLEHM QV-06 RZMO RZGO DHZE / DHZO DLHZO QVH* H* (modular)	DHA / DHW DLAH / DLWH RZMA RZGA DHZA DLHZA QVHZA
	4401-03-03-0-05 P, A, B, T = Ø 7,5 max Y = Ø 3,3 max	DHZO / Y DLHZO / Y	DHZA / Y DLHZA / Y
 **X and Y port only for 4401-05-05-0-05**	**4401-05-04-0-05** P, A, B, T = Ø 11,2 max without X and Y port	DKE DKZOR DLKZOR QVKZOR K* (modular)	DKZA DLKZA QVKZA
	4401-05-05-0-05 P, A, B, T = Ø 11,2 max X, Y = Ø 6,3 max	DKE/Y DKZOR / Y DLKZOR / Y DP-1* DPH-1* DPZO-*-1*	DKZA / Y DLKZA / Y DPHA-1*/ DPHW-1 DPZA-*1
	**4401-07-07-0-05** P, A, B, T = Ø 17,5 max Y = Ø 6,3 max	DP-2* DPH*-2* DPZO-*-2* JP*-2* (modular)	DPHA-2 / DPHW-2 DPZA-*-2

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	**4401-08-08-0-05** P, A, B, T = Ø 25 max X, Y, L = Ø 11,2 max	DP-4* DPH*-4* DPZO-*-4* JP*-3* (modular)	DPHA-4 / DPHW-2 DPZA-*-4
	**4401-10-09-0-05** P, A, B, T = Ø 32 max X, Y, L = Ø 11,2 max	DP-6* DPH*-6* DPZO-*-6*	DPHA-6 DPZA-*-6
	**4401-10-09-0-05** P, A, B, T = Ø 50 max X, Y, L = Ø 11,2 max	DPZO-*-8*	-

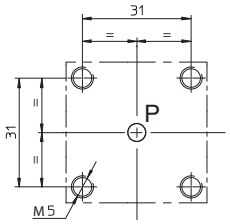
2 **ISO 6264: 2007 - for pressure relief valves**

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	**6264-06-09-1-97** P, T = Ø 14,7 max X = Ø 4,8 max	AGAM-10 AGMZO-*-10	AGAM-10 / AO AGAM-10 / WO AGMZA-*-10
	**6264-08-11-1-97** P, T = Ø 23,4 max X = Ø 6,3 max	AGAM-20 AGMZO-*-20	AGAM -20 / AO AGAM-20 / WO AGMZA-*-20
	**6264-10-17-1-97** P, T = Ø 32 max X = Ø 6,3 max	AGAM-32 AGMZO-*-32	AGAM-32 / AO AGAM-32 / WO AGMZA-*-32

3 **ISO 5781: 2000 - for pressure reducing and piloted check valves**

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	**5781-06-07-0-00** A, B = Ø 14,7 max X, Y = Ø 4,8 max	AGIS-10 AGIR-10 AGIU-10 AGRL*-10 AGRCZO-*-10	AGRCZA-*-10
	**5781-08-10-0-00** A, B = Ø 23,4 max X, Y = Ø 4,8 max	AGIS-20 AGIR-20 AGIU-20 AGRL*-20 AGRCZO-*-20	AGRZA-*-20
	**5781-10-13-0-00** A, B = Ø 32 max X, Y = Ø 4,8 max	AGIS-32 AGIR-32 AGIU-32 AGRL*-32	-

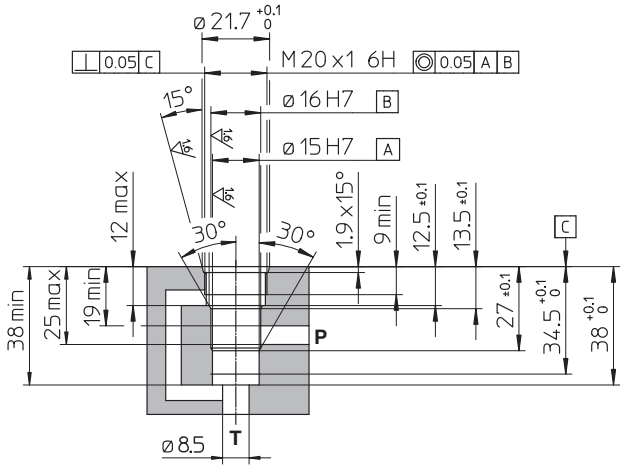
4 **ISO 16873: 2002 - for pressure switches**

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type
	**16873-01-01-0-02** P = Ø 4 max	MAP

Mounting surfaces and cavities for cartridge valves

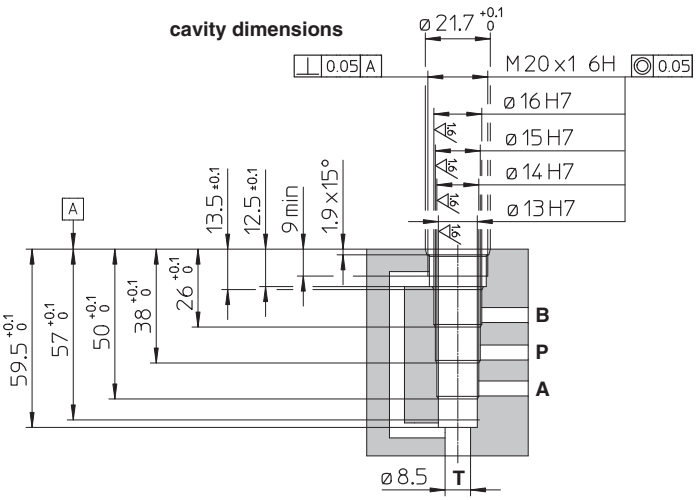
1 **CAVITIES DIMENSIONS for 2 WAY and 3 WAY CARTRIDGE VALVES type CART-LEH, CART-LEHM [mm]**

CAVITY for CART-LEH 2 way

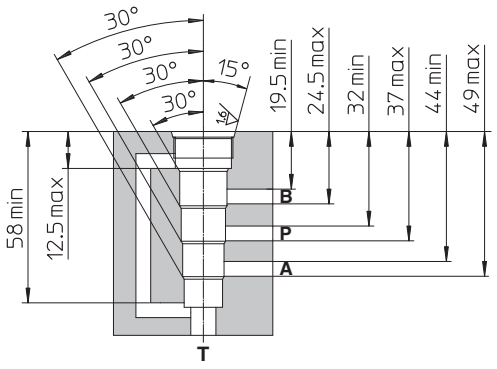


CAVITY for CART-LEH 3 way

cavity dimensions

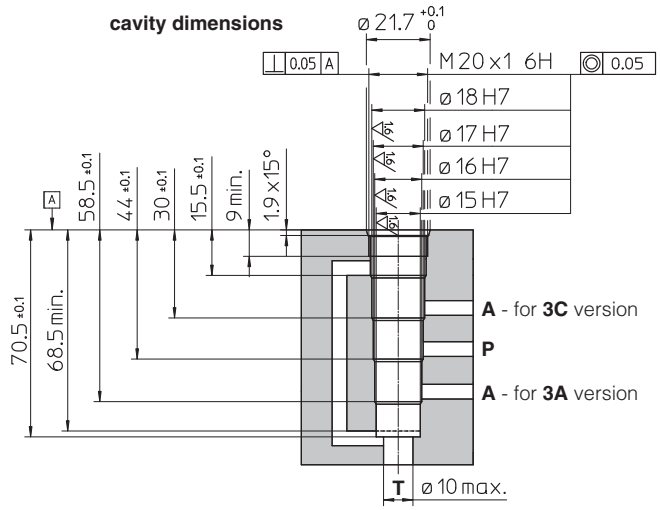


cavity edges and P, A, B, T connections

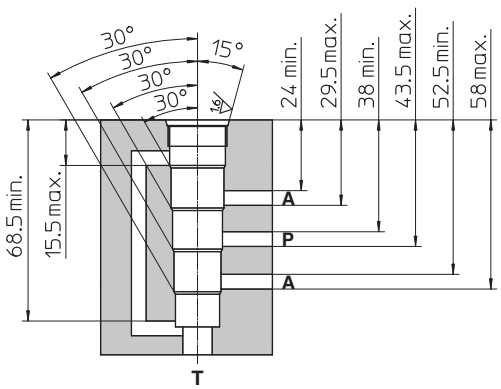


CART-LEHM 3 way

cavity dimensions

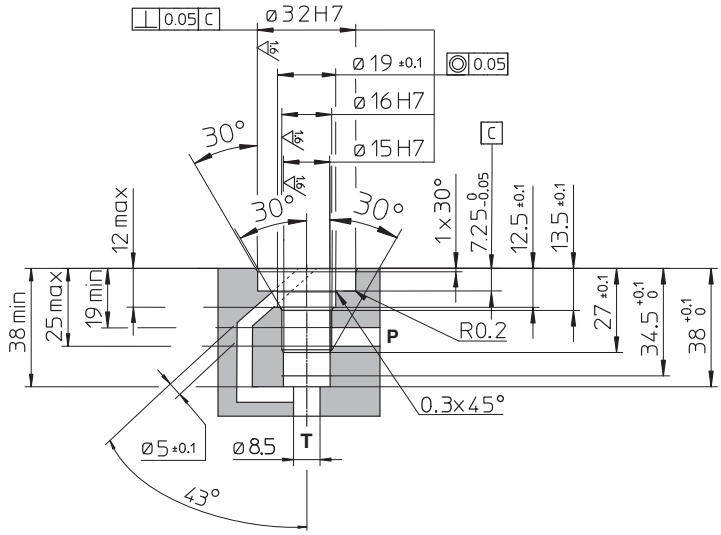


cavity edges and P, A, T connections



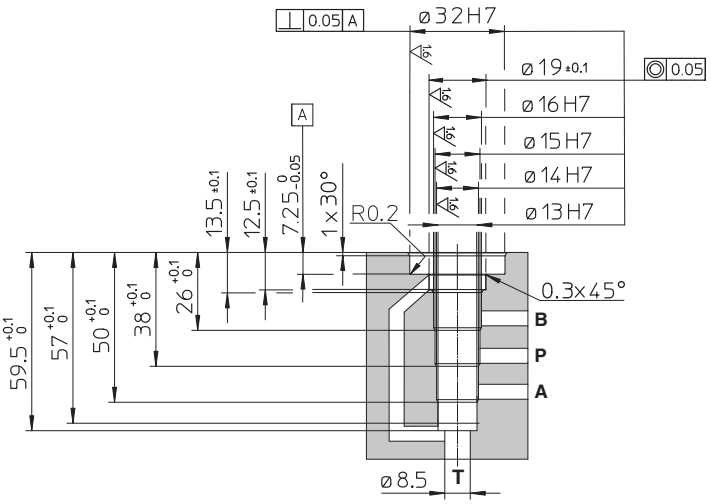
2 CAVITIES DIMENSIONS for 2 WAY and 3 WAY EX-PROOF CARTRIDGE VALVES type CART-LAH [mm]

CAVITY for CART-LAH 2 way

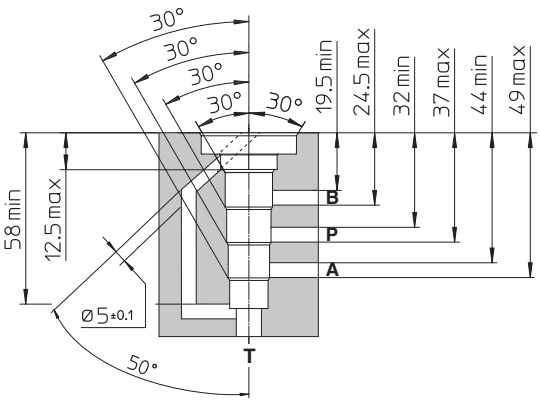


CAVITY for CART-LAH 3 way

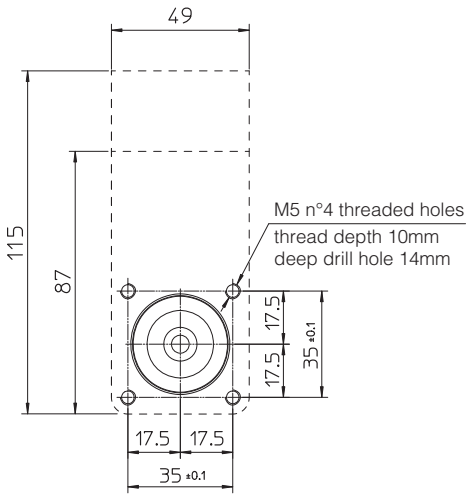
cavity dimensions



cavity edges and P, A, B, T connections



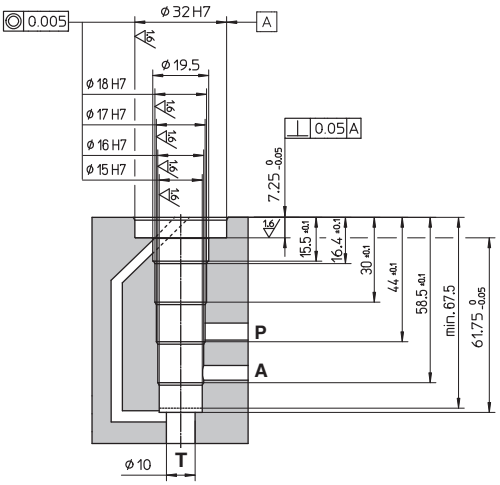
MOUNTING SURFACE for CART-LAH 2 and 3 way



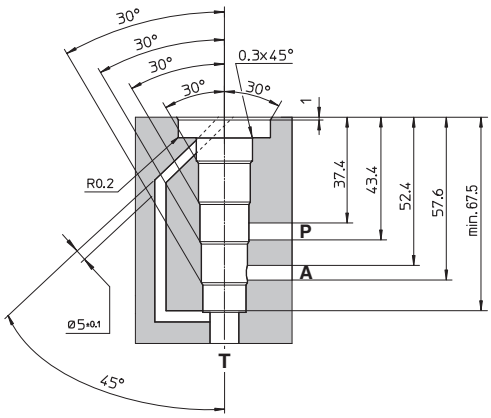
3 CAVITIES DIMENSIONS for 3 WAY EX-PROOF CARTRIDGE VALVES type CART-LAHM [mm]

CAVITY for CART-LAHM-3A

cavity dimensions

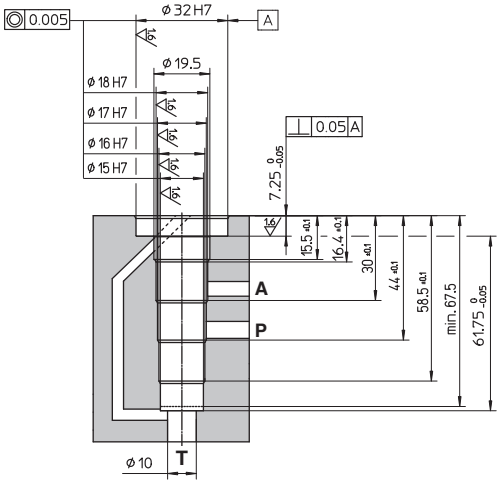


cavity edges and P, A, T connections

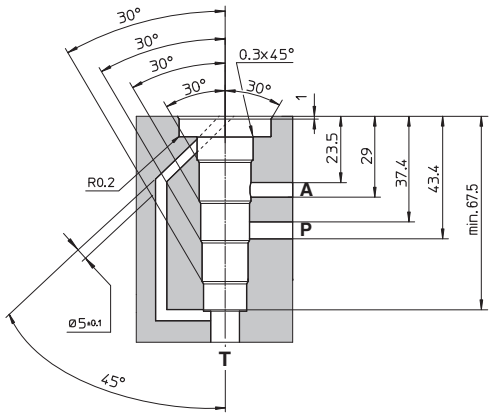


CAVITY for CART-LAHM-3C

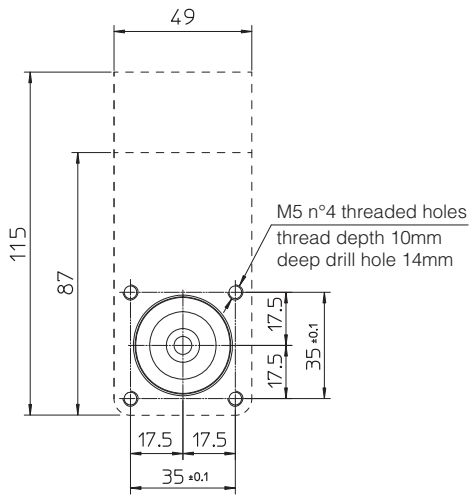
cavity dimensions



cavity edges and P, A, T connections

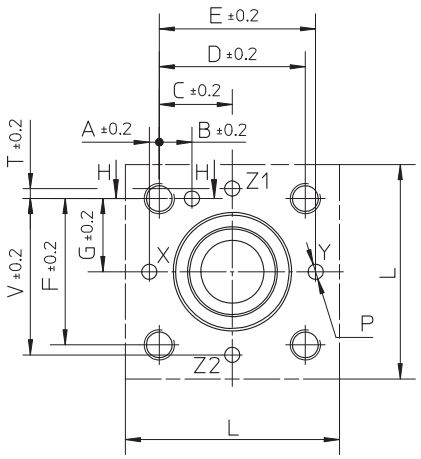


MOUNTING SURFACE for CART-LAHM 3 way



4 ISO 7368 COVER INTERFACE DIMENSIONS for 2 WAY and 3 WAY CARTRIDGE VALVES [mm]

Size from 16 to 63



VALVE TYPE

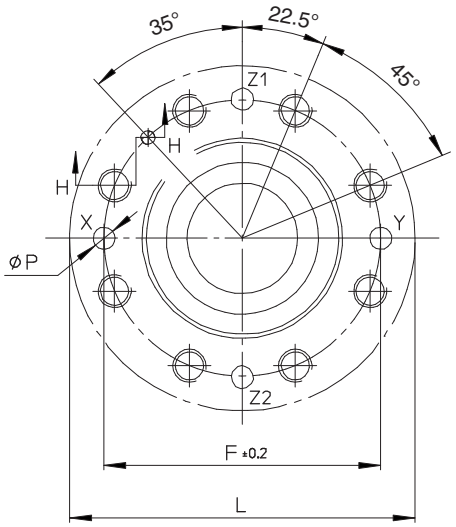
on off

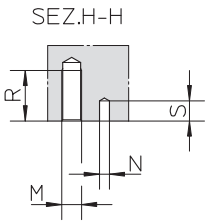
LIM
LIR
LIC
LIQV
LIDD
LIDEW
LIDBH
LIDO
LIDB
LIDR
LIDAS

proportional

LIQZO-T*
LIQZO-L* 2 way
LIQZO-L* 3 way
LIQZP-L* 2 way
LIQZP-L* 3 way

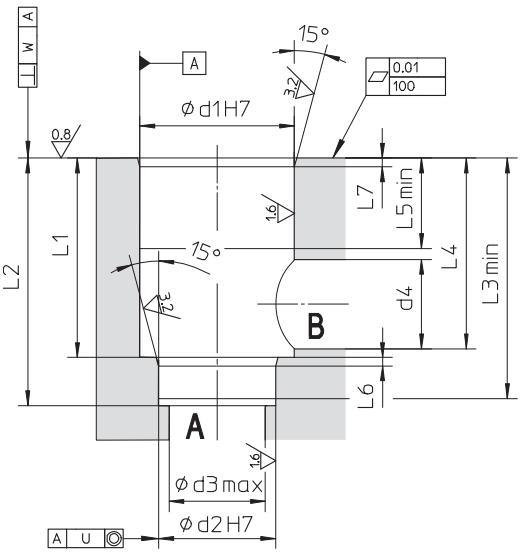
Size 80 and 100





Size	A	B	C	D	E	F	G	L	M	Ø N	P max	R	S min	T	V
16	2	12,5	23	46	48	46	23	65	M8	4	4	20	6	2	48
25	4	13	29	58	62	58	29	85	M12	6	6	30	8	4	62
32	6	18	35	70	76	70	35	102	M16	6	8	38	8	6	76
40	7,5	19.5	42.5	85	92.5	85	42,5	125	M20	6	10	46	8	7.5	92.5
50	8	20	50	100	108	100	50	140	M20	8	10	46	8	8	108
63	12.5	24.5	62.5	125	137,5	125	62.5	180	M30	8	12	66	8	12.5	137.5
80	-	-	-	-	-	Ø200	-	Ø250	M24	10	16	50	10	-	-
100	-	-	-	-	-	Ø245	-	Ø300	M30	10	20	63	10	-	-

5 ISO 7368 CAVITIES DIMENSIONS for 2 WAY CARTRIDGE VALVES [mm]



VALVE TYPE

on off

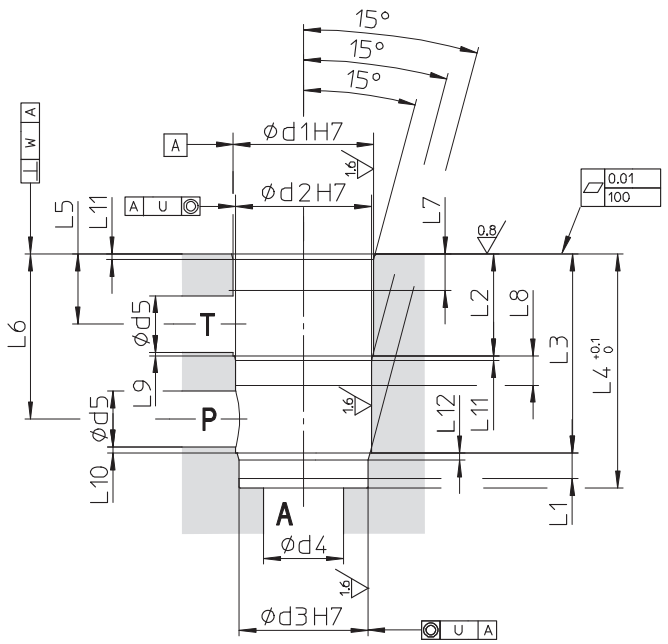
SC LI-*
LIDAS

proportional

LIQZO-T*
LIQZO-L* 2 way
LIQZP-L* 2 way

Size	ød1	ød2	ød3 max	ød4 max	L1	L2	L3	L4	L5	L6	L7	U	W
16	32	25	16	22,5	$43^{+0,1}_{0}$	$56^{+0,1}_{0}$	54	42,5	20	2	2	0,03	0,05
25	45	34	25	27	$58^{+0,1}_{0}$	$72^{+0,1}_{0}$	70	57	30	2,5	2,5	0,03	0,05
32	60	45	32	38,5	$70^{+0,1}_{0}$	$85^{+0,1}_{0}$	83	68,5	30	2,5	2,5	0,03	0,1
40	75	55	40	54,5	$87^{+0,1}_{0}$	$105^{+0,1}_{0}$	102	84,5	30	3	3	0,05	0,1
50	90	68	50	62,5	$100^{+0,1}_{0}$	$122^{+0,1}_{0}$	117	97,5	35	3	3	0,05	0,1
63	120	90	63	87	$130^{+0,1}_{0}$	$155^{+0,1}_{0}$	150	127	40	4	4	0,05	0,2
80	145	110	80	100	$175^{+0,2}_{0}$	$205^{+0,2}_{0}$	200	170,5	40	5	5	0,05	0,2
100	180	135	100	120	$210^{+0,2}_{0}$	$245^{+0,2}_{0}$	239	205,5	50	5	5	0.05	0.2

4 CAVITIES DIMENSIONS for 3 WAY CARTRIDGE VALVES [mm]



VALVE TYPE

proportional

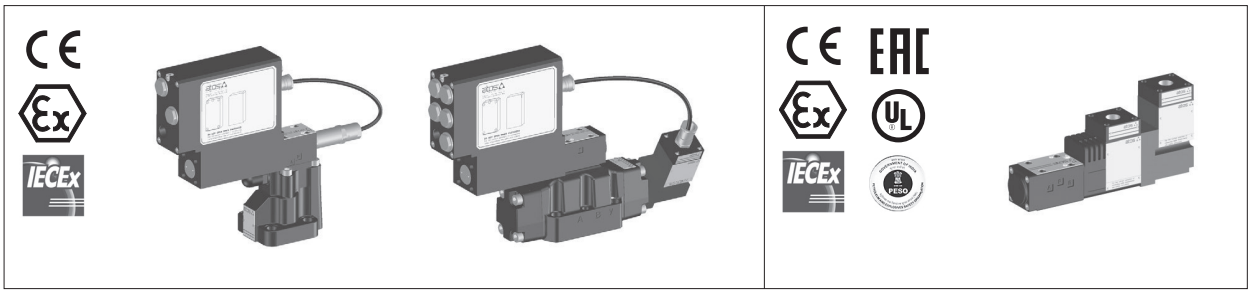
LIQZO-L* 3 way
LIQZP-L* 3 way

Size	ød1	ød2	ød3	ød4	ød5	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	U	W
25	45	43	34	20	20	11,5	56	89	103	45	78	25	15	1	1	2,5	2,5	0,03	0,05
32	60	58	55	32	24	13	43,5	85	100	30	70,5	18	15	1,5	2,5	2,5	2,5	0,03	0,05
40	75	73	55	40	30	15	54	105	125	36	87	21	18	3	3	3	3	0,03	0,05
50	90	87	68	50	35	17	87	143	165	66	122	48	18	3,5	3,5	4	3	0,05	0,05
63	120	116	90	63	48	20	85	165	195	57	137	33	28	4	4	4	4	0,05	0,05
80	145	140	110	80	60	25	125	215	245	90	180	60	25	5	5	5	5	0,05	0,05

Operating and maintenance information

for ex-proof proportional valves

This operating and maintenance information apply to Atos ex-proof proportional valves and is intended to provide useful guidelines to avoid risks when the valves are installed in a system operating in hazardous areas with explosive or flammable environement.
The prescriptions included in this document must be strictly observed to avoid damages and injury. The respect of this operating and maintenance information grant an increased working life, trouble-free operation and thus reduced repairing costs.
Information and notes on the transport and storage of the valves are also provided.



1 SYMBOL CONVENTIONS

This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The operating and maintenance information is part of the operating instructions for the complete machine but it cannot replace them.

This document is relevant to the installation, use and maintenance of proportional directional, flow and pressure control valves equipped with ex-proof proportional solenoid and on-board driver type OZA-* and MZA-* for application in explosive hazardous environments.

2.1 Warranty

All the ex-proof proportional valves have 1 year warranty; the expiration of warranty results from the following operations:
- unauthorized mechanical or electronic operations
- the ex-proof proportional valves are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

Service work performed on the valve by the end users or not qualified personnel invalidates the certification

3 CERTIFICATIONS AND PROTECTION MODE

3.1 Valves with on-board driver/axis controller

The ex-proof proportional valves subject of this operating and maintenance information are certified ATEX or IECEx.
They are in compliance with following protection mode:

II 2 G Ex d IIC T6, T5, T4 Gb

II 2 D Ex tb IIIC T85°C, T100°C, T135°C Db

3.2 Valves with off-board driver/axis controller

The ex-proof solenoids subject of this operating and maintenance information are multicertified ATEX, IECEx, EAC, PESO or cULus
They are in compliance with following protection mode:

Multicertification Group II – ATEX, IECEx, EAC, PESO

II 2 G Ex d IIC T6, T4, T3 Gb

II 2 D Ex tb IIIC T85°C, T135°C, T200°C Db

Multicertification Group I (mining) – ATEX, IECEx

I M2 Ex d I Mb

cULus Noth American certification

Class I, Div. I, Groups C & D	**T. class T4/T3**
Class I, Zone I, Groups II A & II B	**T. class T4/T3**

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

ATEX

EN 60079-0 Explosive atmospheres - Equipment: General requirements
EN 60079-1 Explosive atmospheres - Equipment protection by flameproof enclosures “d”
EN 60079-31 Explosive atmospheres - Equipment dust ignition protection by enclosures “t”

IECEx

IEC 60079-0 Explosive atmospheres - Part 0: General requirements
IEC 60079-1 Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures “d”
IEC 60079-31 Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosures “t”

5 GENERAL CHARACTERISTICS

Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU (not for valves type T) REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

See technical tables relevant to the specific components, listed in section 12

7 ELECTRICAL CHARACTERISTICS

7.1 Valves with on-board driver/axis controller

Characteristics:

The power limitation is obtained by feeding the solenoid with current of 2,75 A, controlled by the on-board electronic driver/axis controller:

- Power supply: 24 VDC ±10 % stabilized - Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
- Current supply: IMAX = 2,75 A PWM square wave type
- Max power consumption: 35 W
- Output protection: against short circuit

Note: 2,5 A external fuse type RVT (fast) must be provided on the power supply line

For details see technical tables relevant to the specific components, listed in section 12

7.2 Valves with off-board driver/axis controller

Solenoid characteristics:

- Max power consumption: 35 W
- Coil resistance R at 20°C: 3,2 Ω; 17,6 Ω (option /24)
- Max solenoid current: 2,5 A; 1,1 A (option /24)

For details see technical tables relevant to the specific components, listed in section 12

Off-board driver/axis controller characteristics:

The power limitation is obtained by feeding the solenoid with current of 2,5 A, controlled by following off-board driver/axis controller:

- Power supply: 24 VDC ±10 % stabilized - Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
- Current supply: IMAX = 2,5 A PWM square wave type
- Output protection: against short circuit

Note: 2,5 A external fuse type RVT (fast) must be provided on the power supply line

For valves without transducer:

E-BM-AS-*/A see tech table G030
E-BM-AES-*/A see tech table GS050

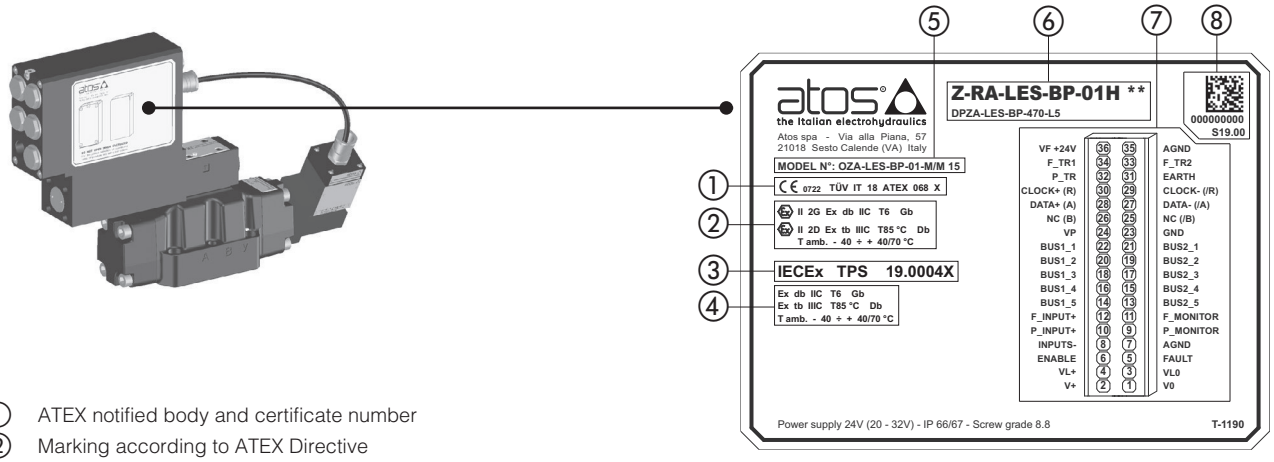
For valves with LVDT transducer:

E-BM-TEB/LEB-*/A see tech table GS230
E-BM-TES/LES-*/A see tech table GS240
Z-BM-TEZ/LEZ-*/A see tech table GS330

8 NAMEPLATES

8.1 Valve with on-board driver/axis controller - ATEX and IECEx certification

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22



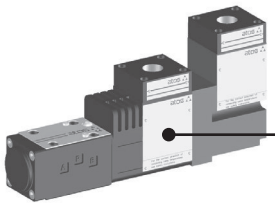
① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ Code of solenoid
⑥ Code of on-board driver and related proportional valve
⑦ Electronic connections
⑧ Qr code and driver serial number

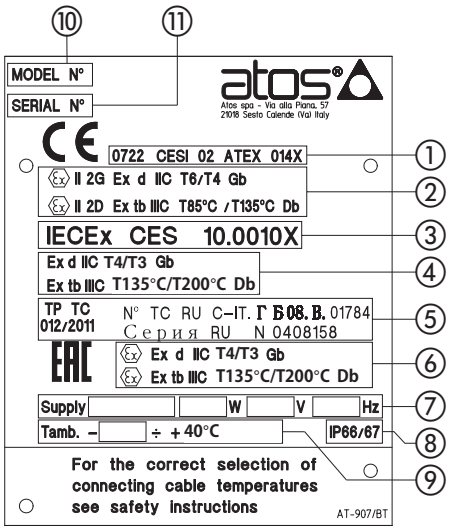
CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/EU directive and to the relevant technical norms
II 2 G	Equipment for surface plants with gas and vapors environment, category 2, suitable for zone 1 and zone 2
Ex db	Explosion-proof equipment
II C	Group II C equipment suitable for substances (gas) for group II C
T6	Equipment temperature class (maximum surface temperature)
Gb	Equipment protection level, very high level protection for explosive Gas atmospheres
II 2 D	Transducer for surface plants with dust environment, category 2, suitable for zone 21 and zone 22
Ex tb	Equipment protection by enclosure"tb"
III C	Suitable for conductive dust (applicable also IIIB and/or IIIA)
IP66/67	Protection degree
T85°C	Maximum surface temperature (Dust)
Db	Equipment protection level, high level protection for explosive Dust atmospheres
TUV IT 18 ATEX 068 X	Name of the laboratory responsible for the CE certification: 18 year of the certification release; 068 X certification number
0948	Number of the Certified Body authorized for the production quality system certification
IECEx TPS 19.0004X	Certificate number: TPS laboratory name responsible for the IECEx certification scheme: 19 year of the certification release; 0004X number of certification
T amb.	Ambient temperature range

Notes:
The group IIC solenoids are suitable for IIA and IIB environments.
The T6 temperature class solenoids are suitable for all the substances having higher temperature class (T5, T4, T3, T2, T1).
The T5 temperature class solenoids are suitable also for all the substances having higher temperature class (T4, T3, T2, T1).

8.2 Valve with off-board driver/axis controller - ATEX, IECEx, EAC and PESO

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22





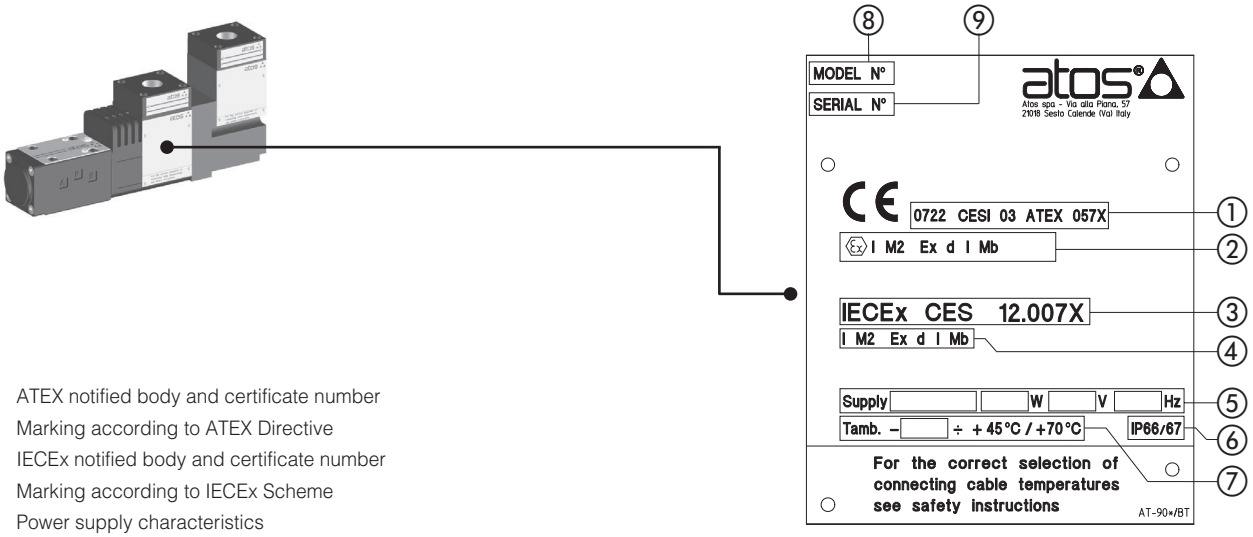
① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ EAC notified body and certificate number
⑥ Marking according to EAC
⑦ Power supply characteristics
⑧ Ingress protection:
- IP66 = no dust ingress, protection against heaving seas or powerful jets of water
- IP67 = no dust ingress, protection to water immersion

⑨ Ambient temperature
⑩ Solenoid model code
⑪ Solenoid serial number

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/EU directive and to the relevant technical norms
II 2 G	Equipment for surface plants with gas and vapors environment, category 2, suitable for zone 1 and zone 2
Ex d	Explosion-proof equipment
II C	Group II C equipment suitable for substances (gas) for group II C
T4, T3	Solenoid temperature class (maximum surface temperature)
Gb	Equipment protection level, very high level protection for explosive Gas atmospheres
II 2 D	Equipment for surface plants with dust environment, category 2, suitable for zone 21 and zone 22
Ex tb	Equipment protection by enclosure"tb"
III C	Suitable for conductive dust (applicable also IIIB and/or IIIA)
IP66/67	Protection degree
T85°C, T135°C, T200°C	Maximum surface temperature (Dust)
Db	Equipment protection level, high level protection for explosive Dust atmospheres
CESI 02 ATEX 014 X	Name of the laboratory responsible for the CE certification: 02 year of the certification release; 014 X certification number
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 10.0010X	Certificate number: CES laboratory name responsible for the IECEx certification scheme: 10 year of the certification release; 0010X number of certification
T amb.	Ambient temperature range

8.3 Valve with off-board driver/axis controller - ATEX and IECEx

Gas - group I M2 - Mining



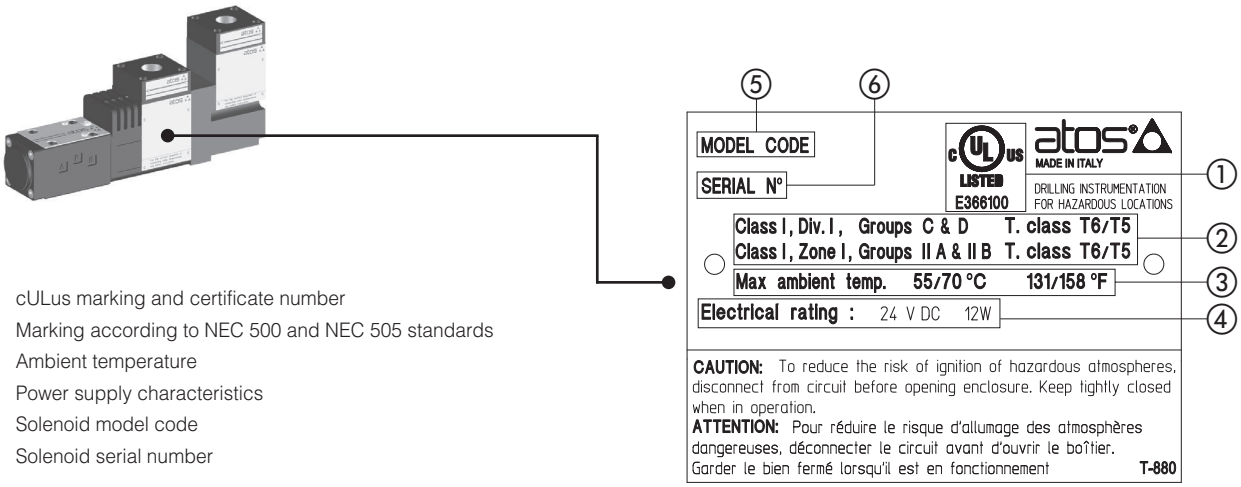
① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ Power supply characteristics
⑥ Ingress protection:
- IP66 = no dust ingress, protection against heaving seas or powerful jets of water
- IP67 = no dust ingress, protection to water immersion

⑦ Ambient temperature
⑧ Solenoid model code
⑨ Solenoid serial number

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/UE directive and to the technical norms
I M2	Equipment for mining (or relevant surface plants) which could be exposed to gas and / or flammable dust. The power supply of these equipment has to be switched off in case of explosive atmosphere.
Ex d	Explosion-proof equipment
I	Group I equipment suitable for substances (gas) for group I
Mb	Equipment protection level, high level protection for explosive atmospheres
CESI 03 ATEX 057 X	Name of the laboratory responsible for the CE certification: 03 year of the certification release; 057 certification number X= reduced risk of mechanical shock (the equipment has to be protected from mechanical shocks)
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 12.007X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 12 year of the certification release; 007X number of certification
T amb.	Ambient temperature range

8.4 Valve with off-board driver/axis controller - cULus certification

Class I, Division I, Groups C and D
Class I, Zone I, Groups IIA and IIB



① cULus marking and certificate number
② Marking according to NEC 500 and NEC 505 standards
③ Ambient temperature
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number

c UL us LISTED E366100	cULus mark and certificate number
Class I	Equipment for flammable gas and vapours
Division I	Explosive substances continuously or intermittently present in the atmosphere
Groups C & D	Gas group C (Methane, Buthane, Petrol, etc) and D (Etylene, Formaldeyde, Cloruprophane, etc)
Zone I	Location where explosive substances are continuously present
Groups IIA & IIB	Equipment of group IIA and IIB suitable for gas of group IIA and IIB
Class T6/T5	Solenoid temperature class (maximum surface temperature)
Max ambient temp.	Max ambient temperature range in °C and °F

9 SAFETY NOTES

9.1 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:
- Wrong installation / installation in areas not approved for the specific component
- Incorrect cleanliness during storage and assembly
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of the specified performance limits
- Use of inappropriate electrical power supply
- Incorrect transport

9.2 Installation

The installation or use of inappropriate components in explosive hazardous environments could cause personal injuries and damage to property.

For the application in explosion hazardous environments, the compliance of the solenoid with the zone classification and with the flammable substances present in the system must be verified.
The main safety requirements against the explosion risks in the classified areas are established by the European Directives 2014/34/UE (for the components) and 99/92/CE (for the plants and safety of the workers against the risk of explosion).

The classification criteria of the area against the explosion risks are established by the norm EN60079-10.
The technical requirements of the electrical systems are established by the norm EN60079-14 (group II).

Note: the max fluid temperature controlled by the valve must not exceed + 60°C

Ensure that no explosive atmosphere may occur during the valve installation.
Only use the valve in the intended explosion protection area.
The ignition temperature of the hydraulic fluid used must be 50°C higher than the maximum surface temperature of the valve.

Use of the valve outside the approved temperature ranges may lead to functional failures like e.g. overheating of the valve solenoid/driver. This means that the explosion protection is no longer ensured.
Only use the valve within the fluid temperature range.
During operation, touch the valve solenoid only by using protective gloves.
Unload the system pressure before working on the valve.
Danger of serious injury can be caused by a powerful leaking of hydraulic fluid jet.
Before working on the valve, ensure that the hydraulic system is depressurized and the electrical control is de-energized.

9.3 Electrical connection - valve with on-board driver/axis controller

Electrical connections to the external circuits are achieved through 36 poles terminal block installed on a PCB fixed inside driver housing.
The threaded cable entrance is provided with a cylindrical thread M20x1,5 UNI 4535.

The cable glands used for the cable entrance must be certified for the specific hazardous environment – see tech. table **KX800** for Atos ex-proof cable glands.

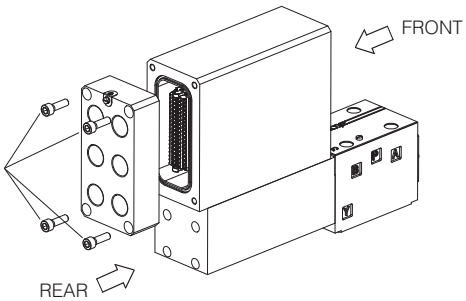
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

The electrical cables must be suitable for the working temperatures as shown in the section 9.4

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

n°4 M6
Tightening torque **15 Nm**

5



⚠ **WARNING:** the above operation must be performed in a safety area

9.4 Cable specification and temperature - Valve with on-board driver/axis controller

Power supply and signals: section of wire = 1,0 mm²

Grounding: section of external ground wire = 4 mm²

Cable temperature

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

9.5 Electrical connection - valve off-board driver/axis controller

The connection to the external circuit is made with a screw clamps 2 poles + ground, installed inside the solenoid and transducer housing.
The eventual requirement of the additional ground connection on the solenoid housing must be made on the relative screw (M3x6 UNI-6107).

The threaded cable entrance is provided with one of following optional connections:
- conical thread 1/2" NPT ANSI B2.1
- conical thread GK-1/2" "(Annex 1 CEI EN 60079-1 2008-11) only for the Italian market
- cylindrical thread M20x1,5 UNI 4535

The cable glands used for the cable entrance must be certified for the specific hazardous environment – see tech. table **KX800** for Atos ex-proof cable glands.

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

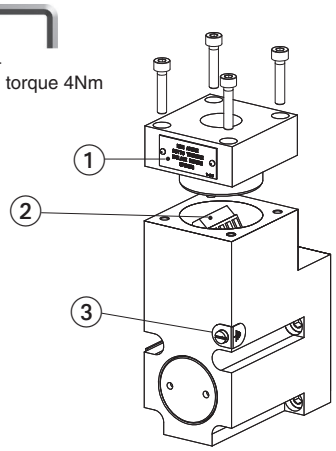
The electrical cables must be suitable for the working temperatures as shown in the section 9.6

LVDT main stage transducer - only for DPZA-T

Multicertification

3

n°4 M4
locking torque 4Nm



① cover with threaded connection for vertical cable gland fitting
② terminal board for cables wiring
③ screw terminal for additional equipotential grounding

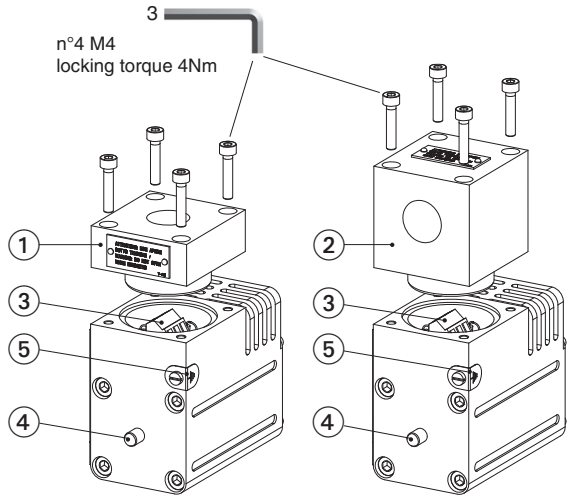
Position transducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

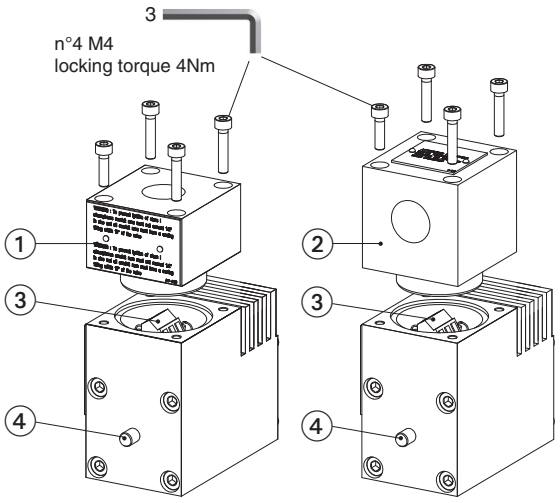
Valve without LVDT transducer

Multicertification



Standard version **Option /O**

cULus certification

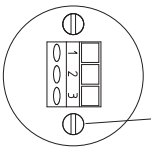


Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)



⚠ **Pay attention to coil polarity**

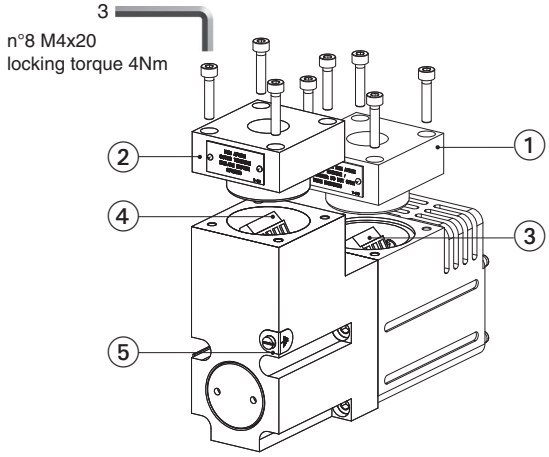
1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16)

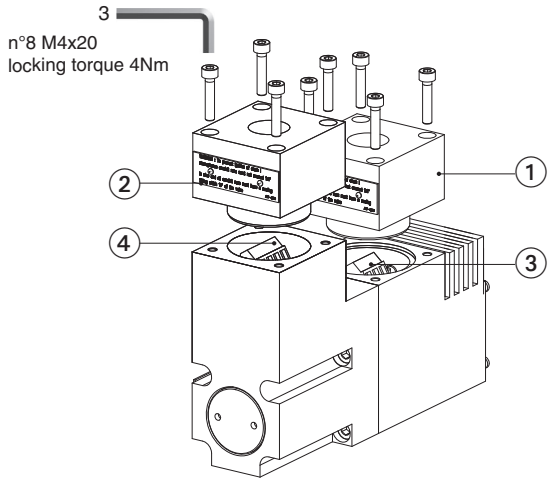
alternative GND screw terminal connected to solenoid housing

Valve with LVDT transducer

Multicertification



cULus certification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

Solenoid wiring

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

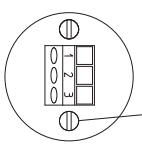
Position transducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

Solenoid wiring

⚠ **Pay attention to respect the polarity**

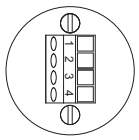


1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9.6 note 1

alternative GND screw terminal connected to solenoid housing

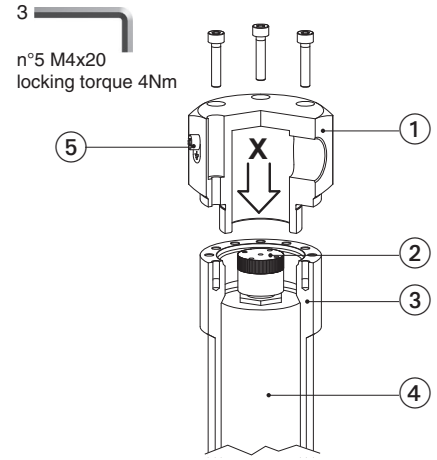
Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

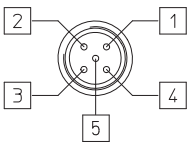
PCB 4 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9.6 note 1

LVDT main stage transducer - only for LIQZA-L



① transducer cover with threaded connection for cable gland fitting
② transducer terminal board for cables wiring
③ ex-proof protection for LVDT transducer
④ LVDT transducer
⑤ screw terminal for additional equipotential grounding

Transducer wiring - view from **X**



1 = Do not connect
2 = Supply -15 V
3 = GND
4 = Output signal
5 = Supply +15 V

9.6 Cable specification and temperature - Valve with off-board driver/axis controller

Cable specification - Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

Cable temperature - Multicertification Group I and Group II

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	-	90 °C	-
45 °C	-	T4	150 °C	135 °C	-	90 °C
55 °C	-	T3	150 °C	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

Cable specification - cULus certification

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: for Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring

Cable temperature - cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

9.7 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.
The hydraulic fluids must be compatible with the selected seals.
Make sure that the working fluid is compatible with gas and dust present in the environment. The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s

9.8 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.

Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet.
In the worst case, this may result in unexpected system movements and thus constitute a risk of injury.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the valve over the entire operating range.

Max fluid contamination level, see also filter section at www.atos.com or KTF catalog:

- normal operation: ISO4406 class 18/16/13 NAS1638 class 7
- longer life: ISO4406 class 16/14/11 NAS1638 class 5

10 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

10.1 Ordinary maintenance

Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

- The valves does not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer over 5 mm
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

10.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.
Unauthorized opening of the valves during the warranty period invalidates the warranty and invalidates the certification tools for repairing.

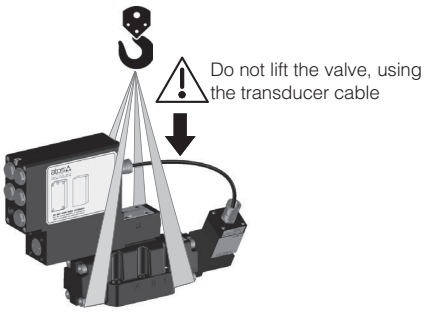
The intrinsically safe solenoids must not be opened.
Any tampering invalidates the certification and it may cause serious dangerous.

11 TRANSPORT AND STORAGE

11.1 Transport

Observe the following guidelines for transportation of valves:

- Before any movement check the valve weight reported in the technical table relevant to the specific component
- Use soft lifting belts to move or lift the heavy valves to avoid damages



Danger of damage to property and personal injuries!
The valve may fall down and cause damage and injuries, if transported improperly:
- Use the original packaging for transport
- Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.

11.2 Storage

Valve's corrosion protection is achieved with zinc coating: this treatment protect the valve to grant a storage period up to 12 months.
Additionally all valves are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.
In case of storage period longer than 12 months please contact our technical office.
Ensure that valves are well protected against water and humidity in case of storage in open air.

12 RELATED DOCUMENTATION

12.1 Valve with on-board driver/axis controller

Servoproportional directional - zero overlap with LVDT transducer
FX150 DLHZA-TES, DLKZA-TES - direct, sleeve execution
FX135 DHZA-TES, DKZA-TES - direct
FX235 DPZA-LES, piloted
FX380 LIQZA-LES, 3-way cartridge

High performance directional - positive overlap with LVDT transducer
FX130 DHZA-TES, DKZA-TES - direct
FX230 DPZA-LES - piloted
FX360 LIQZA-LES, 2-way cartridge

Directional valves - positive overlap without transducer
FX110 DHZA-AES, DKZA-AES - direct
FX210 DPZA-AES - piloted

High performance pressure valves - with pressure transducer
FX030 RZMA-RES, AGMZA-RES - relieft
FX060 RZGA-RES, AGRCZA-RES - reducing
FX320 LIMZA-RES, LIRZA-RES, LICZA-RES - relief, reducing, compensator

Pressure valves - without transducer
FX020 RZMA-AES, AGMZA-AES - relief
FX050 RZGA-AES, AGRCZA-AES - reducing
FX080 DHRZA-AES - reducing
FX310 LIMZA-AES - relief
LIRZA-AES - reducing
LICZA-AES - compensator

Flow valves, pressure compensated
FX430 QVHZA-TES, QVKZA-TES - with LVDT transducer
FX410 QVHZA-AES, QVKZA-AES - without transducer

Servoproportional valves with on-board axis controller
FX610 DLHZA-TEZ, DLKZA-TEZ – direct, sleeve execution
FX620 DHZA-TEZ, DKZA-TEZ - direct
FX630 DPZA-LEZ - piloted

12.2 Valve with off-board driver/axis controller

Servoproportional directional - zero overlap with LVDT transducer
FX140 DLHZA-T DLKZA-T - direct, sleeve execution
FX370 LIQZA-L, 3-way cartridge

High performance directional - positive overlap with LVDT transducer
FX120 DHZA-T, DKZA-T - direct
FX220 DPZA-T - piloted
FX350 LIQZA-L, 2-way cartridge

Directional valves - positive overlap without transducer
FX100 DHZA-A, DKZA-A - direct
FX200 DPZA-A - piloted

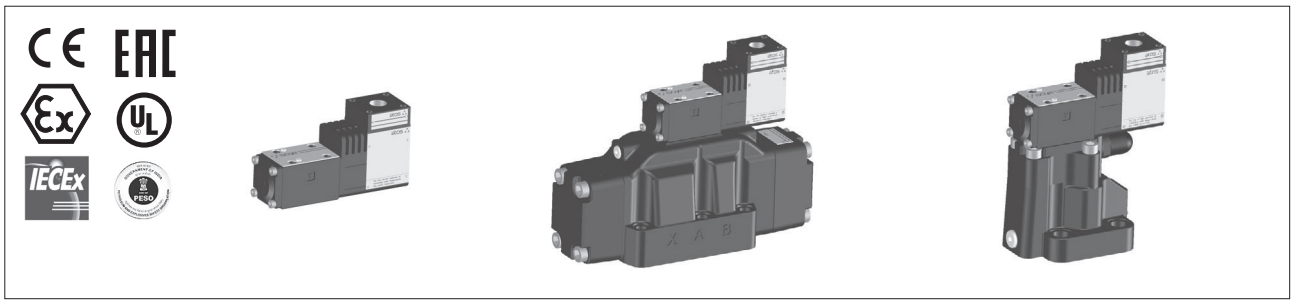
Pressure valves - without pressure transducer
FX010 RZMA-A, HZMA-A, AGMZA-A - relief
FX040 RZGA-A, AGRCZA-A, HZGA-A, KZGA-A - reducing
FX070 DHRZA-A - reducing
FX300 LIMZA-A - relief
LIRZA-A - reducing
LICZA-A - compensator

Flow valves, pressure compensated
FX420 QVHZA-T, QVKZA-T - with LVDT transducer
FX400 QVHZA-A, QVKZA-A - without transducer

Operating and maintenance information

for ex-proof on-off valves

This operating and maintenance information apply to Atos ex-proof on-off valves and is intended to provide useful guidelines to avoid risks when the valves are installed in a system operating in hazardous areas with explosive or flammable environement.
The prescriptions included in this document must be strictly observed to avoid damages and injury. The respect of this operating and maintenance information grant an increased working life, trouble-free operation and thus reduced repairing costs.
Information and notes on the transport and storage of the valves are also provided.



1 SYMBOL CONVENTIONS

This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The operating and maintenance information is part of the operating instructions for the complete machine but it cannot replace them.

This document is relevant to the installation, use and maintenance of on-off directional, flow and pressure control valves equipped with ex-proof solenoids type OA-* for application in explosive hazardous environments.

2.1 Warranty

All the ex-proof on-off valves have 1 year warranty; the expiration of warranty results from the following operations:
- unauthorized mechanical or electronic interventions
- the ex-proof on-off valves are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

Service work performed on the valve by the end users or not qualified personnel invalidates the certification

3 CERTIFICATIONS AND PROTECTION MODE

The ex-proof on-off solenoids subject of this operating and maintenance information are multicertified ATEX, IECEx, EAC or cULus
They are in compliance with following protection mode:

Multicertification Group II – ATEX, IECEx, EAC, PESO

II 2 G Ex d IIC T6, T4, T3 Gb

II 2 D Ex tb IIIC T85°C, T135°C, T200°C Db

Multicertification Group I (mining) – ATEX, IECEx

I M2 Ex d I Mb

MA chinese mining certification

d I Mb

cULus Noth American certification

Class I, Div. I, Groups C & D T. class T4/T3
Class I, Zone I, Groups II A & II B T. class T4/T3

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

ATEX

EN 60079-0	Explosive atmospheres - Equipment: General requirements
EN 60079-1	Explosive atmospheres - Equipment protection by flameproof enclosures “d”
EN 60079-31	Explosive atmospheres - Equipment dust ignition protection by enclosures “t”

IECEx

IEC 60079-0	Explosive atmospheres - Part 0: General requirements
IEC 60079-1	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures “d”
IEC 60079-31	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosures “t”

cULus

UL 1203	Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for use in Hazardous (classified) locations
UL 429	Standard for Electrically Operated valves
CSA C22.2	No.139-13 Electrically Operated Valves

5 GENERAL CHARACTERISTICS

Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU (not for valves type T) REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

See technical tables relevant to the specific components, listed in section 12

7 ELECTRIC CHARACTERISTICS

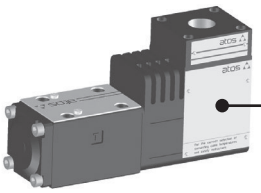
Harmonized standard	**Multicertification**	**cULus**
Power consumption at 20°C	8W	12W

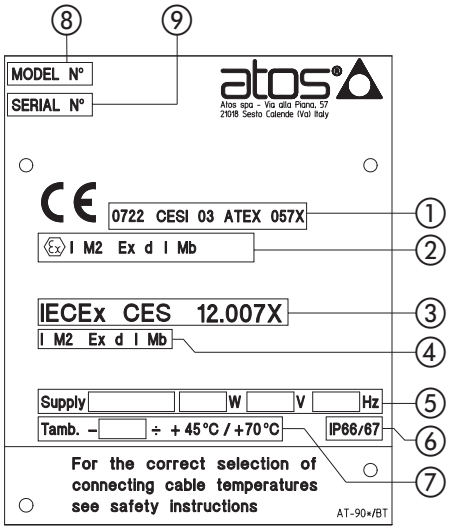
See technical tables relevant to the specific components, listed in section 12

8 NAMEPLATES

8.1 ATEX and IECEx multicertification

Gas - group I M2 - Mining





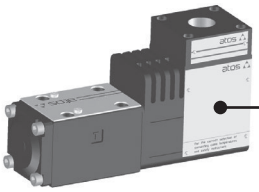
① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ Power supply characteristics
⑥ Ingress protection:
- IP66 = no dust ingress, protection against heaving seas or powerful jets of water
- IP67 = no dust ingress, protection to water immersion

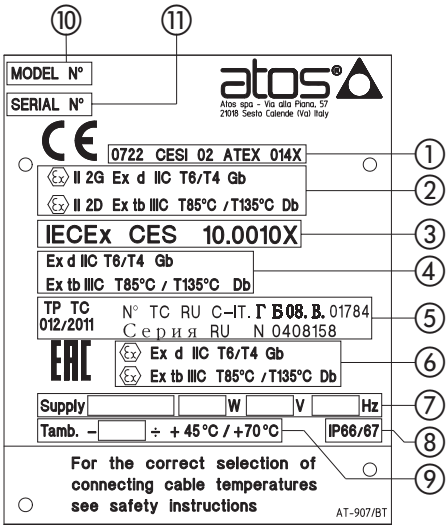
⑦ Ambient temperature
⑧ Solenoid model code
⑨ Solenoid serial number

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/UE directive and to the relevant technical norms
I M2	Equipment for mining (or relevant surface plants) which could be exposed to gas and / or flammable dust. The power supply of these equipment have to be switched off in case of explosive atmosphere.
Ex d	Explosion-proof equipment
I	Group I equipment suitable for substances (gas) for group I
Mb	Equipment protection level, high level protection for explosive atmospheres
CESI 03 ATEX 057 X	Name of the laboratory responsible for the CE certification: 03 year of the certification release; 057 certification number X= reduced risk of mechanical shock (the equipment has to be protected from mechanical shocks)
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 12.007X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 12 year of the certification release; 007X number of certification
T amb.	Ambient temperature range

8.2 ATEX, IECEx, EAC and PESO multicertification

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22





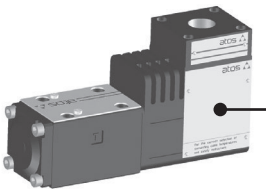
① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ EAC notified body and certificate number
⑥ Marking according to EAC
⑦ Power supply characteristics
⑧ Ingress protection:
- IP66 = no dust ingress, protection against heaving seas or powerful jets of water
- IP67 = no dust ingress, protection to water immersion

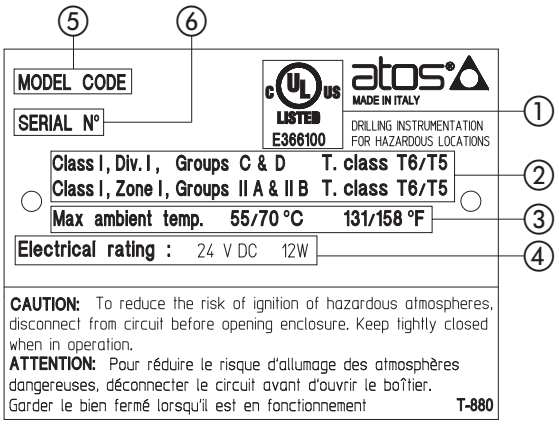
⑨ Ambient temperature
⑩ Solenoid model code
⑪ Solenoid serial number

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/UE directive and to the relevant technical norms
II 2 G	Equipment for surface plants with gas or vapors environment, category 2, suitable for zone 1 and 2
Ex d	Explosion-proof equipment
II C	Group II C equipment suitable for substances (gas) for group II C
T6, T4, T3	Equipment temperature class (maximum surface temperature)
Gb	Equipment protection level, high level protection for explosive Gas atmospheres
II 2 D	Equipment for surface plants with dust environment, category 2, suitable for zone 21 and zone 22
Ex tb	Equipment protection by enclosure"tb"
IIIC	Suitable for conductive dust (applicable also IIIB and/or IIIA)
IP66/67	Protection degree
T85°C, T135°C, T200°C,	Maximum surface temperature (Dust)
Db	Equipment protection level, high level protection for explosive Dust atmospheres
CESI 02 ATEX 014 X	Name of the laboratory responsible for the CE certification: 02 year of the certification release; 014 X certification number
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 10.0010X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 10 year of the certification release; 0010X number of certification
T amb.	Ambient temperature range

8.3 cULus certification

Class I, Division 1
Class I, Zone 1



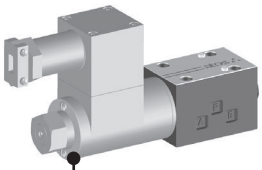


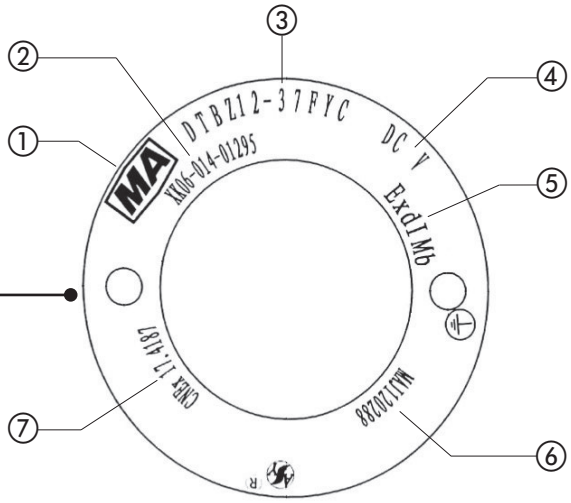
① cULus marking and certificate number
② Marking according to NEC 500 and NEC 505 standards
③ Ambient temperature
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number

c UL us LISTED E366100	cULus mark and certificate number
Class I	Equipment for flammable gas and vapours
Division I	Explosive substances continuously or intermittently present in the atmosphere
Groups C & D	Gas group C (Methane, Buthane, Petrol, etc) and D (Etylene, Formaldeyde, Cloruprophane, etc)
Zone I	Location where explosive substances are continuously present
Groups IIA & IIB	Equipment of group IIA and IIB suitable for gas of group IIA and IIB
Class T6/T5	Solenoid temperature class (maximum surface temperature)
Max ambient temp.	Max ambient temperature range in °C and °F

8.4 MA certification

Gas - group I Mb - Mining





① MA logo
② License
③ Solenoid model code
④ Power supply characteristics
⑤ MA classification for Mining
⑥ MA certificate number
⑦ Notified body and certificate number

MA	MA Center mark
Ex d	Explosion-proof equipment
I	Group I equipment suitable for substances (gas) for group I
Mb	Equipment protection level, high level protection for explosive atmospheres

9 SAFETY NOTES

9.1 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:
- Wrong installation / installation in areas not approved for the specific component
- Incorrect cleanliness during storage and assembly
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of specified performance limits
- Use of inappropriate electrical power supply
- Incorrect transport

9.2 Installation

The installation or use of inappropriate components in explosive hazardous environments could cause personal injuries and damage to property.

For the application in explosion hazardous environments, the compliance of the solenoid with the zone classification and with the flammable substances present in the system must be verified.
The main safety requirements against the explosion risks in the classified areas are established by the European Directives 2014/34/UE (for the components) and 99/92/CE (for the plants and safety of the workers against the risk of explosion).

The classification criteria of the area against the explosion risks are established by the norm EN60079-10.
The technical requirements of the electrical systems are established by the norm EN60079-14 (group II).

Note: the max fluid temperature controlled by the valve must not exceed + 60°C

Ensure that no explosive atmosphere may occur during the valve installation.
Only use the valve in the intended explosion protection area.
The ignition temperature of the hydraulic fluid used must be 50°C higher than the maximum surface temperature of the valve.

Use of the valve outside the approved temperature ranges may lead to functional failures like e.g. overheating of the valve solenoid.
This means that the explosion protection is no longer ensured.
Only use the valve within the fluid temperature range.
During operation, touch the valve solenoid only by using protective gloves.
Unload the system pressure before working on the valve.
Danger of serious injury can be caused by a powerful leaking of hydraulic fluid jet.
Before working on the valve, ensure that the hydraulic system is depressurized and the electrical control is de-energized.

9.3 Electrical connection - valve off-board driver/axis controller

The connection to the external circuit is made with a screw clamps 2 poles + ground, installed inside the solenoid and transducer housing.
The eventual requirement of the additional ground connection on the solenoid housing must be made on the relative screw (M3x6 UNI-6107).

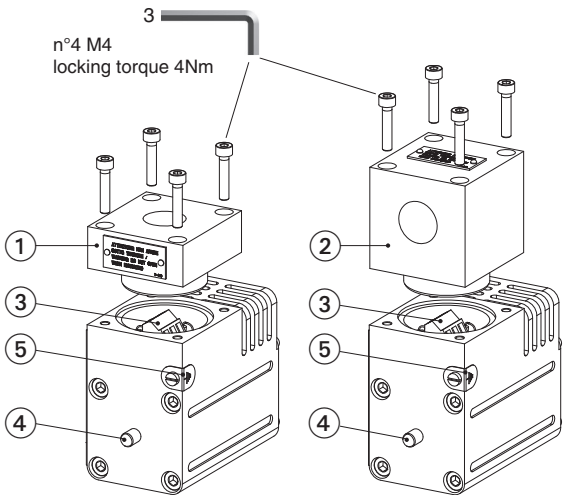
The threaded cable entrance is provided with one of following optional connections:
- conical thread 1/2" NPT ANSI B2.1
- conical thread GK-1/2" "(Annex 1 CEI EN 60079-1 2008-11) only for the Italian market
- cylindrical thread M20x1,5 UNI 4535

The cable glands used for the cable entrance must be certified for the specific hazardous environment – see tech. table **KX800** for Atos ex-proof cable glands.

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

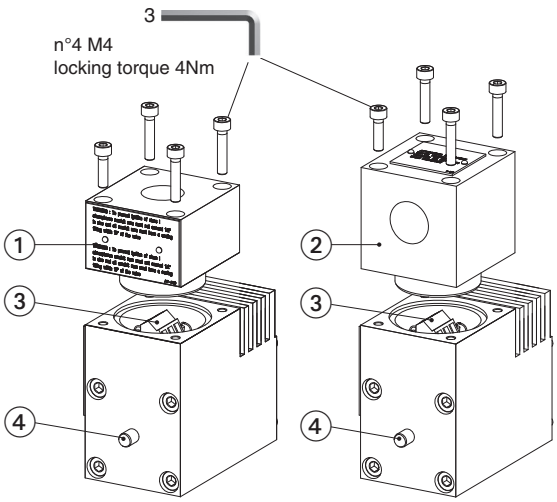
The electrical cables must be suitable for the working temperatures as shown in the section 9.6

Multicertification



Standard version **Option /O**

cULus certification

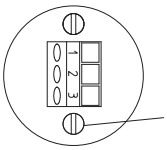


Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)



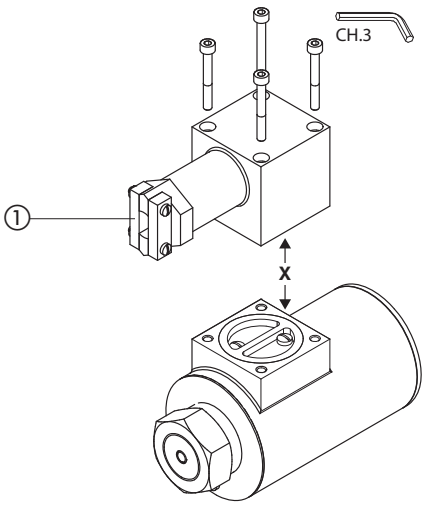
Pay attention to coil polarity

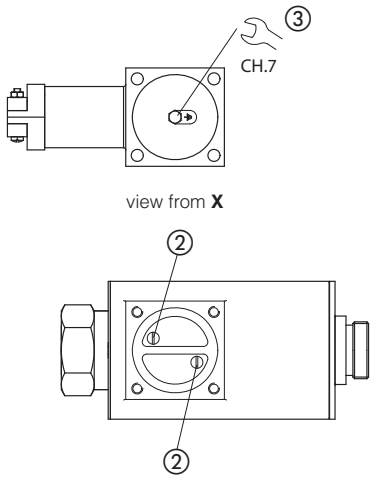
1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16)

alternative GND screw terminal connected to solenoid housing

MA chinese mining certification





① cable entrance = ø 10,5 mm
② terminal board for power supply coil connection
③ screw terminal for ground connection

9.4 Cable specification and temperature

Cable specification - Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²	**Grounding:** section of internal ground wire = 2,5 mm² section of external ground wire = 4 mm²

Cable temperature - Multicertification Group I and Group II

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]
	Goup I	Goup II	Goup I	Goup II	
40 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

Cable specification - cULus certification

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

Cable temperature - cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

9.5 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.
The hydraulic fluids must be compatible with the selected seals.
Make sure that the working fluid is compatible with gas and dust present in the environment.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s

9.6 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.

Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet.
In the worst case, this may result in unexpected system movements and thus constitute a risk of injury.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the valve over the entire operating range.

Max fluid contamination level:

ISO 4406 class 20/18/15 NAS 1638 class 9

Note: see also filter section at www.atos.com or KTF catalog

10 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

10.1 Ordinary maintenance

Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

- The valves does not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer over 5 mm
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

10.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos which will provide for the reparation.
If the reparations are not made by the manufacturer, they must be performed in accordance to the criteria of IEC 60079-19 standard for IECEx and EN 60079-19 for ATEX, and by facilities having the technical know-how about the protection modes and equipped with suitable tools for repairing and controls.

Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

Before beginning any repairing activity, the following guidelines must be observed:

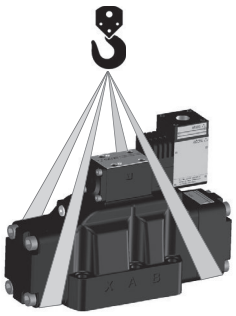
- Unauthorized opening of the valves during the warranty period invalidates the warranty and invalidates the certification
- Be sure to use only original spare parts manufactured or supplied by Atos factory
- Provide all the required tools to make the repair operations safely and to don't damage the components
- Read and follow all the safety notes given in section

11 TRANSPORT AND STORAGE

11.1 Transport

Observe the following guidelines for transportation of valves:

- Before any movement check the valve weight reported in the technical table relevant to the specific component
- Use soft lifting belts to move or lift the heavy valves to avoid damages



Danger of damage to property and personal injuries!
The valve may fall down and cause damage and injuries, if transported improperly:
- Use the original packaging for transport
- Use personal protective equipment
  (such as gloves, working shoes, safety goggles, working clothes, etc.)

11.2 Storage

Valve's corrosion protection is achieved with zinc coating: this treatment protect the valve to grant a storage period up to 12 months.
Additionally all valves are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.
In case of storage period longer than 12 months please contact our technical office.
Ensure that valves are well protected against water and humidity in case of storage in open air.

12 RELATED DOCUMENTATION

Directional valves

EX010 DHA - direct, spool type
EX015 DHA, DKA - direct, spool type
EX020 DLAH , DLAHM - direct, poppet type
EX030 DPHA - piloted
EX050 LIDEW-AO, LIDBH-AO - piloted ISO cartridges and functional covers

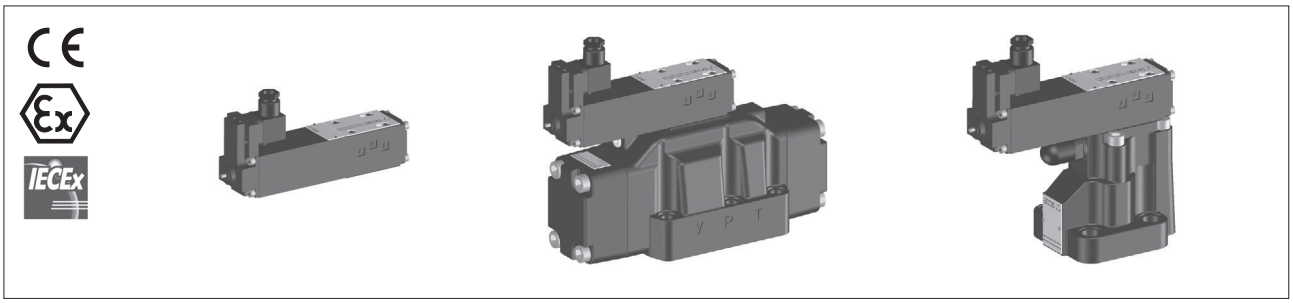
Pressure relief valves

CX010 AGAM-AO, ARAM-AO - piloted, with solenoid valve for venting

Operating and maintenance information

for intrinsically safe on-off valves

This operating and maintenance information apply to Atos intrinsically safe on-off valves and is intended to provide useful giudelines to avoid risks when the valves are installed in a system operating in hazardous areas with explosive or flammable environement.
The prescriptions included in this document must be strictly observed to avoid damages and injury. The respect of this operating and maintenance information grant an increased working life, trouble-free operation and thus reduced repairing costs.
Information and notes on the transport and storage of the valves are also provided.



1 SYMBOL CONVENTIONS

This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The operating and maintenance information is part of the operating instructions for the complete machine but it cannot replace them.

This document is relevant to the installation, use and maintenance of on-off directional and pressure control valves equipped with intrinsically safe solenoids type OW-* for application in explosive hazardous environments.

Due to the low power consumption, the intrinsically safe circuit is virtually protected against electrical sparks or thermal effects that could cause the ignition of the explosive atmosphere, also in case of failure. The protection is ensured only if the whole system is in compliance with the requirements of IEC/EN 60079-25 (Ex-i systems).

2.1 Warranty

All the intrinsically safe valves have 1 year warranty; the expiration of warranty results from the following operations:
- unauthorized mechanical or electronic interventions
- the intrinsically safe valves are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

Service work performed on the valve by the end users or not qualified personnel invalidates the certification

3 CERTIFICATIONS AND PROTECTION MODE

The intrinsically safe solenoids subject of this operating and maintenance information are certified ATEX or IECEx.
They are in compliance with following protection mode:

Group II

II 1G Ex ia IIC T6 Ga

II 1G Ex ia IIB T6 Ga

II 1G Ex ia IIA T5 Ga

Group I (mining)

I M2 Ex ia I Mb / Ex ib I Mb

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

ATEX

EN 60079-0 Electrical apparatus for explosive atmospheres - Part 0: general requirements
EN 60079-11 Equipment protection by intrinsic safety 'i'
EN 60079-26 Equipment with equipment protection level (EPL) Ga

IECEx

IEC 60079-0 Electrical apparatus for explosive atmospheres - Part 0: general requirements
IEC 60079-11 Equipment protection by intrinsic safety 'i'
IEC 60079-26 Equipment with equipment protection level (EPL) Ga

5 GENERAL CHARACTERISTICS

Ambient temperature	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Surface protection	Zinc coating with black passivation
Compliance	Intrinsically safe protection "Ex ia" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

See technical tables relevant to the specific components, listed in section 12

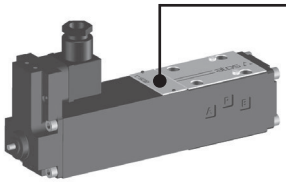
7 CERTIFIED ELECTRICAL CHARACTERISTICS

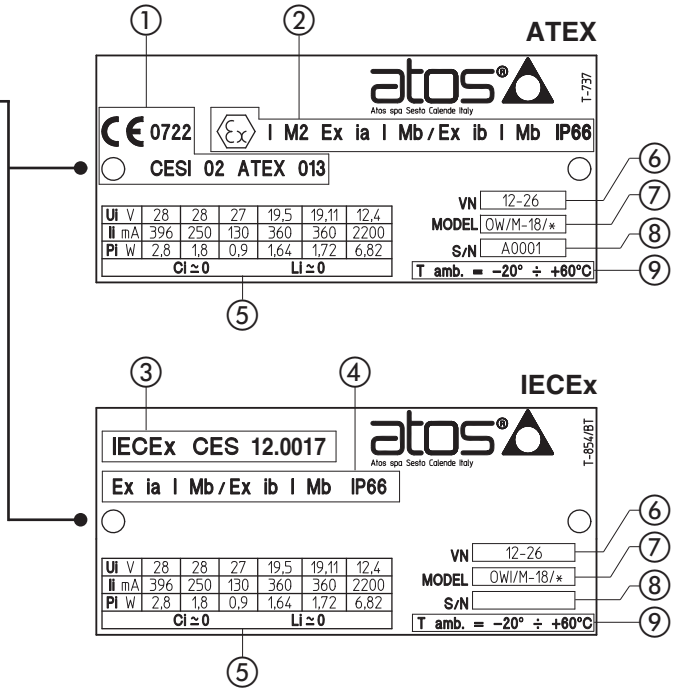
Electrical characteristics (max values)	Metod of protection										
	Group II					Group I (Mining)					
	Ex II 1G Ex ia					Ex I M2		Ex ia I Mb		Ex ib I Mb	
	IIA T5 Ga	IIB T6 Ga	IIC T6 Ga								
Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
Ii [mA]	396	250	160	360	360	396	250	160	360	360	2200
Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
Ci , Li	≅ 0										
VN	12 ÷ 26 V										

8 NAMEPLATES

8.1 ATEX and IECEx certification

Gas - group I M2 - Mining



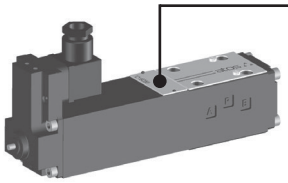


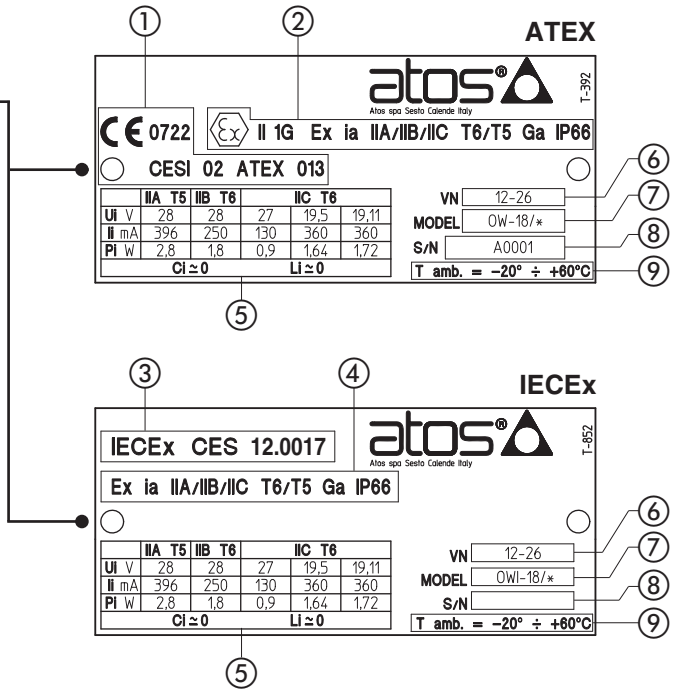
① ATEX notified body and certificate nember
② Marking according to ATEX directive
③ IECEx notified body and certificate nember
④ Marking according to IECEx scheme
⑤ Electric characteristics
⑥ Power supply characteristics
⑦ Solenoid model code
⑧ Solenoid serial number
⑨ Ambient temperature

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/EU directive and to the relevant technical norms
I M2	Solenoid for mining (or relevant surface plants) which could be exposed to gas and / or flammable dust. Category M2: power supply of these equipments has to be switched off in case of explosive atmosphere.
Ex ia / Ex ib	Intrinsically safe solenoid, category "ia" or "ib"
I	Equipment of group I
Mb	Equipment protection level, high level protection for explosive atmospheres
CESI 02 ATEX 013	Name of the laboratory responsible for the CE certification: 02= year of the certification release; 013 certification number
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 12.0017X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 12 year of the certification release; 0017X number of certification
Ui, Ii, Pi, Ci, Li	Max input parameters of the equipment (relevant to the intrinsically safe)
T amb.	Ambient temperature range (min. -20°C max. +60°C)

8.2 ATEX and IECEx certification

Gas - group II 1G - Zone 0, 1, 2





① ATEX notified body and certificate nember
② Marking according to ATEX directive
③ IECEx notified body and certificate nember
④ Marking according to IECEx scheme
⑤ Electric characteristics
⑥ Power supply characteristics
⑦ Solenoid model code
⑧ Solenoid serial number
⑨ Ambient temperature

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/EU directive and to the technical norms
II 1 G	Solenoid for surface plants with gas or vapours environment, category 1, suitable for zone 0 and with redundancy for zone 1 and 2
Ex ia	Intrinsically safe solenoid, category “ia“
II C	Group II C equipment suitable for substances (gas) for group II C
II B	Group II B equipment suitable for substances (gas) for group II B
II A	Group II A equipment suitable for substances (gas) for group II A
T6 / T5	Solenoid temperature class (maximum surface temperature)
Ga	Equipment protection level, very high level protection for explosive Gas atmospheres
CESI 02 ATEX 013	Name of the laboratory responsible for the CE certification: 02= year of the certification release; 013 certification number
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 12.0017X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 12 year of the certification release; 0017X number of certification
Ui, Ii, Pi, Ci, Li	Max input parameters of the equipment (relevant to the intrinsically safe)
T amb.	Ambient temperature range (min. -20°C and -40°C for /BT option, max. +60°C)

Notes:

The group IIC solenoids are suitable for IIA and IIB environments.

The T6 temperature class solenoids are suitable for all the substances having higher temperature class (T5, T4, T3, T2, T1).

The T5 temperature class solenoids are suitable also for all the substances having higher temperature class (T4, T3, T2, T1).

9 SAFETY NOTES

9.1 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:
- Wrong installation / installation in areas not approved for the specific component
- Incorrect cleanliness during storage and assembly
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of the specified performance limits
- Use of inappropriate electrical power supply
- Incorrect transport

9.2 Installation

The installation or use of inappropriate components in explosive hazardous environments could cause personal injuries and damage to property.

For the application in explosion hazardous environments, the compliance of the solenoid with the zone classification and with the flammable substances present in the system must be verified.
The main safety requirements against the explosion risks in the classified areas are established by the European Directives 2014/34/UE (for the components) and 99/92/CE (for the plants and safety of the workers against the risk of explosion).

The classification criteria of the area against the explosion risks are established by the norm EN60079-10.
The technical requirements of the electrical systems are established by the norm EN60079-14 (group II).

Note: the max fluid temperature controlled by the valve must not exceed + 60°C

Ensure that no explosive atmosphere may occur during the valve installation.
Only use the valve in the intended explosion protection area.
The ignition temperature of the hydraulic fluid used must be 50°C higher than the maximum surface temperature of the valve.

Use of the valve outside the approved temperature ranges may lead to functional failures like e.g. overheating of the valve solenoid.
This means that the explosion protection is no longer ensured.
Only use the valve within the fluid temperature range.
During operation, touch the valve solenoid only by using protective gloves.
Unload the system pressure before working on the valve.
Danger of serious injury can be caused by a powerful leaking of hydraulic fluid jet.
Before working on the valve, ensure that the hydraulic system is depressurized and the electrical control is de-energized.

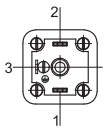
9.3 Electrical connection

For the solenoid application in classified area, specific equipment (safety barriers), certified in conformity to EN60079-11 norms, must be used.
Their electrical output characteristics must be in accordance to the solenoid max input parameters, printed on the solenoid nameplate.
See tech. table GX010 for Atos safety barriers.
The analysis of the system composed by the electrical equipment, the solenoid and the connection cables has to be performed by trained personnel and it must be in accordance to the requirements of EN 60079-25 (Ex-i systems) concerning to the intrinsically safety systems.

Connector wiring

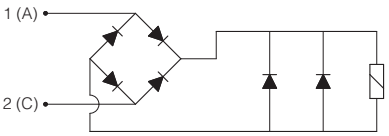
/6	Connections
1	Coil
2	Coil
3	GND

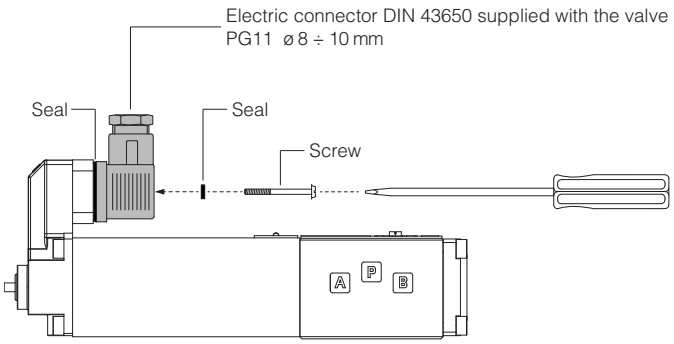
Connector interface



DIN 43650

Electric circuit





In case of humid or wet environments, water or humidity may penetrate into the electrical connections.
This case may lead to malfunctions at the valve and to unexpected movements of the controlled hydraulic actuator which may result in personal injury and damage to property.
Only use the valve within the intended IP protection class.
Before the assembly ensure that the connector seals are in good condition.
The electric connector must be fully tightened with the relevant screw.

9.4 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.
The hydraulic fluids must be compatible with the selected seals.
Make sure that the working fluid is compatible with gas and dust present in the environment.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s

9.5 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.

Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet.
In the worst case, this may result in unexpected system movements and thus constitute a risk of injury.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the valve over the entire operating range.

Max fluid contamination level:

ISO 4406 class 20/18/15 NAS 1638 class 9

Note: see also filter section at www.atos.com or KTF catalog

10 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

10.1 Ordinary maintenance

Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

- The valves does not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer over 5 mm
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

10.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.
Unauthorized opening of the valves during the warranty period invalidates the warranty and invalidates the certification tools for repairing.

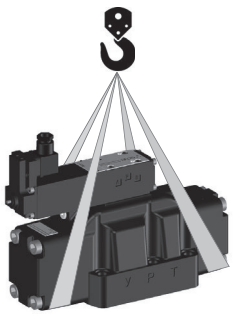
The intrinsically safe solenoids must not be opened.
Any tampering invalidates the certification and it may cause serious dangerous.

11 TRANSPORT AND STORAGE

11.1 Transport

Observe the following guidelines for transportation of valves:

- Before any movement check the valve weight reported in the technical table relevant to the specific component
- Use soft lifting belts to move or lift the heavy valves to avoid damages



Danger of damage to property and personal injuries!
The valve may fall down and cause damage and injuries, if transported improperly:
- Use the original packaging for transport
- Use personal protective equipment (such as gloves, working shoes, safety goggles, working clothes, etc.)

11.2 Storage

Valve's corrosion protection is achieved with zinc coating: this treatment protect the valve to grant a storage period up to 12 months.
Additionally all valves are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.
In case of storage period longer than 12 months please contact our technical office.
Ensure that valves are well protected against water and humidity in case of storage in open air.

12 RELATED DOCUMENTATION

Directional valves

EX100 DHW - direct, spool type
EX120 DLWH - direct, poppet type
EX130 DPHW - piloted, spool type
EX150 LIDEW-WO, LIDBH-WO - piloted ISO cartridges and functional covers

Pressure relief valves

CX030 AGAM-WO, ARAM-WO - piloted, with solenoid valve for venting

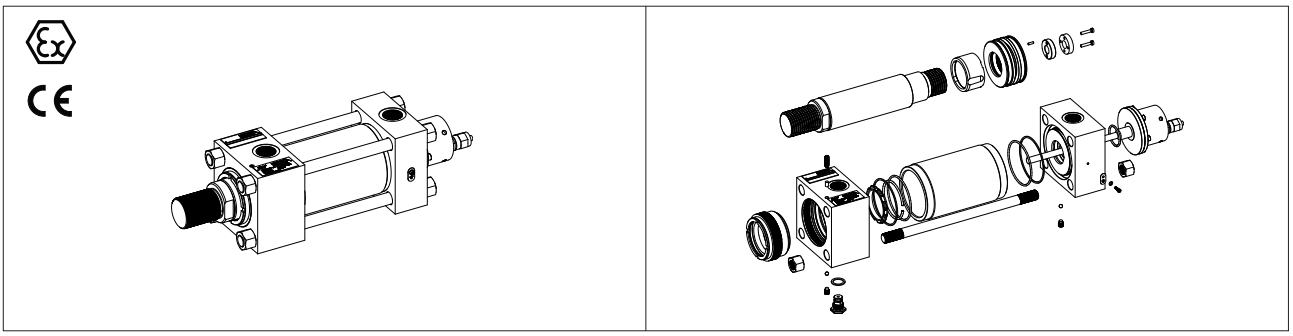
Safety barriers

GX010 Y-BXNE Power supply barrier

Operating and maintenance information

for ex-proof cylinders & servocylinders

These operating and maintenance information are valid only for Atos ex-proof cylinders & servocylinders; they are intended to provide useful guidelines to avoid risks when hydraulic cylinders are installed in a machine or a system. Information and notes about transportation and storage of hydraulic cylinders are also provided.
These norms must be strictly observed to avoid damages and ensure trouble-free operation. The respect of these operating and maintenance information ensures an increased working life and thus reduced repairing cost of the hydraulic cylinders and system.



1 SYMBOLS CONVENTIONS

⚠ This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The cylinder operating and maintenance information are part of the operating instructions for the complete machine but they cannot replace them

Atos is not liable for damages resulting from an incorrect observance of these instructions.
All the hydraulic cylinders have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorised mechanical or electronic interventions
- The hydraulic cylinders are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

3 HARMONIZED STANDARDS

CKA cylinders meet the requirements laid down in the Explosion protection directive 2014/34/EU with reference to European standards documentations:

ISO 80079-36 "Non electrical equipment for potentially explosive atmospheres - Basic method and requirements"
ISO 80079-37 "Non electrical equipment for explosive atmospheres - Protection constructional safety 'c', liquid immersion 'k'"

The hydraulic cylinder must be exclusively used in areas and zones assigned to the equipment group and category. Also observe the other details about explosion protection given as follow. See section 6 for zones in relation to equipment groups and category.

⚠ **Check the code in the nameplate to ensure that the hydraulic cylinder is suitable for the installation area**

4 WORKING CONDITIONS

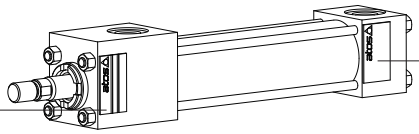
⚠ **The operation of hydraulic cylinders is not permitted at different operating and environmental conditions than those specified below**

Description	**CKA, CKAM**
Ambient temperature	-20 ÷ +70°C -40 ÷ +65°C for **CKAM**
Fluid temperature	-20 ÷ +70°C (**T6**) -20 ÷ +120°C (**T4**) for seals type **G2** (1)
Max surface temperature	≤ +85 °C (**T6**) ≤ +135 °C (**T4**) for seals type **G2** (1)
Max working pressure	16 MPa (160 bar)
Max pressure	25 MPa (250 bar)
Max frequency	5 Hz
Max speed	1 m/s 0,5 m/s for seals type **G1**
Recommended viscosity	15 ÷ 100 mm^2/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

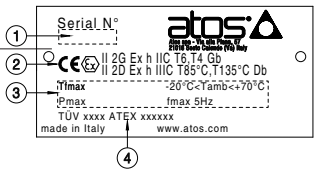
Note: (1) Cylinders with seals type **G2** may also be certified **T6** limiting the max fluid temperature to 70°C

5 NAMEPLATES

Nameplate 1 - Standard



Nameplate 2 - ATEX



Nameplate 1 - Standard (2)

Pos.	Description
①	Delivery date
②	Cylinder code
③	Series number
④	Customer code (only if requested)
⑤	CE mark

Nameplate 2 - ATEX (1)(2)

Pos.	Description
①	Cylinder serial number
②	Marking according to ATEX directive
③	Working limit conditions
④	Notified body and certified number

Working conditions - legend

Sym.	Meaning
Tfmax	Max fluid temperature
Pmax	Max pressure
Tamb	Ambient temperature
fmax	Max frequency

Notes: (1) ATEX cylinders are supplied with 2 nameplates: standard and ATEX
(2) The position of the nameplate on the rear or front heads can change due to the cylinder overall dimensions

6 ATEX CERTIFICATION

The user must define the overall areas of the system into different explosive atmospheres zones in accordance with directive EN 60079-10-1/2. The table below shows the available installation zones related to the equipment group and category.

EN 60079-0		Directive 2014/34/EU		Application, properties (exerpt from Directives)	Zones EN 60079-10-1/2
EPL	Group	Equipment group	Category		
Gb	II	II	2G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur occasionally. **High level of protection**	1, 2
Gc		II	3G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur for short periods. **Normal level of protection**	2
Db	III	II	2D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur occasionally. **High level of protection**	21,22
Dc		II	3D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur rarely or for short periods. **Normal level of protection**	22

⚠ **The cylinder group and category may change when rod position transducers or proximity sensors are provided, see table below and tab. BX500. For details about certification and safety notes consult the user's guides included in the supply**

Cylinder type		Group	Equipment category	Gas/dust group	Temperature class	Zone
CKA		II	2 GD	II C/III C	T85°C(T6) / T135°C(T4)	1,2,21,22
CKA with ex-proof rod position transducer	**GAS**	II	2 G	II B	T6/T5	1,2
	DUST	II	2 D	IIIC	T85°C/T100°C	21,22
CKA with ex-proof proximity sensors		II	3 G	II	T4	2

II 2G Ex h IIC T6,T4 Gb (gas) **II 2D Ex h IIIC T85°C, T135°C Db (dust)**

GROUP II, Atex

II = Group II for surface plants
2 = High protection (equipment category)
G = For gas, vapours
D = For dust
Ex = Equipment for explosive atmospheres
IIC = Gas group
IIIC = Dust group
T85°C/T135°C = Surface temperature class for dust
T6/T4 = Surface temperature class for gas
Gb/Db = EPL Equipment group

7 SAFETY NOTES

7.1 General

- The presence of cushioning can lead to a peak of pressure that can reduce the cylinder working life, ensure that the dissipated energy is less than the max value reported in **tab. B015**
- Make sure that the maximum working conditions, shown in section 4, are not exceeded
- Ensure to use hydraulic fluids compatible with the selected sealing system, see **tab. BX500**
- The rod must be handled with care to prevent damages on the surface coating which can deteriorate the sealing system and lead to the corrosion of the basic material
- The mounting screws must be free from shearing stress
- Transverse forces on the rods must always be avoided
- When the cylinder has to drive a rotating structure or where little alignment errors are expected, mounting style with spherical bearing should be used
- Contact surfaces, support elements in tolerance, elastic materials and labels must be covered before painting the cylinder

7.2 Proximity sensors

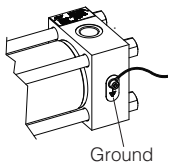
- Proximity sensors are supplied already adjusted, if other regulations are necessary see **tab. BX500** or contact our technical office
- Ensure not to remove the sensor while the cylinder is under pressure
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.3 Position measuring system

- Position transducers must never be removed, if not otherwise specified in **tab. BX500**, while the cylinder is under pressure
- Observe the information provided in **tab. BX500** for the electronic connections
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.4 Installation

- Consult **tab. P002** for installation, commissioning and maintenance of electrohydraulic system
- The piping have to be dimensioned according to the max pressure and max flow rate required
- All pipes and surfaces must be cleaned from dirt before mounting
- Remove all plug screws and covers before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the cylinders
- Bleed-off the system or the hydraulic cylinder using the proper device, see the technical data sheet for details
- Ensure that the cylinder mounting allow easy of acces for the purpose of maintenance and the adjustment of cushioning
- The max surface temperature indicated in the nameplate must be lower than the following values:
  GAS - **80% of gas ignition temperature**
  DUST - max value between **dust ignition temperature - 75°C** and **2/3 of dust ignition temperature**
- The ignition temperature of the fluid must be 50°C greater than the maximum surface temperature indicated in the nameplate
- The cylinder must be grounded using the threaded hole on the rear head, evidenced by the nameplate with ground symbol. The hydraulic cylinder must be put at the same electric potential of the machine



⚠ **For details about ex-proof proximity sensors or position transducer refer to the user's guide included in the supply**

8 MAINTENANCE

- Ordinary maintenance of the cylinder consist of cleaning of the external surfaces using a wet cloth to avoid accumulation of dust layer > 5 mm
- Do not use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires immediate stop of the system and inspection of the relevant components

⚠ **Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics**

8.1 Preliminary check and ordinary maintenance

Atos hydraulic cylinders don't require any maintenance after commissioning. Anyway it is recommended to take into account the following remarks:

- Results of maintenance and inspection must be planned and documented
- Check oil escaping from oil ports or leakages at the cylinder heads
- Check for damages of the chromeplated surface of the rod: damages may indicate oil contamination or the presence of excessive transverse load
- Determine lubricating intervals for spherical clevises, trunnion and all parts not self-lubricated
- The rod should always be retracted during long stop of the machine or system

⚠ **Any repairing must be performed only by experienced personnel, authorized by Atos**

- Remove any salt, machining residuals or other dirt cumulated on the rod surface
- Follow the maintenance instructions of the fluid manufacturer

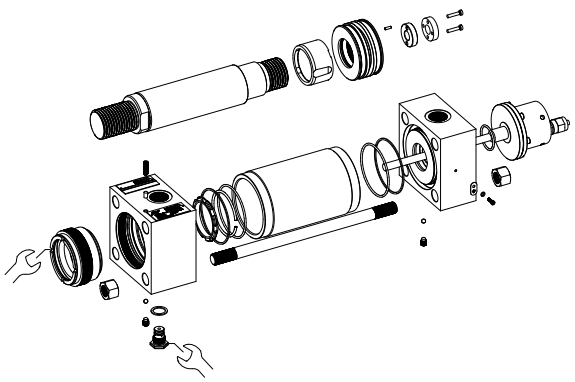
8.2 Repairing

Before beginning any repairing observe the following guidelines:

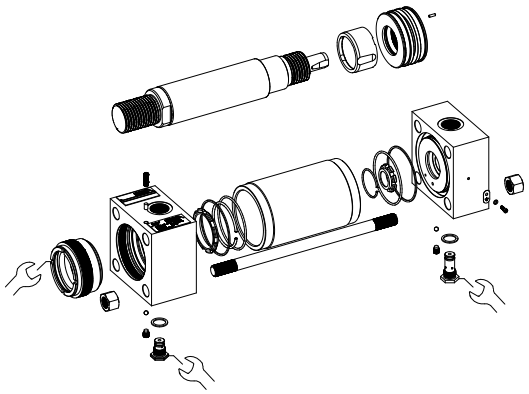
- Unauthorized opening of the cylinder during the warranty period results in the warranty expiration
- Be sure to use only original spare parts manufactured or supplied by Atos
- Provide all the required tools to make the repair operations safely and not damage the components
- Read and follow all the safety notes given in section 7
- Ensure that the cylinder is well locked before beginning any operation
- Disassembly or assembly the cylinder with the right order as indicated in section **8.3**
- When mounting rod or piston guides and seals observe the correct position as indicated in section **8.4**. Any bad positioning can result in oil leakages
- It is strongly recommended the use of expanding sleeves to insert the seals in the proper groove
- Tighten all the screws or nuts as follow: lubricates the threads, insert the screw or the nut by hand for some turns, tighten the screw crosswise with the tightening torque specified in the technical table (a pneumatic screw driver may be used)
- Rod bearing and piston must be locked respectively to the front head and to the rod by means of special pin to avoid unscrewing
- The replacement of wear parts such as seals, rod bearing and guide rings depends on the operating conditions, temperature and quality of the fluid

8.3 Cylinders exploded views

CKAM servocylinder - For spare parts contact our technical office



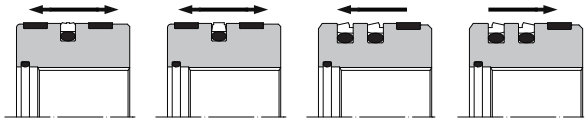
CKA - For spare parts contact our technical office



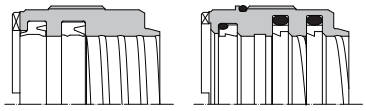
Note: this symbol means that a particular equipment is required for mounting, contact our technical office

8.4 Sealing system mounting

PISTON



ROD BEARING



9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transport of hydraulic cylinders:

- Cylinders have to be transported using a forklift truck or a lifting gear always ensuring a stable position of the cylinder
- Cylinders have to be transported in horizontal position in their original packaging
- Use soft lifting belts to move or lift the cylinders in order to avoid damages
- Before any movement check the cylinders weight (due to tolerances, the weight may be 10% greater than the values specified in the technical table)

⚠ **Additional parts such as pipes, subplates and transducers must never be used for lifting**

9.2 Storage

Corrosion protection is achieved with alkyd primer painting RAL 9007: the primer grants a storage period up to 12 months. Additionally all cylinders are tested with mineral oil OSO 46; the oil film, presents in the cylinder chambers after testing, ensures the internal corrosion protection.

Anyway be care to observe the following remarks:

- When a storage in the open air is foreseen ensure that cylinders are well protected against water
- The cylinders must be inspected at least once a year and rotated through 90° every six months to preserve the seals

⚠ **In case of storage period longer than 12 months, contact our technical office**

10 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads involve a premature wear of the bronze bushing, seals and wear rings	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **C**-**D**-**G**-**H**-**S**-**L**
	Fluid contaminants produce scratch and score marks on the seals	Check the fluid contamination class is < 20/18/15
	Chemical attack cause the deterioration of seals compound	Check seals compatibility with operating fluid
	High temperatures (fluid/ambient) the seals dark and flaked	a) Decrease the fluid temperature b) Install **G2** sealings for high temperatures
	Low temperature (ambient) make the seals brittle	a) Move the cylinder in a higher temperature zone b) Install **G9** seals for low temperatures
	High rod speed reduce the lubricant capacity of the seals	For rod speed > 0,5 m/s Install **G2** – **G4** seals
	High frequency reduce the lubricant capacity of the seals	For rod frequency > 5 hz Install **G0** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect)	Bleed off completely the air inside the hydraulic circuit
Wiper or seal extrusion	Overpressure	a) Limit the pressure of the system b) Install **G2**-**G4**-**G8** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	a) See possible causes and solutions for oil leakage troubles b) Install draining option **L**
Lose of cushioning effect	Rod speed too low at end stroke	a) Check the cushioning adjustment is not fully open, regulate it if necessary b) Replace "fast" cushioning **1**-**2**-**3**, with "slow" cushioning **4**-**5**-**6** if the cushioning is not effective with cushioning adjustment fully closed
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants produce scratch and score marks on the cushioning piston	Check the fluid contamination class is < 20/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking	a) Replace "fixed" cushioning **7**-**9** with "adjustable" cushioning **1**-**3** b) For adjustable cushioning, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances	Check the fluid contamination class is < 20/18/15
Rod failure	Overload/overpressure involves ductile rod failure	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation involves fatigue rod failure	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G2**-**G4**, see tech.table **B015**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 20/18/15
	High oil flow speed > 6 m/s	a) Increase the piping diameters to reduce the oil flow speed b) Install oversized oil ports, options **D**-**Y**

11 SERVOCYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

Note: for cylinders troubleshooting refer to section 10

Operating and maintenance information

for ex-proof pumps

This operating and maintenance information apply to ATOS ex-proof pumps and is intended to provide useful guidelines to avoid risks when the pumps are installed in a system.
These norms must be strictly observed to avoid damages and to ensure trouble-free operation. The respect of these operating and maintenance norms grant an increased working life, trouble-free operation and thus reduced repairing costs.
Information and notes on the transport and storage of the pumps are also provided.

1 SYMBOLS CONVENTIONS

This symbol refers to possible dangers which can cause serious injuries

2 GENERAL NOTES

The operating and maintenance information are part of the operating instructions for the complete machine but thay cannot replace them

This document is relevant to the installation, use and maintenance of ex-proof fixed displacement vane pumps and ex-proof variable displacement piston pumps for application in explosive hazardous environments.

2.1 Warranty

All the hydraulic pumps have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorized mechanical interventions
- The hydraulic pumps are not used exclusively for their intended porpose as defined in these operating and maintenance information
- Respect the working limits indicated on nameplate and on technical tables: AX010 for PFEA and AX050 for PVPCA

3 CERTIFICATIONS AND PROTECTION MODE

The ex-proof pumps subject of this operating and maintenance information are certified ATEX
They are in compliance with following protection mode:

II 2/2 G Ex h IIC T5 Gb **II 2/2 D Ex h IIIC T100°C Db**

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

EN ISO 80079-36 Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres – Basic method and requirements
EN ISO 80079-37 Explosive atmospheres – Part 37: Non-electrical equipment for explosive atmospheres – Non electrical type of protection constructional safety “c”, control of ignition source “b”, liquid immersion “k”

The pumps may exclusively be used in areas and zones assigned to the equipments group and category. See section 6 for zones in relation to equipment groups and category.

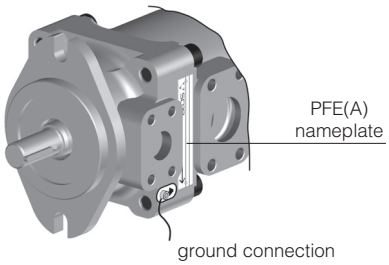
Check the code in the nameplate to ensure that the pump is suitable for the installation area.

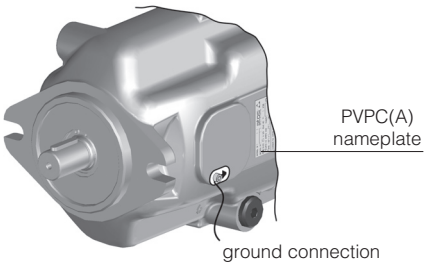
5 WORKING CONDITIONS

Pumps type		**PFEA**		**PVPCA**	
Pumps version		**STD, /PE**	**/7 /PE**	**STD, /PE**	**/7 /PE**
Ambient temperature	[°C]	-20 ÷ +60	-20÷+70	-20 ÷ +60	-20÷+70
Max inlet fluid temperature	[°C]	+60	+80	+60	+80
Protection degree		IP 66			
Max working pressure (1)		**PFEA*-*1**: from 160 to 210 bar, **PFEA*-*2**: from 210 to 300 bar		280 bar for size 29, 46, 73 250 bar for size 90	
Recommended pressure at inlet port		**PFEA*-*1**: from -0,15 to +1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm **PFEA*-*2**: from 0 to +1,5 bar		from -0,2 to +24 bar	
Speed range (1)	[rpm]	from 800 to 2800 rpm, depending to the size		from 600 to 3000 rpm, depending to the size	

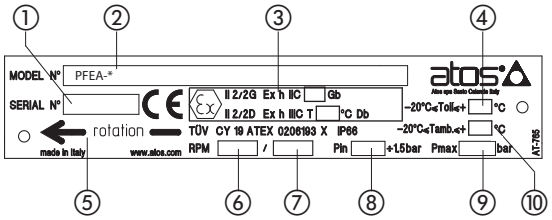
(1) Max working pressure and speed range must be reduced for /PE versions and for water glycol fluids, see tab. **AX10** for PFEA and **AX050** for PVPCA-*

5 NAMEPLATES

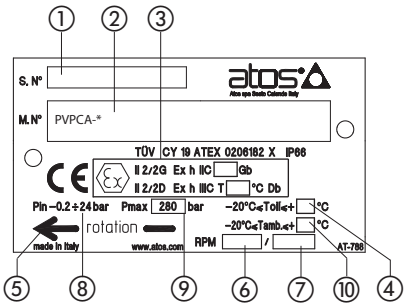




Nameplate for PFEA



Nameplate for PVPCA



Description

① Serial number
② Pump code
③ Marking according to ATEX
④ Maximum inlet fluid temperature
⑤ Pump shaft rotation direction: clockwise or counterclockwise
⑥ Minimum pump rotation speed in RPM = revolution/min
⑦ Maximum pump rotation speed in RPM = revolution/min
⑧ Mimimun inlet pressure (PFEA), range inlet pressure (PVPCA)
⑨ Maximum working pressure
⑩ Maximum ambient temperature
⑪ Delivery date

Ex II 2/2G Ex h IIC T(*) Gb or **Ex II 2/2D Ex h IIIC T(**)°C Db**

Ex = Equipment for explosive atmospheres
II = Group II for surfaces plants
2/2 = Pump category
G or **D** = **G** for gas and vapours, **D** for dust
h = Marking includes one on more of the following types of protection ("c", "b", "k")
IIC = Gas group (acetylene, hydrogen)
IIIC = Conduictive dust
T* = Temperature class (T6, T5, T4)
T°C** = Max surface temperature (85, 100, 135)

6 EQUIPEMENT GROUP, CATEGORY AND INSTALLATION ZONE

The user must define the overall areas of the system into different explosive atmospheres zones in accordance with directive 99/92/CE.
The table below shows the available installation zones related to the equipment group and category.

Equipment group	Category	Application, properties	Zone
II	2/2G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur occasionally. **High level of protection**	1, 2
II	2/2D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur occasionally. **High level of protection**	21, 22

PUMP VERSION	Equipment group	Category	Gas and Dust group	Temperature class	Zone
PFEA and PVPCA	II	2/2G and 2/2D	IIC and IIIC	PFEA T6 (T85°C), PVPCA T5 (T100°C)	1, 2, 21, 22
PFEA* /7 /PE and PVPCA* /7 /PE	II	2/2G and 2/2D	IIC and IIIC	PFEA* T5 (T100°C), PVPCA* T4 (T135°C)	1, 2, 21, 22

7 SAFETY NOTES

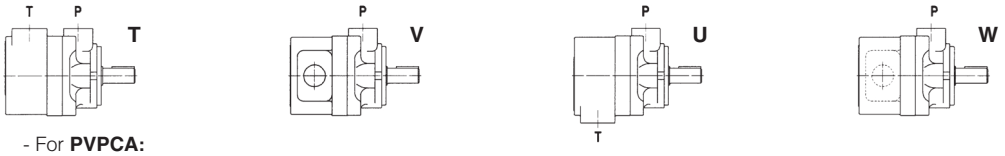
- General:

- Before start up make sure that the pump is always filled with the working fluid. See section 7.4.
- The pump must not be used with “OUT” port closed; in order to limit the maximum working pressure a relief valve must be installed on the pressure line.
- Make sure that the maximum working conditions shown in section 5 are not exceeded

7.1 Installation position and port orientation

The installation must ensure that the pump remains always filled with the working fluid.

- For **PFEA:** the pump can operate in any position, the available orientation of the oil ports is according to the below picture. In the ordering code must be specified the selected orientation.



- For **PVPCA:**
  - The pumps can be installed in horizontal or in vertical position. In case of vertical position the pump shaft must be oriented upward.
  - The drain pipe must be oriented so that the pump body always remains filled with the fluid, specially when not working. For this reason the pump is provided with 2 drain connections located in opposite side of the body, so that, depending to the pump orientation, the optimal drain piping can be arranged
  - Before the commissioning the pump body must be filled with the working fluid through one of the drain connections.
  - The connection with the electric motor must be realized by means of proper elastic coupling.

7.2 Shaft loads

PFEA: axial and radial loads acting on shaft are not permitted.
PVPCA: axial and radial loads acting on shaft are permitted, max permissible loads are indicated in the table AX050, section 2 .
The coupling with the electric motor must be sized to absorb the power peaks.
The coupling alignment between the motor and pump shaft must ensured

7.3 Shaft rotation

The direction of shaft rotation (D = clockwise, S = counterclockwaise, viewed from the shaft end) must be the same of the arrow on the nameplate.

7.4 Oil level and temperature

Make sure that the pump is always filled with flui. The installer / end user has to provide a level meter to verify the presence of fluid inside the tank.

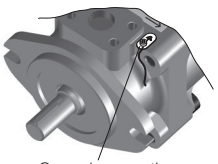
The monitoring of the inlet fluid temperature it is required only when it can reach critical values.

This monitoring should be performed on the surface of the fluid inlet pipe, near the pump’s suction flange.
The monitoring system must operating with a tolerance of -5 °C of the maximum declared value.
For example, if the maximum inlet fluid temperature is 60 °C, the control system must be operating between + 55 °C and + 60 °C.
The sensor used for monitoring the fluid level and the temperature must be ATEX certified and conform to the installation area:
the control unit (PLC) must be certified IPL1 or SIL 1 also.

7.5 Important notes

- A pressure relief valve must be installed on the pressure line near the pump outlet port.
- The electric motor to be used for the pump operation must be also certified in compliance with installation zone. The compliance with applicable norms is extended to all electrical components connected with the installed pump.
- The piping have to be dimensioned according to the max pressure and max flow rate
- All pipes and surfaces must be cleaned from dirt before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the system
- Ensure that the pump installation allows an easy acces for maintenance purpose
- According to EN 1127-1:2008, the maximum surface temperature indicated in the nameplate must be lower than the following Tmax values:

  Gas - Tmax= max value (80% of gas ignition temperature) **Dust** - Tmax = dust ignition tempeature - 75°C
- Make sure that the pump is suitable for the use in the designated installation area, on the base of the zone classification according to the Directive 99/92/CE and to the type of flammable atmosphere (gas, vapor, dust)
- The fluid ignition temperature must be 50K greater than the maximum surface temperature indicated in the nameplate
- The maximum operating pressure and minimum inlet pressure are indicated on pump’s nameplate
- The pump must be connected to ground using the ground facility (screw M3x5) provided on the pump body and evidenced with grounding nameplate
- The pump’s body and the electric motor, or other devices used to drive the pump, must be connected at the same electric equipotential level
- Pumps PVPCA with control devices type CH are equipped with Explosion-proof solenoid valves (assembled to the pump body and certified according to ATEX 2014/34/EU
- Pumps PVPCA with control devices type LW are equipped with a device to achieve a constant power, factory set at a specific power value required by customer


Ground connection


Grounding nameplate

7.6 Hydraulic fluids and operating viscosity range

Recommended mineral oils type HLP having high viscosity index. Ensure to use hydraulic fluids compatible with the selected seals.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.
Note: for PVPCA the temperature of the fluid contained in the pump body (drain line) is always higher than the tank temperature, specially if the pump is working for long time in null flow conditions and at high pressure.

Fluid viscosity limits:
- 10 mm²/s for short periods at max fluid temperature on drain line
- 24 to 100 mm²/sduring normal operation
- 1000 mm²/s for short period at cold start-up (800 mm^2/sec for PVPCA)

7.7 Filtration

The correct fluid filtration ensures a long service life of the pumps and it prevent anomalous wearing or sticking.
Contamination in the hydraulic fluid may cause functional failures e.g. loss of efficiency and increased noise level.
In the worst case, this may result in heavy damages and breakages.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the pumps over the entire operating range.

Max fluid contamination level:
- normal operation: **PFEA** = ISO4406 class 21/19/16 NAS1638 class 10; **PVPCA** = ISO4406 class 20/18/15 NAS1638 class 9
- longer life: **PFEA** = ISO4406 class 19/17/14 NAS1638 class 8; **PVPCA** = ISO4406 class 18/16/13 NAS1638 class 7

Note: see also filter section at www.atos.com or KTF catalog

8 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics.

8.1 Ordinary Maintenance

- Service work perfomed on the valve by end user or not qualified personnel invalidates the certification
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer over 5 mm
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components
- The pump does not require other maintenance operations except for bearing and front shaft seal, according to the following schedule:
  PFEA must be replaced after reaching **20000 working hours**
  PVPCA without radial loads must be replaced after reaching **20000 working hours**

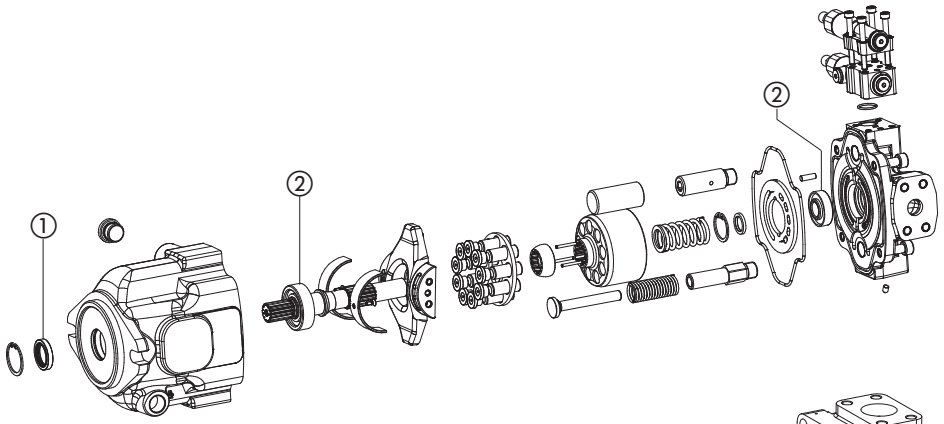
In presence of radial loads (permitted only for PVPCA) the following maintenance schedule must be considerated:

PVPCA-3029 must be replaced after reaching **1550 working hours**
PVPCA-4046 must be replaced after reaching **2600 working hours**
PVPCA-5073 must be replaced after reaching **5000 working hours**
PVPCA-5090 must be replaced after reaching **5000 working hours**

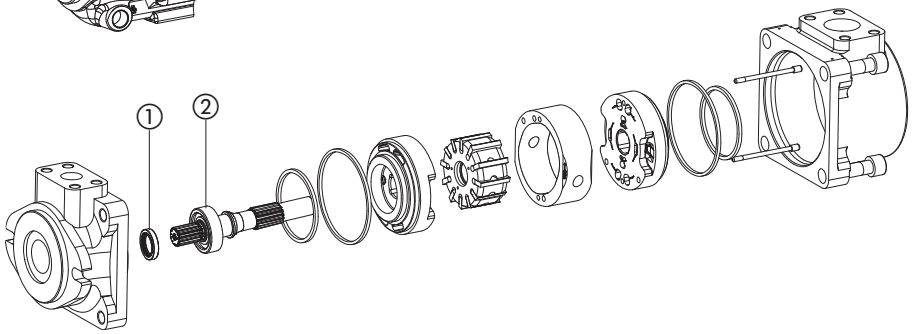
- When mounting bearings and front seal, observe the correct position as indicated in the drawing below: any incorrect positioning can result in oil leakages
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer

① Front seal
② Bearings

PVPCA



PFEA



8.2 Repairing

Before beginning any repairing activity, the following guidelines must be observed:

- Unauthorized opening of the pump during the warranty period invalidates the warranty
- Be sure to use only original spare parts manufactured or supplied by ATOS factory
- Provide all the required tools to make the repair operations safely and to don't damage the components

9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transportation of pumps:

- Hydraulic pumps should be transported using a forklift or a lifting gear ensuring a stable position of the pump
- Use soft lifting belts to move or lift the pumps in order to avoid damages
- Before any movement check the pumps weight specified in the rilevant technical tables AX010 and AX050

9.2 Storage

PFEA corrosion protection is achieved with zinc phosphating: this treatment protect the pump to grant a storage period up to 12 months.
PVPCA corrosion protection is achieved with trasparent oil film.
Additionally all pumps are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.

In case of storage period longer than 12 months please contact our technical office.

Ensure that pumps are well protected against water and humidity in case of a storage in the open air.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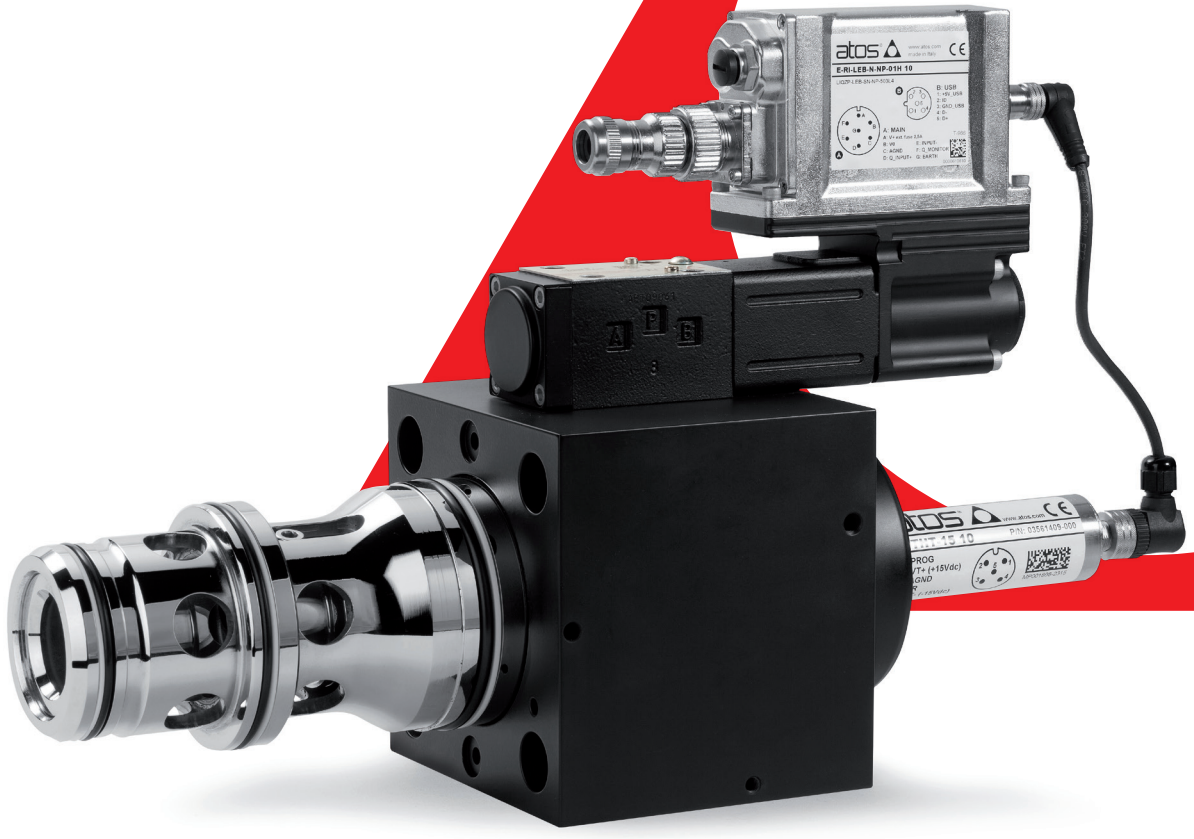

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GENERAL INDEX

CYLINDERS, see KTC catalog • **FILTERS**, see KTF catalog

1 PROPORTIONAL VALVES

INDEX

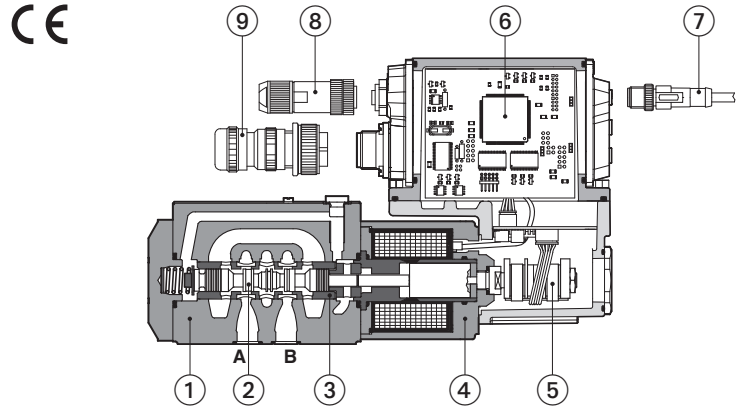
PROPORTIONAL VALVES

NEXT

Supplementary components range available on **www.atos.com**

Digital servoproportional directional valves **sleeve execution**

direct, with on-board driver, LVDT transducer and zero spool overlap with fail safe



DLKZOR-TES-SN-BC-160

① Valve body
② Spool
③ Sleeve
④ Proportional solenoid
⑤ LVDT transducer
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector

DLHZO-TEB, DLHZO-TES
DLKZOR-TEB, DLKZOR-TES

Digital servoproportional directional valves, direct, in sleeve execution with LVDT position transducer and zero spool overlap for best performances in any position closed loop control.

TEB basic execution with analog reference signal and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Digital TEZ version (see tech. table FS610) integrates on-board driver and axis card, while TEB and TES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

DLHZO:	**DLKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **70 l/min**	Max flow: **160 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 **MODEL CODE**

DLHZO	-	TES	-	SN	-	NP	-	0	40	-	L	7	3	/	*	*	/	*

DLHZO = size 06
DLKZOR = size 10

TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

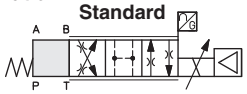
Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

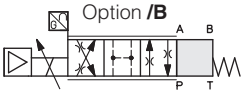
Valve size ISO 4401: **0** = 06 **1** = 10

Configuration:

40 = Standard

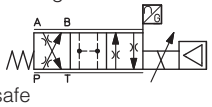


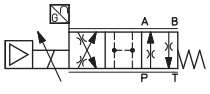
Option **/B**



with fail safe configuration 1 or 3

60 =





without fail safe

Spool type, regulating characteristics:

L = linear

V = progressive

T = not linear **(2)**

D = differential-linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

DT = differential-not linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

***** Series number

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (3):
B = solenoid with on-board digital driver and LVDT transducer at side of port A
Y = external drain

Electronics options (3):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **TES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(4)**

Safety options TÜV certified - only **TES (3)**:
U = safe double power supply
K = safe on/off signals
See section 7

SAFETY CERTIFIED

Fail safe configuration, see section 13 :

1 =

3 =

Note: select **1** for configuration **60** even without fail safe

Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZO =	4	7	8	14	-	20	28	40
DLKZOR =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) Only in version **SN-NP**
(2) Only for configuration **40**
(3) For possible combined options, see section 16
(4) Double power supply only for **TES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

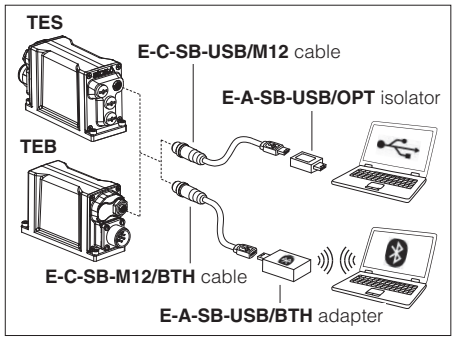
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for **TES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for **TES**, see tech. table **FS500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 AXIS CONTROLLER - see tech. table **FS610**

Digital servoproportional with on-board electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. S* option add alternated P/Q control to the basic position ones.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 SAFETY OPTIONS - only for **TES**

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** ,
designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DLHZO												DLKZOR						
Pressure limits [bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10												ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10						
Spool type	**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Nominal flow Δp P-T [l/min] **(1)** Δp= 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
Δp= 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
Max permissible flow	8	14	16	30	40	50		70			70÷40		90		160			160÷80	
Leakage **(2)** [cm³/min]	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time **(3)** [ms]	≤ 10												≤ 15						
Hysteresis	≤ 0,1 [% of max regulation]																		
Repeatibility	± 0,1 [% of max regulation]																		
Thermal drift	zero point displacement < 1% at ΔT = 40°C																		

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) Referred to spool in neutral position and 50°C oil temperature
(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**DLHZO** = 2,6 A **DLKZOR** = 3 A			
Coil resistance R at 20°C	**DLHZO** = 3 ÷ 3,3 Ω **DLKZOR** = 2,2 ÷ 2,4 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid contamination level normal operation	ISO4406 class 18/16/13 NAS1638 class 7			see also filter section at www.atos.com or KTF catalog
longer life	ISO4406 class 16/14/11 NAS1638 class 5			
Hydraulic fluid	**Suitable seals type**		**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR		HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM		HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR		HFC	

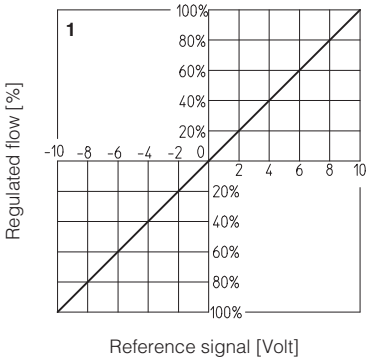
12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

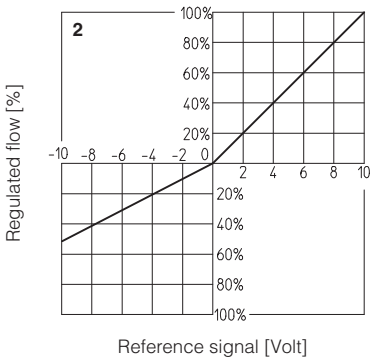
12.1 Regulation diagrams

1 = Linear spools L
2 = Differential - linear spool D7

3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZO)

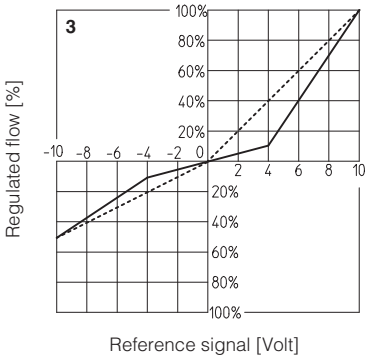
5 = Non linear spool T3 (only for DLKZOR) and T7
6 = Progressive spool V

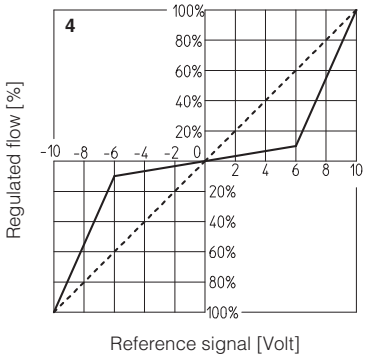




T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2





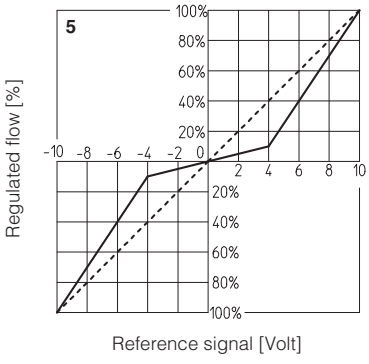
Note:
Hydraulic configuration vs. reference signal:

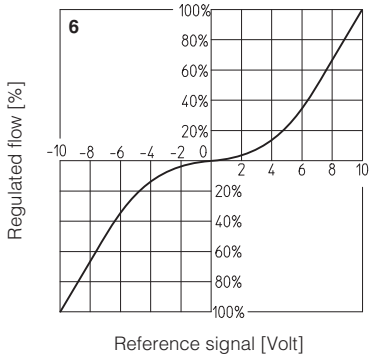
Standard:
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

option /B:
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → B / A → T

Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → A / B → T



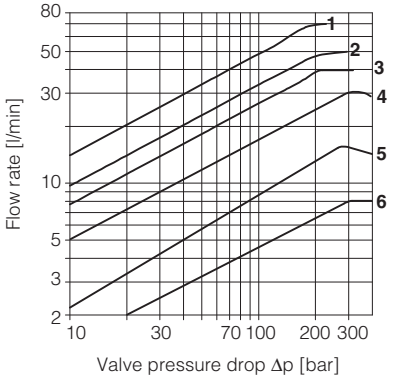


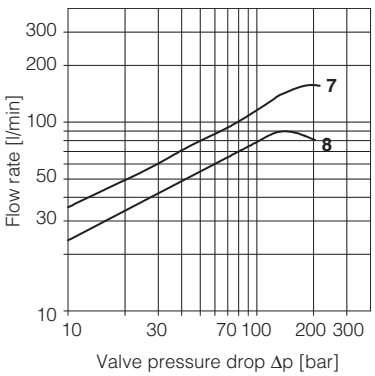
12.2 Flow /Δp diagrams

Stated at 100% of spool stroke

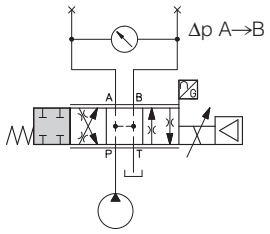
DLHZO:
1 = spool L7, T7, V7, D7, DT7
2 = spool L5, T5
3 = spool V3
4 = spool L3
5 = spool L1, V1
6 = spool L0

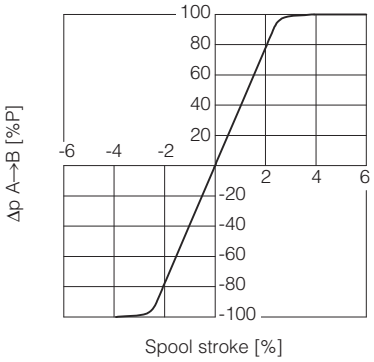
DLKZOR:
7 = spool L7, T7, V7, D7, DT7
8 = spool L3, T3





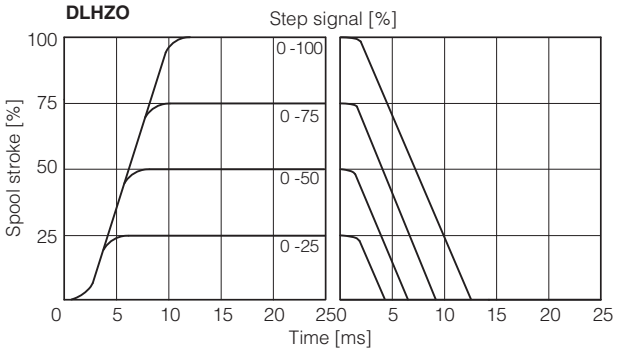
12.3 Pressure gain

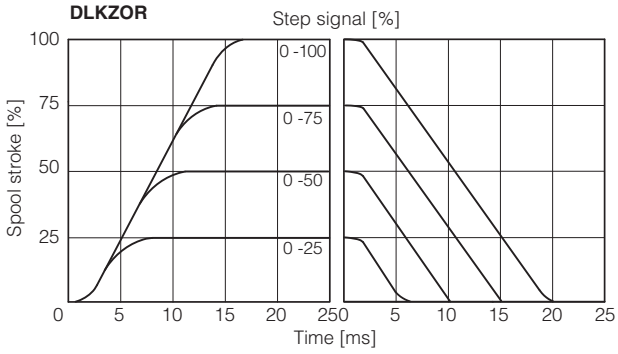




12.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



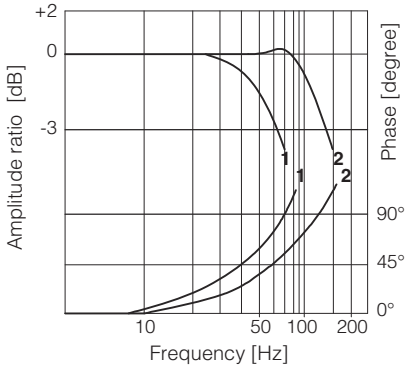


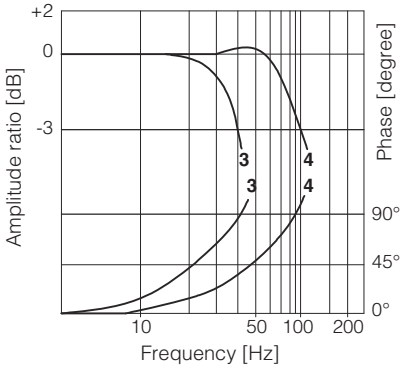
12.5 Bode diagrams

Stated at nominal hydraulic conditions

DLHZO:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZOR:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke





13 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
fail safe **1** fail safe **3** without fail safe	**t** = 7-10 ms (DLHZO) **t** = 15-20 ms (DLKZOR) mechanical stop fail safe regulation range **t** = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar mechanical stop regulation range	**t** = 7-10 ms (DLHZO) **t** = 15-20 ms (DLKZOR) mechanical stop fail safe regulation range mechanical stop regulation range

Fail safe connections		**P → A**	**P → B**	**A → T**	**B → T**
Leakage [cm³/min] at P = 100 bar **(1)**	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] **(2)** DLHZO	Fail safe 3	-	-	15÷30	10÷20
Flow [l/min] **(2)** DLKZOR	Fail safe 3	-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature **(2)** Referred to spool in fail safe position at Δp = 35 bar per edge

14 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

15 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 17.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 17.8)
Power supply for driver's logics and communication - only for **TES** (see 17.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

16 POSSIBLE COMBINED OPTIONS

Standard versions for **TEB-SN** and **TES-SN**:
/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ,
/BQY /BY, /BYZ, /BZ,
/FI, /FIY, /FY,
/IQ, /IQY, /IY, /IYZ, /IZ,
/QY, /YZ

Standard versions for **TES-SP, SF, SL**:
/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **TES-SN**:
/BIU, /BIUY, /BU, /BUY, /IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Safety certified versions for **TES-SP, SF, SL**:
/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCIK, /BCIKY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option and **TES-SP, SF, SL** with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only for **TES-SP, SF, SL**

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Flow monitor output signal (Q_MONITOR) - not for **/F**

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for **TES-SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE) - not for standard and **/F**

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.8 Repeat enable output signal (R_ENABLE) - only for **TEB** with **/Z** option

Repeat enable is used as output repeater signal of enable input signal (see 17.7).

17.9 Fault output signal (FAULT) - not for standard and **/Q**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.10 Remote pressure/force transducer input signal - only for **TES-SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver (see 18.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

17.11 Multiple PID selection (D_IN0 and D_IN1) - only **NP** execution for **TES-SP, SF, SL**

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z	TES-SN /Z	TES-SP, SF, SL Fieldbus	TES-SP, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

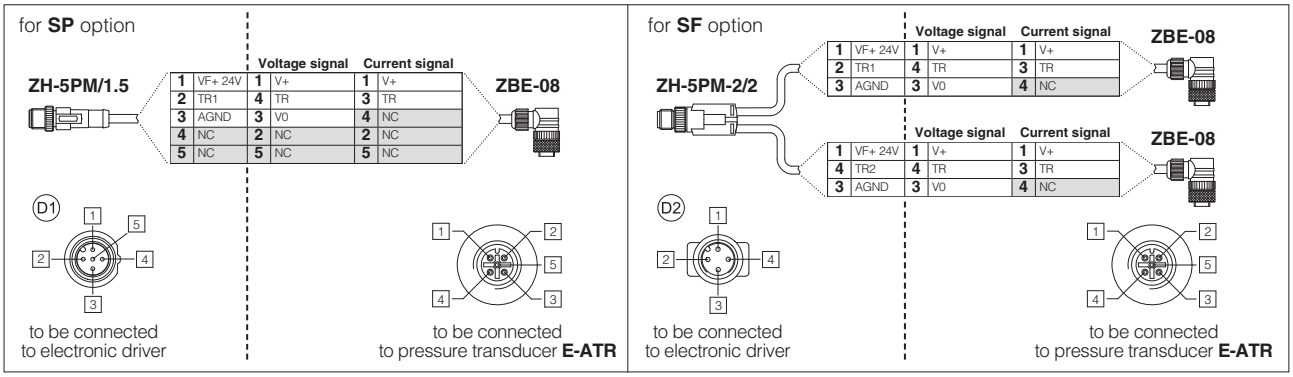
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.4 Remote pressure/force transducer connector - M12 - 5 pin - only for **SP, SF, SL** (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	**Current**	**Voltage**	**Current**
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

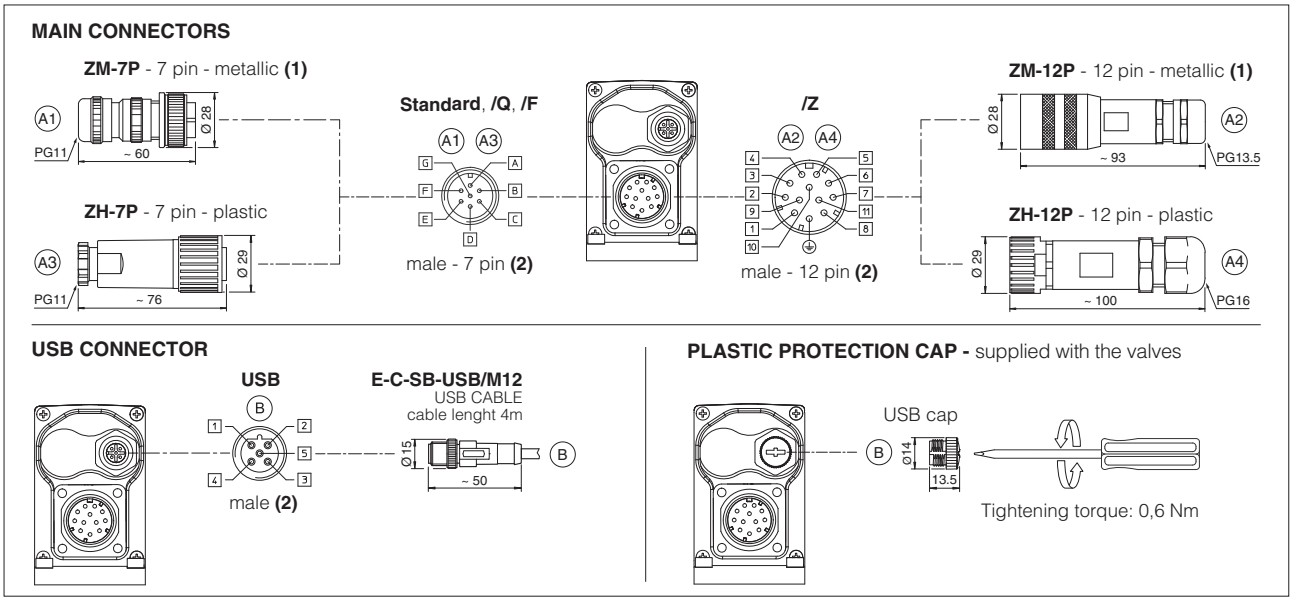
(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

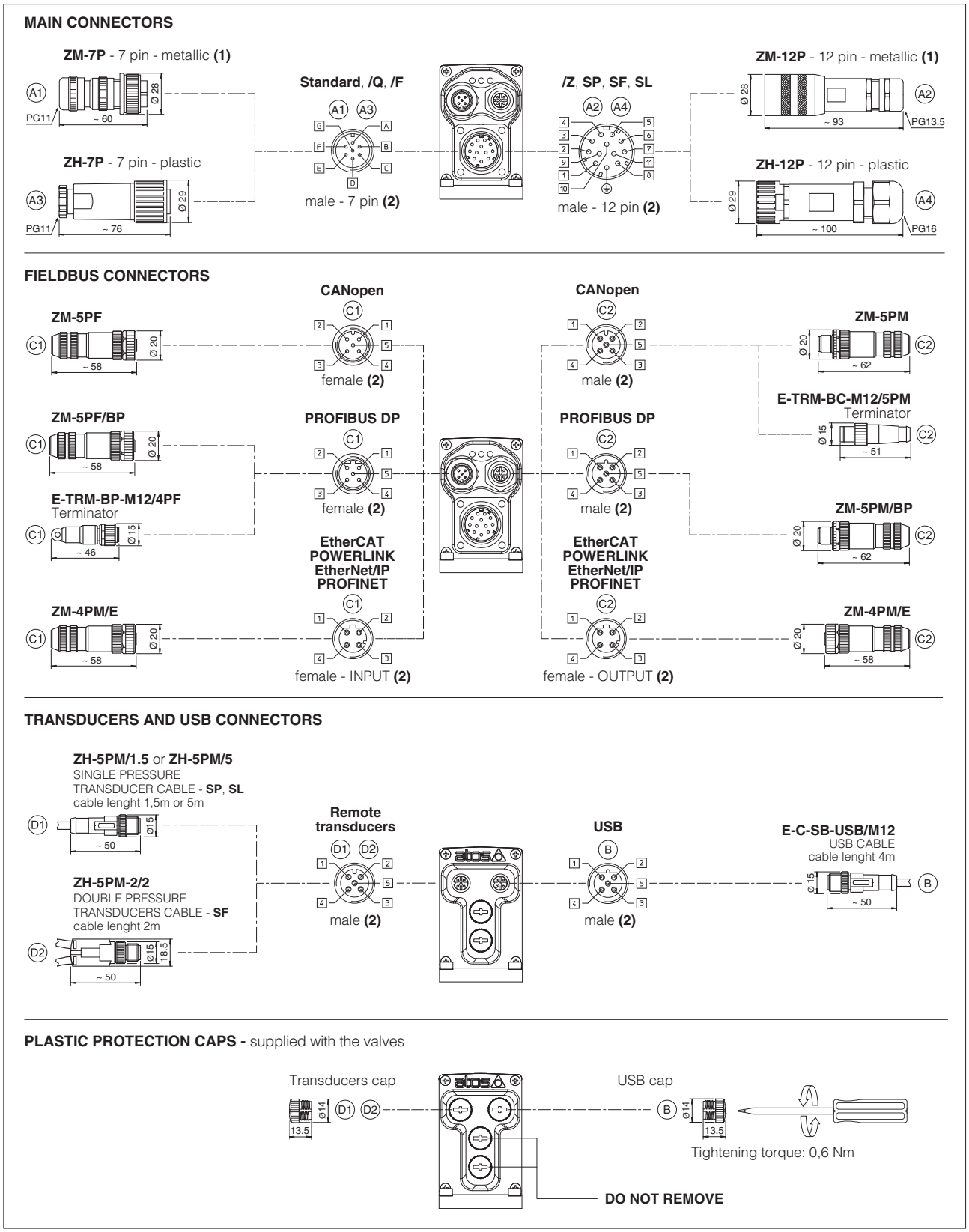
18.5 TEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

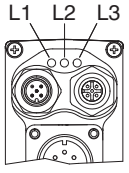
18.6 TES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 Diagnostic LEDs - only for **TES**

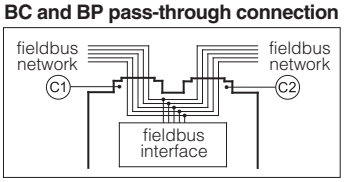
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A1 ZM-7P	A3 ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A2 ZM-12P	A4 ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2 ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

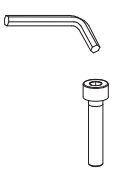
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20.4 Pressure/Force transducer connectors - only for **SP, SF, SL**

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5	D2 ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

21 FASTENING BOLTS AND SEALS

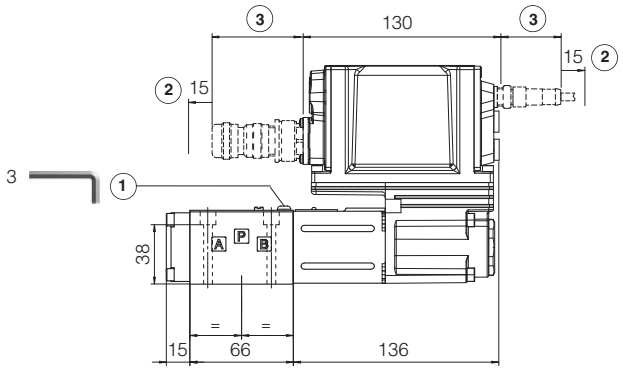
	DLHZO	DLKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

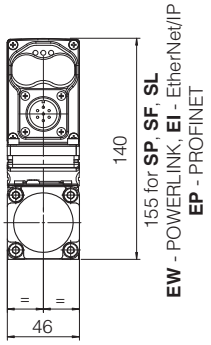
22 INSTALLATION DIMENSIONS [mm]

DLHZO-TEB, DLHZO-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DLHZO	2,3

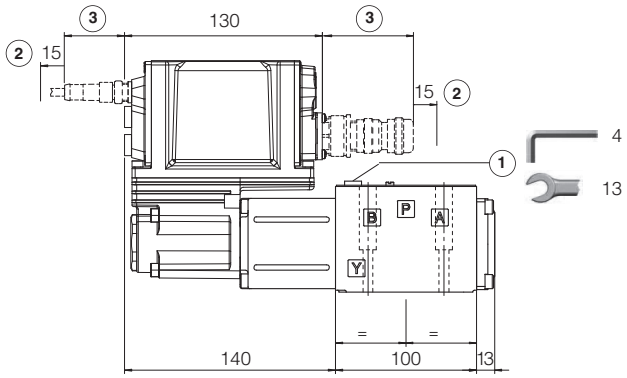


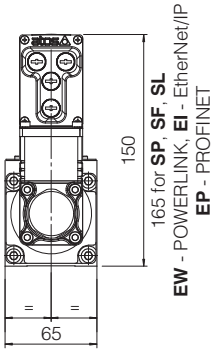


DLKZOR-TEB, DLKZOR-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DLKZOR	4,3





(1) = Air bleeding

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 18.5 and 18.6

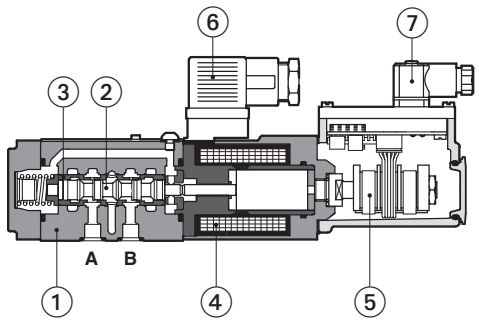
Note: for option /B the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS610	Digital proportional valves with integral axis controller
FS900	Operating and maintenance information for proportional valves
FY100	Safety proportional valves - option /U
FY200	Safety proportional valves - option /K
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB300	Quickstart for TEB valves commissioning
QF300	Quickstart for TES valves commissioning
Y010	Basics for safety components

Servoproportional directional valves **sleeve execution**

direct, with LVDT transducer and zero spool overlap with fail safe



DLHZO-T-060

① Valve body
② Spool
③ Sleeve
④ Proportional solenoid
⑤ LVDT transducer
⑥ Solenoid connector
⑦ Transducer connector

DLHZO-T, DLKZOR-T

Servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for best performances in any position closed loop.

The valves operate in association with digital off-board divers or axis card, see section [2].

The LVDT transducer and the sleeve execution grant very high regulation accuracy and response sensitivity.

The fail safe position permits to intercept the actuator movement in case of power supply interruption.

Spools regulation characteristics:
L = linear
V = progressive
T = non linear for fine low flow control
D and DT = differential, for control of actuators with area ratio 1:2

DLHZO:	**DLKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **70 l/min**	Max flow: **160 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DLHZO	-	T	-	0	40	-	L	7	3	/	*	*	/	*

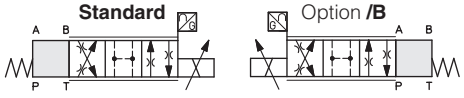
DLHZO = size 06
DLKZOR = size 10

T = with LVDT transducer

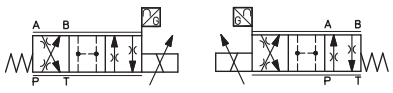
Valve size ISO 4401:
0 = 06 **1** = 10

Configuration:

Standard Option **/B**

40 = 

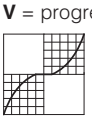
with fail safe configuration 1 or 3

60 = 

without fail safe

Spool type, regulating characteristics:

L = linear 

V = progressive 

T = not linear **(1)** 

D = differential-linear **(1)** 
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

DT = differential-not linear **(1)** 
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) Not available for configuration **60**
(2) Possible combined options: /BY

Seals material, see section [6]:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (2):
B = solenoid and LVDT transducer at side of port A
Y = external drain

Fail safe configuration, see section [8]:
1 = 

3 = 

Note: select **1** for configuration **60** even without fail safe

Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZO =	4	7	8	14	-	20	28	40
DLKZOR =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TID	E-BM-TES	Z-BM-TEZ
Type	Digital	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS235	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DLHZO**												**DLKZOR**						
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10												ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10						
Spool type		**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
	Δp= 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
	Max permissible flow	8	14	16	30	40	50		70			70÷40		90		160			160÷80	
Leakage **(2)** [cm³/min]		<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time **(3)** [ms]		≤ 10												≤ 15						
Hysteresis		≤ 0,1 [% of max regulation]																		
Repeatibility		± 0,1 [% of max regulation]																		
Thermal drift		zero point displacement < 1% at ΔT = 40°C																		

(1) For different Δp, the max flow is in accordance to the diagrams in section 7.2
(2) Referred to spool in neutral position and 50°C oil temperature
(3) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	**DLHZO** = 2,6 A **DLKZOR** = 3 A
Coil resistance R at 20°C	**DLHZO** = 3 ÷ 3,3 Ω **DLKZOR** = 2,2 ÷ 2,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

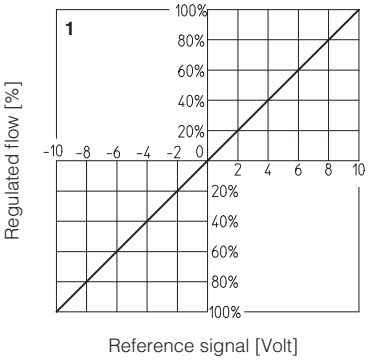
7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

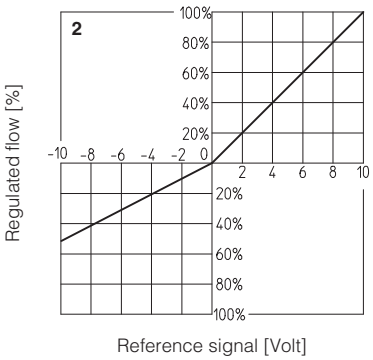
7.1 Regulation diagrams

1 = Linear spools L
2 = Differential - linear spool D7

3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZO)

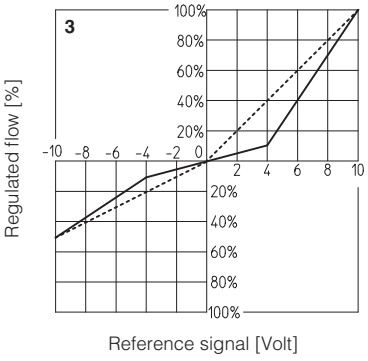
5 = Non linear spool T3 (only for DLKZOR) and T7
6 = Progressive spool V

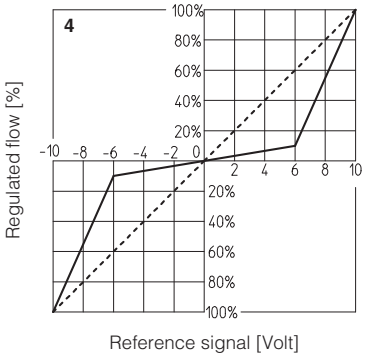




T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3, T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2





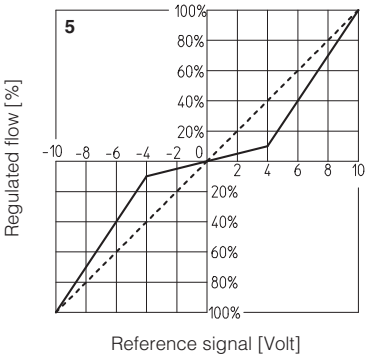
Note:
Hydraulic configuration vs. reference signal:

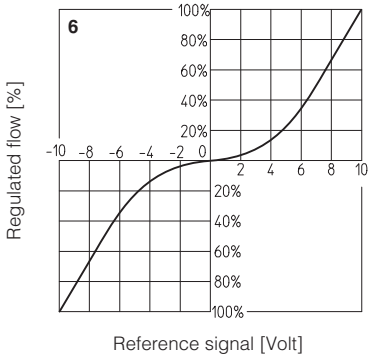
Standard:
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

option /B:
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → B / A → T

Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → A / B → T



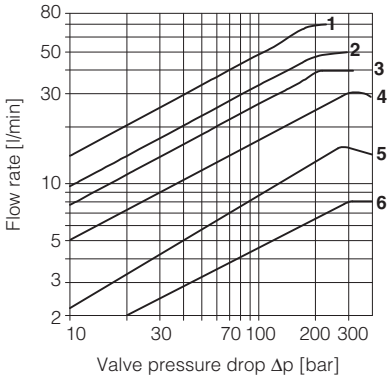


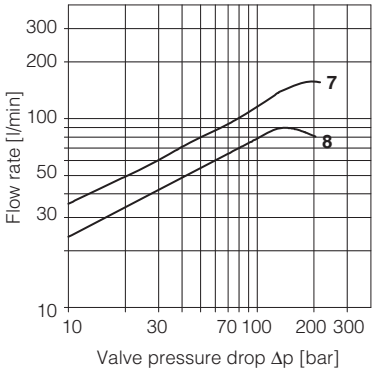
7.2 Flow /Δp diagrams

Stated at 100% of spool stroke

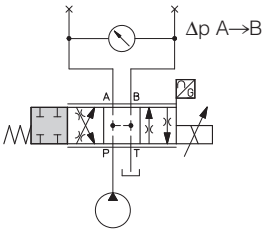
DLHZO:
1 = spool L7, T7, V7, D7, DT7
2 = spool L5, T5
3 = spool V3
4 = spool L3
5 = spool L1, V1
6 = spool L0

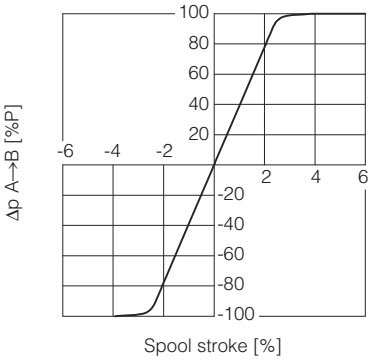
DLKZOR:
7 = spool L7, T7, V7, D7, DT7
8 = spool L3





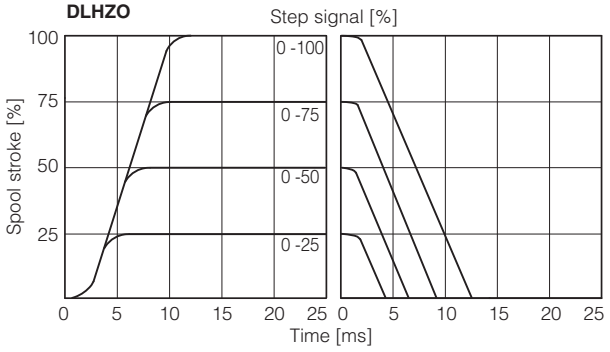
7.3 Pressure gain

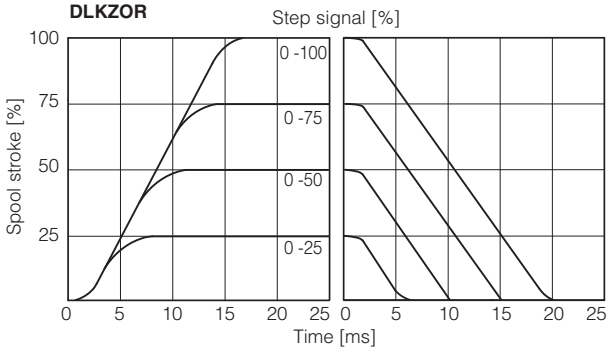




7.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



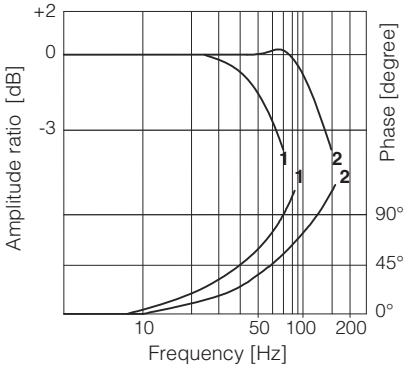


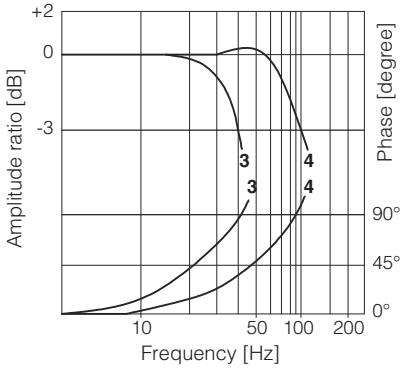
7.5 Bode diagrams

Stated at nominal hydraulic conditions

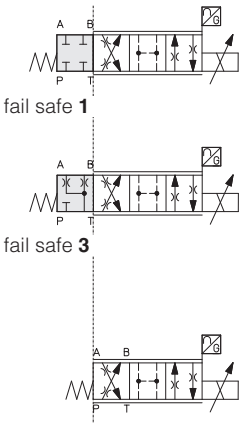
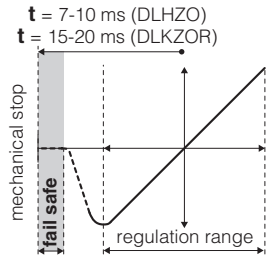
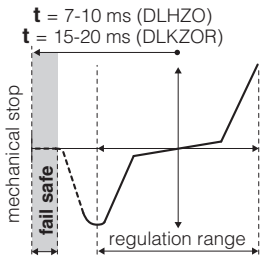
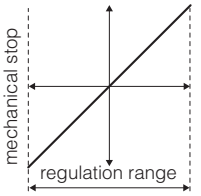
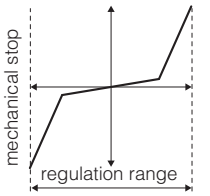
DLHZO:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZOR:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke





8 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
		
		

t = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar

Fail safe connections		**P → A**	**P → B**	**A → T**	**B → T**
Leakage [cm³/min] at P = 100 bar **(1)**	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] **(2)** DLHZO	Fail safe 3	-	-	15÷30	10÷20
Flow [l/min] **(2)** DLKZOR	Fail safe 3	-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature **(2)** Referred to spool in fail safe position at Δp = 35 bar per edge

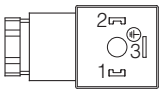
9 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 7.1

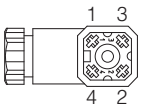
Y = This option is mandatory if the pressure in port T exceeds 210 bar.

10 ELECTRICAL CONNECTION

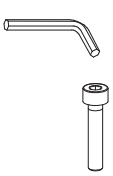
10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

11 FASTENING BOLTS AND SEALS

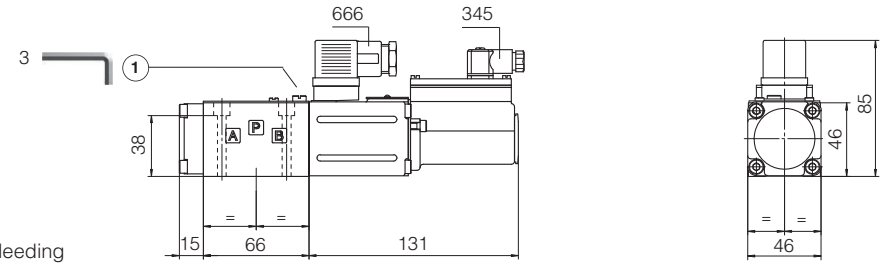
	DLHZO	**DLKZOR**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

12 INSTALLATION DIMENSIONS [mm]

DLHZO-T

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DLHZO	2,3

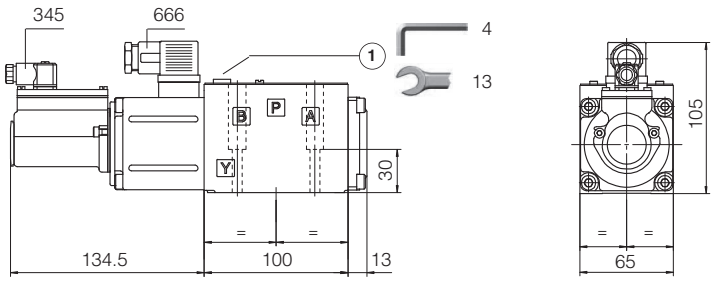


1 = Air bleeding

DLKZOR-T

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DLKZOR	4,3



1 = Air bleeding

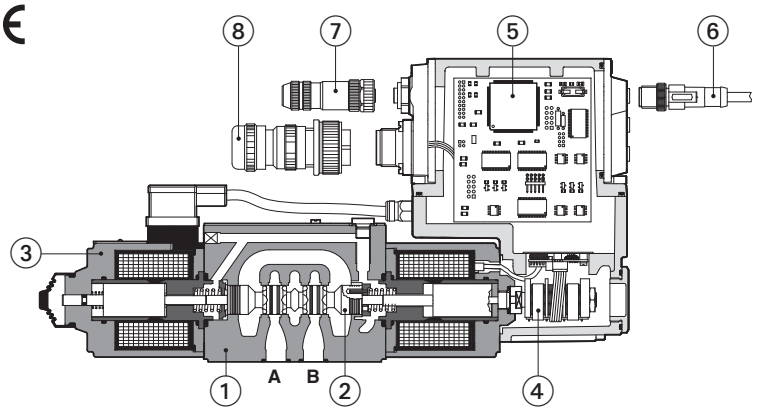
Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS330**	Z-BM-TEZ digital axis card
FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
GS230	E-BM-TEB digital driver	**GS510**	Fieldbus
GS235	E-BM-TID digital driver	**K800**	Electric and electronic connectors
GS240	E-BM-TES digital driver	**P005**	Mounting surfaces for electrohydraulic valves

Digital servoproportional directional valves

direct, with on-board driver, LVDT transducer and zero spool overlap



DKZOR-TES-SN-BC-170

① Valve body
② Spool
③ Proportional solenoid
④ LVDT transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector

DHZO-TEB, DHZO-TES
DKZOR-TEB, DKZOR-TES

Digital servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for position closed loop controls. The double solenoid construction involves larger flows and central safety rest position.

TEB basic execution with analog reference signals and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Digital TEZ version (see tech. table FS620) integrates on-board driver and axis card, while TEB and TES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 **MODEL CODE**

DHZO	-	TES	-	SN	-	NP	-	0	70	-	L	5	/	*	*	/	*

DHZO Servoproportional directional valves, direct
DHZO = size 06
DKZOR = size 10

TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401: **0** = 06 **1** = 10

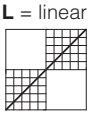
Configuration:

Standard Option **/B**

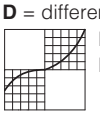
70 =

Spool type, regulating characteristics:

L = linear



D = differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q



Spool size:

	3 (L)	**5** (L,D)
DHZO =	17	28
DKZOR =	45	75

Nominal flow (l/min) at Δp 10bar P-T

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (2):
B = solenoid with on-board digital driver and LVDT transducer at side of port A
Y = external drain

Electronics options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **TES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

Safety options TÜV certified - only **TES (2)**:
U = safe double power supply
K = safe on/off signals
See section 7

SAFETY CERTIFIED

(1) Only in version **SN-NP**
(2) For possible combined options, see section 15
(3) Double power supply only for **TES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

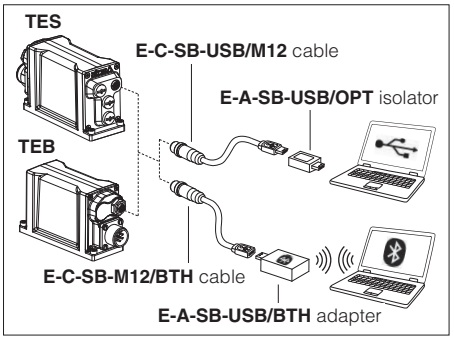
3 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

USB or Bluetooth connection



WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for **TES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for **TES**, see tech. table **FS500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 AXIS CONTROLLER - see tech. table **FS620**

Digital servoproportional with integral electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. S* option add alternated P/Q control to the basic position ones.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 SAFETY OPTIONS - only for **TES**

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** ,
designed to accomplish a safety function, intended to reduce the risk in process control systems.
They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DHZO			DKZOR		
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10			ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10		
Spool type		**L3**	**L5**	**D5**	**L3**	**L5**	**D5**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	18	28	28	45	75	75
	Δp= 30 bar	30	50	50	80	130	130
	Δp= 70 bar	45	75	75	120	170	170
Max permissible flow **(2)**		50	80	80	130	180	180
Leakage [cm³/min]		<500 (at p = 100 bar); <1500 (at p = 350 bar)			<800 (at p = 100 bar); <2500 (at p = 315 bar)		
Response time **(3)** [ms]		≤ 15			≤ 20		
Hysteresis		≤ 0,2 [% of max regulation]					
Repeatibility		± 0,1 [% of max regulation]					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) See detailed diagrams in section 12.3
(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**DHZO** = 2,6 A **DKZOR** = 3 A			
Coil resistance R at 20°C	**DHZO** = 3 ÷ 3,3 Ω **DKZOR** = 3,8 ÷ 4,1 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

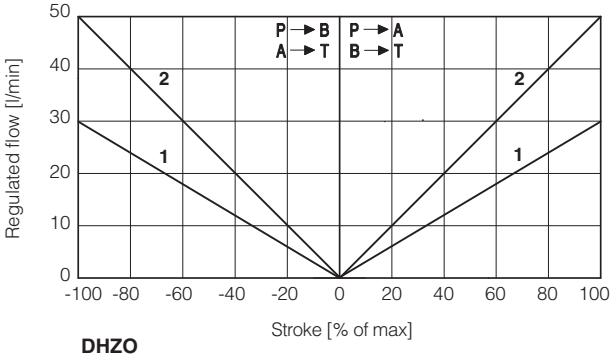
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

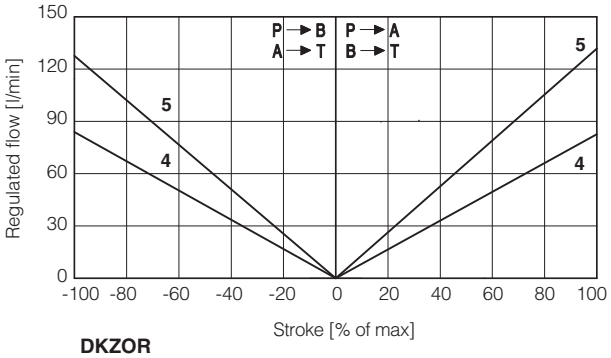
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

12 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

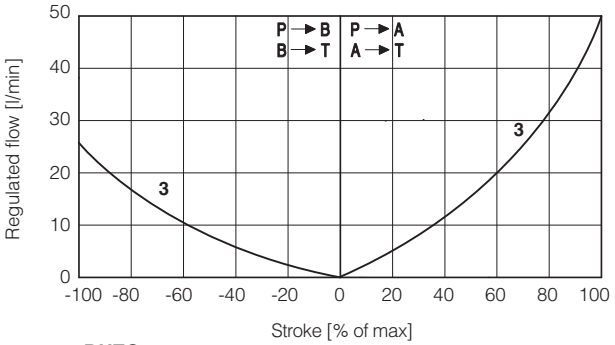
12.1 Regulation diagrams (values measure at Δp 30 bar P-T)



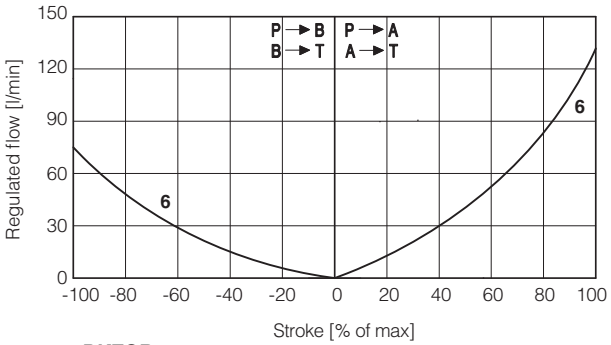
DHZO
1 = L3 **2** = L5



DKZOR
4 = L3 **5** = L5



DHZO
3 = D5



DKZOR
6 = D5

Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B)

Reference signal $\left.\begin{matrix}0 \div +10\ V\\12 \div 20\ mA\end{matrix}\right\}$ P → A / B → T Reference signal $\left.\begin{matrix}0 \div -10\ V\\12 \div 4\ mA\end{matrix}\right\}$ P → B / A → T

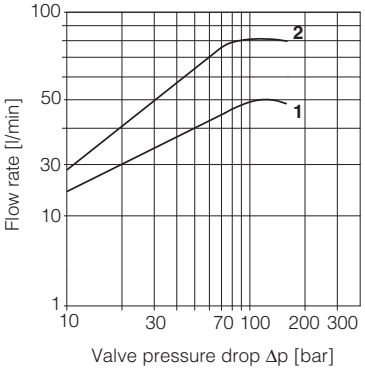
12.2 Flow /Δp diagrams

stated at 100% of valve stroke

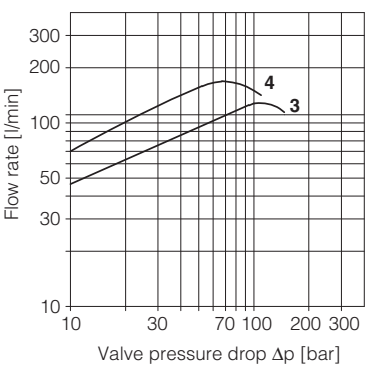
DHZO
1 = spool L3,
2 = spool L5, D5

DKZOR
3 = spool L3
4 = spool L5, D5

DHZO



DKZOR



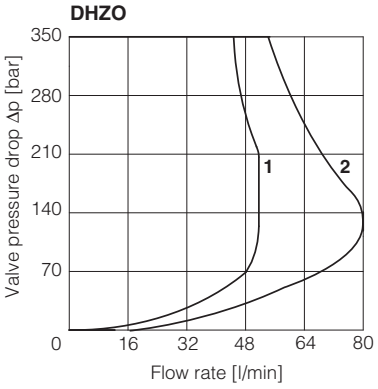
12.3 Operating limits

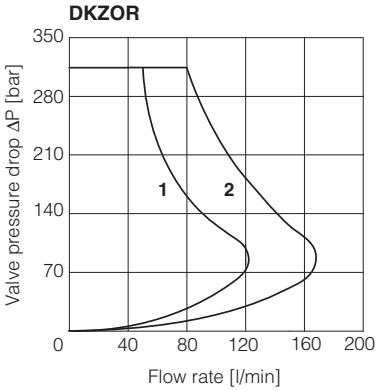
DHZO

1 = spool L3
2 = spool L5, D5

DKZOR

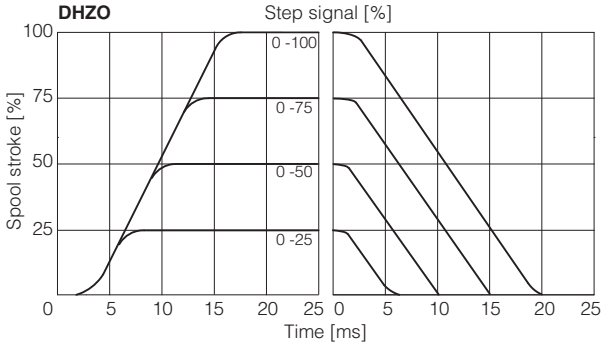
3 = spool L3
4 = spool L5, D5

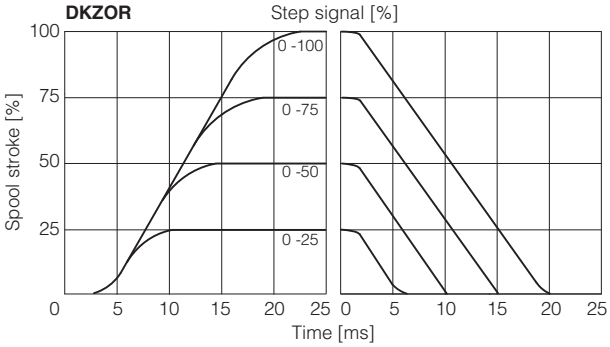




12.4 Response time

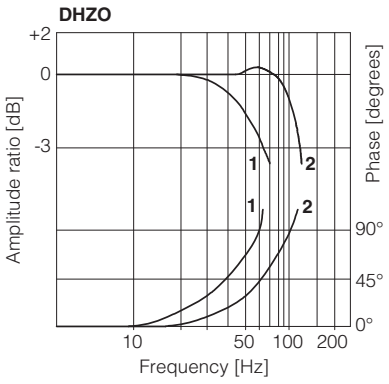
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

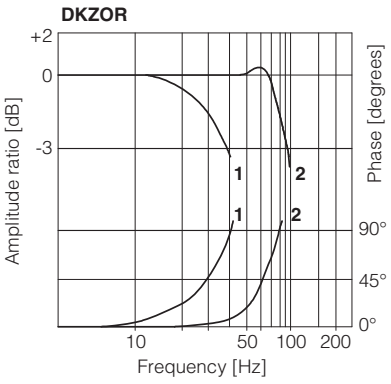




12.5 Bode diagrams

1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke





13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 17.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 17.8)
Power supply for driver's logics and communication - only for **TES** (see 17.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Standard versions for **TEB-SN** and **TES-SN**:
/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ,
/BQY /BY, /BYZ, /BZ,
/FI, /FIY, /FY, /IQ, /IQY,
/IY, /IYZ, /IZ,
/QY, /YZ

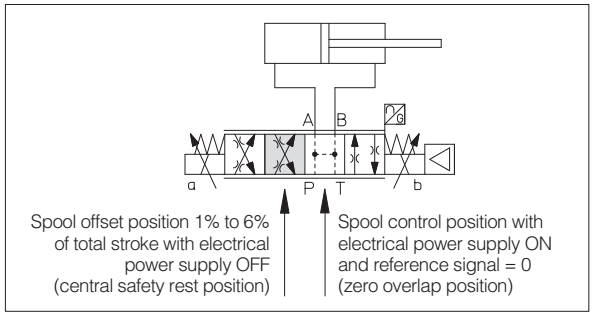
Standard versions for **TES-SP, SF, SL**:
/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **TES-SN**:
/BIU, /BIUY, /BU, /BUY,/IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Safety certified versions for **TES-SP, SF, SL**:
/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCIK, /BCIKY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY

16 SAFETY REST POSITION - configuration 70

In absence of electric power supply (+24 VDC), the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.
This is specifically designed to avoid that in case of accidental interruption of the electrical power supply to the valve, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.
The main spool moves to the closed loop control position (zero overlap) when the pilot pressure is activated, the valve is fed with power supply +24 VDC and reference input = 0V (or 12 mA for option /I) is applied to the driver.



17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option and **TES-SP, SF, SL** with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only for **TES-SP, SF, SL**

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Flow monitor output signal (Q_MONITOR) - not for **/F**

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for **TES-SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE) - not for standard and **/F**

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.8 Repeat enable output signal (R_ENABLE) - only for **TEB** with **/Z** option

Repeat enable is used as output repeater signal of enable input signal (see 17.7).

17.9 Fault output signal (FAULT) - not for standard and **/Q**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.10 Remote pressure/force transducer input signal - only for **TES-SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver (see 18.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

17.11 Multiple PID selection (D_IN0 and D_IN1) - only **NP** execution for **TES-SP, SF, SL**

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	SET 1	SET 2	SET 3	SET 4
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) **Standard**, **/Q** and **/F** options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

18.2 Main connector signals - 12 pin (A2) **/Z** option and **TES-SP, SF, SL**

PIN	TEB-SN /Z	TES-SN /Z	TES-SP, SF, SL Fieldbus	TES-SP, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communications connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

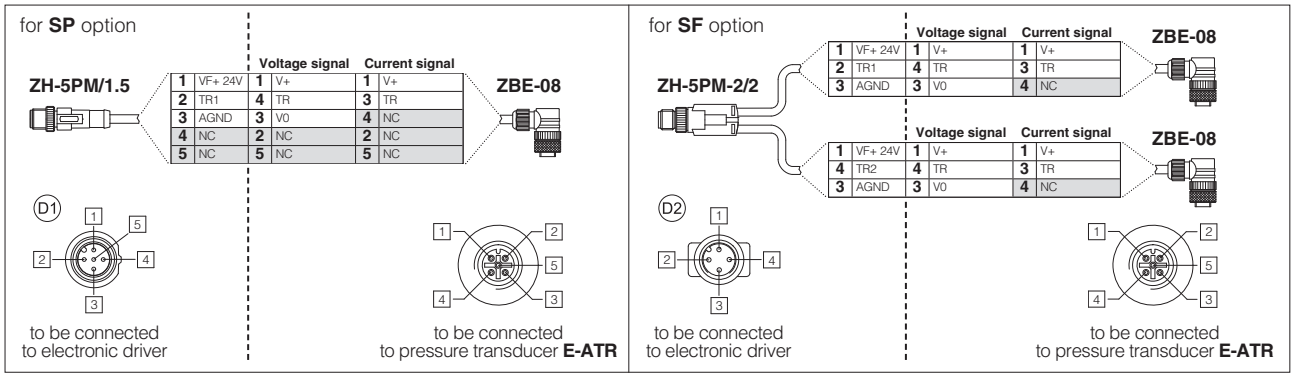
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.4 Remote pressure/force transducer connector - M12 - 5 pin - only for **SP, SF, SL** (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

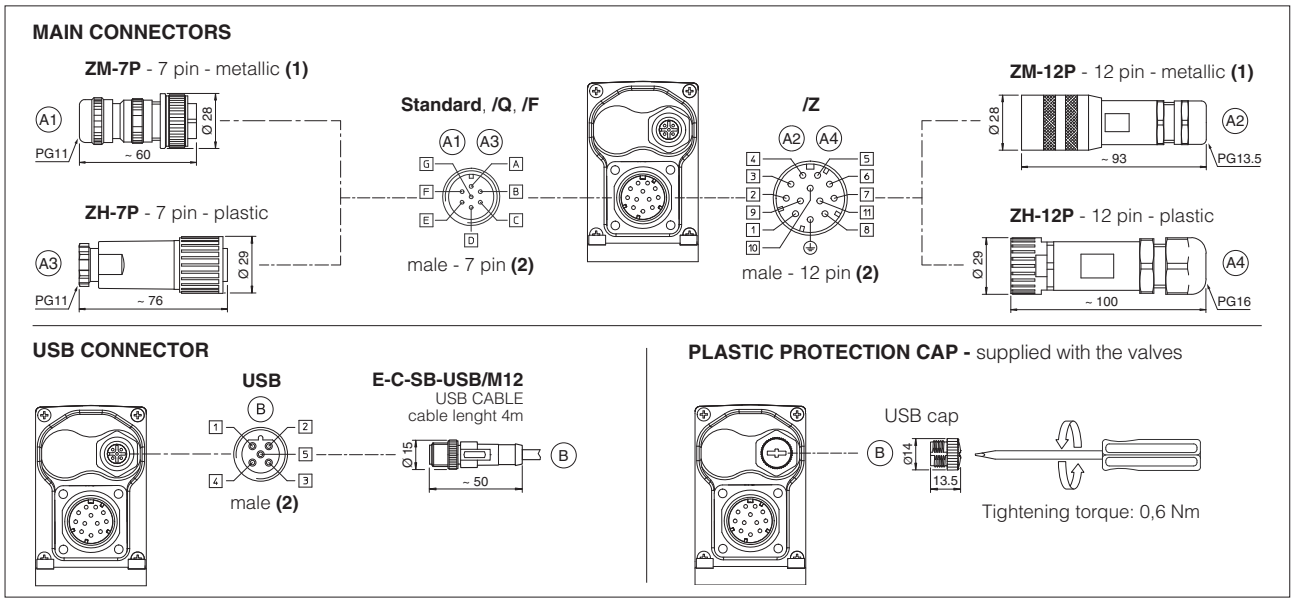
(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



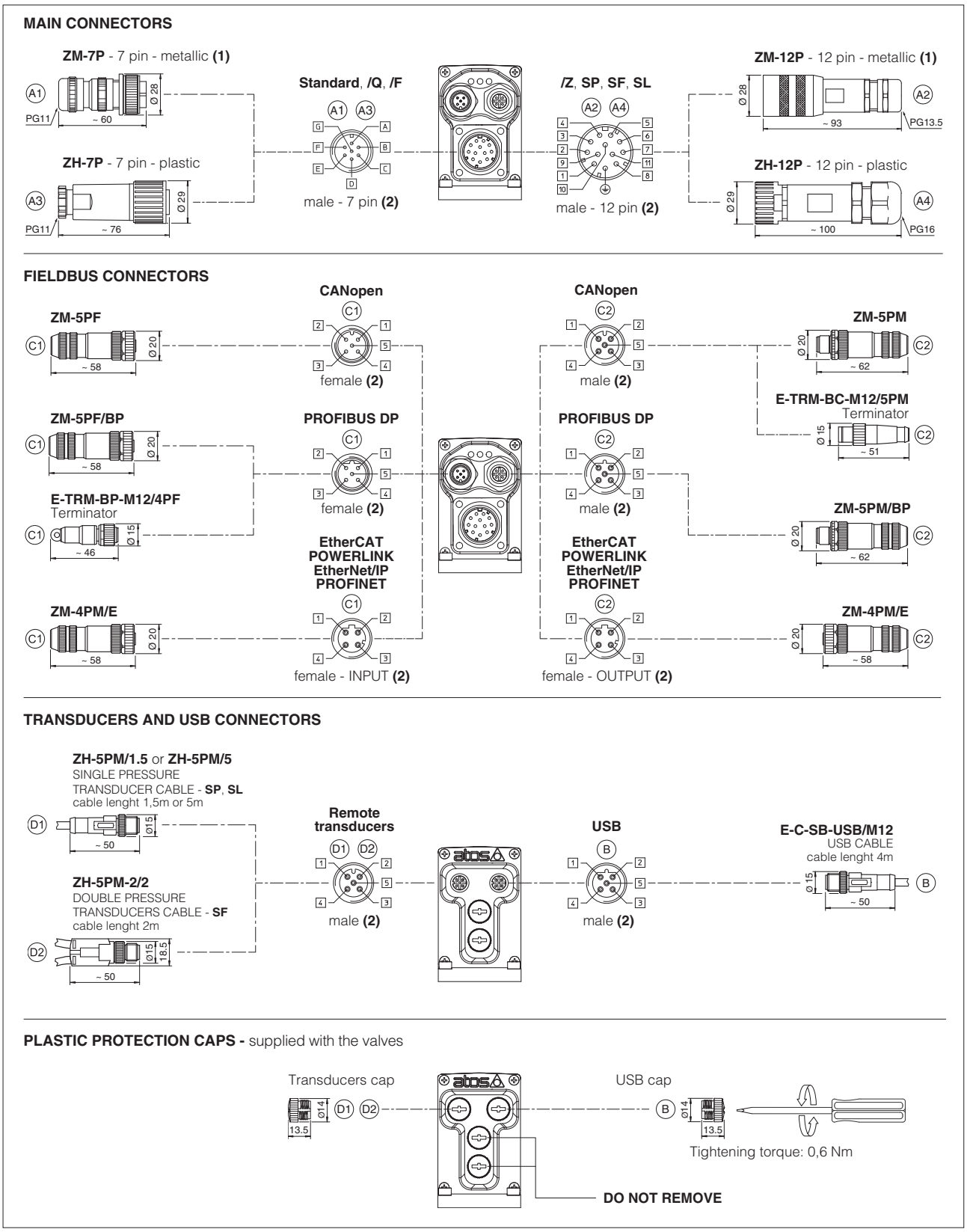
Note: pin layout always referred to driver's view

18.5 TEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

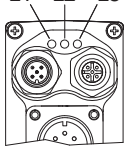
18.6 TES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 Diagnostic LEDs - only for **TES**

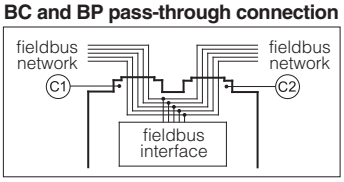
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

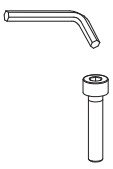
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20.4 Pressure/Force transducer connectors - only for **SP, SF, SL**

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

21 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

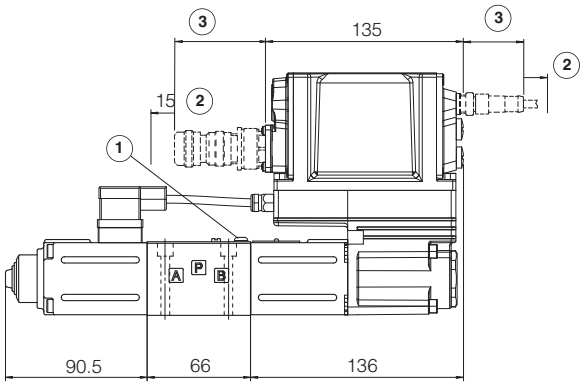
22 INSTALLATION DIMENSIONS [mm]

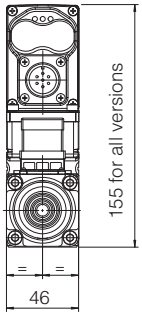
DHZO-TEB, DHZO-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO	3,1

DHZO-TEB-*-07
DHZO-TES-*-07





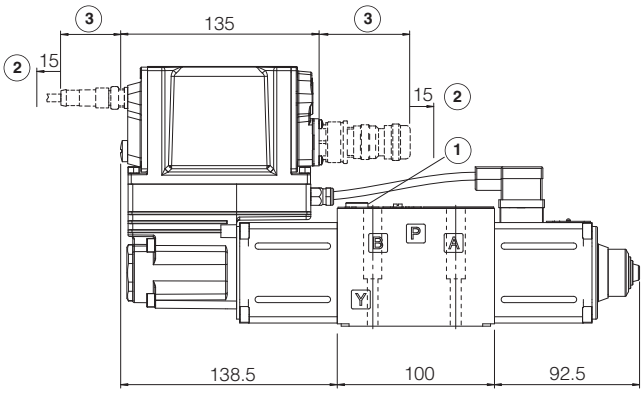
(1) = Air bleeding 3
(2) = Space to remove the connectors
(3) = The dimensions of all connectors must be considered, see section 18.5 and 18.6

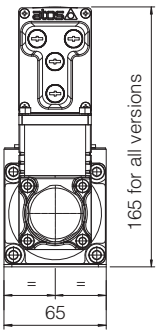
DKZOR-TEB, DKZOR-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR	5,0

DKZOR-TEB-*-17
DKZOR-TES-*-17





(1) = Air bleeding 4 13
(2) = Space to remove the connectors
(3) = The dimensions of all connectors must be considered, see section 18.5 and 18.6

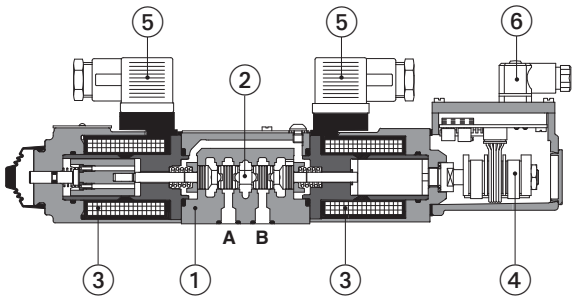
Note: for option /B the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS620	Digital proportional valves with integral axis controller
FS900	Operating and maintenance information for proportional valves
FY100	Safety proportional valves - option /U
FY200	Safety proportional valves - option /K
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB300	Quickstart for TEB valves commissioning
QF300	Quickstart for TES valves commissioning
Y010	Basics for safety components

Servoproportional directional valves

direct, with LVDT transducer and zero spool overlap



DHZO-T-070

① Valve body
② Spool
③ Proportional solenoid
④ LVDT transducer
⑤ Solenoid connector
⑥ Transducer connector

DHZO-T, DKZOR-T

Servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for best performances in any position closed loop.

The valves operate in association with digital off-board divers or axis card, see section 2.

The LVDT transducer grants very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:
L = linear
D = differential-progressive, for control of actuators with area ratio 1:2

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZO	-	T	-	0	70	-	L	5	/	*	*	/	*

DHZO = size 06
DKZOR = size 10

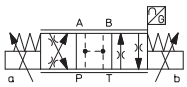
T = with LVDT transducer

Valve size ISO 4401:
0 = 06 **1** = 10

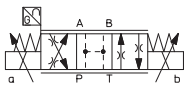
Configuration:

70 =

Standard



Option **/B**



Spool type, regulating characteristics:

L = linear

D = differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Spool size:

	3 (L)	**5** (L,D)
DHZO =	17	28
DKZOR =	45	75

Nominal flow (l/min) at Δp 10bar P-T

Hydraulic options (1):
B = solenoid and LVDT transducer at side of port A
Y = external drain

Series number

Seals material,
see section 6 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /BY

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TID	E-BM-TES	Z-BM-TEZ
Type	Digital	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS235	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DHZO**			**DKZOR**		
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10			ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10		
Spool type		**L3**	**L5**	**D5**	**L3**	**L5**	**D5**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	18	28	28	45	75	75
	Δp= 30 bar	30	50	50	80	130	130
	Δp= 70 bar	45	75	75	120	170	170
Max permissible flow **(2)**		50	80	80	130	180	180
Leakage [cm³/min]		<500 (at p = 100 bar); <1500 (at p = 350 bar)			<800 (at p = 100 bar); <2500 (at p = 315 bar)		
Response time **(3)** [ms]		≤ 15			≤ 20		
Hysteresis		≤ 0,2 [% of max regulation]					
Repeatibility		± 0,1 [% of max regulation]					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 7.2
(2) See detailed diagrams in section 7.3
(3) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

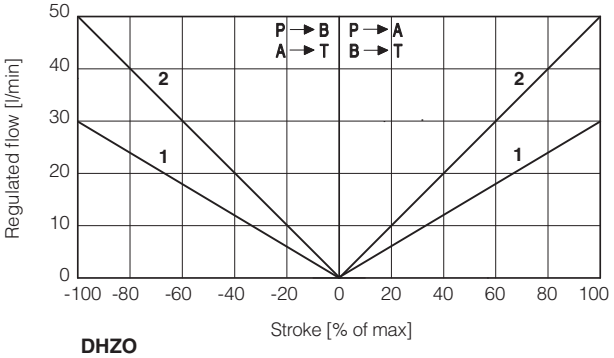
Max power consumption	30 W
Max. solenoid current	**DLHZO** = 2,6 A **DLKZOR** = 3 A
Coil resistance R at 20°C	**DLHZO** = 3 ÷ 3,3 Ω **DLKZOR** = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

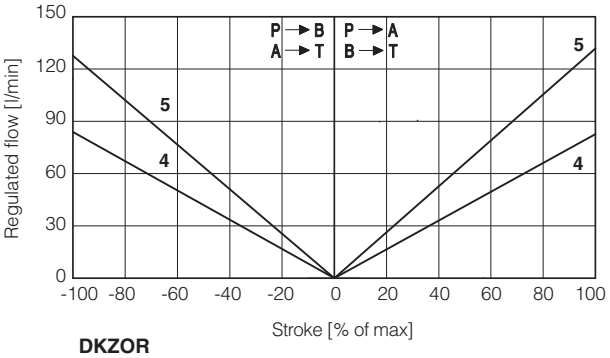
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

7 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

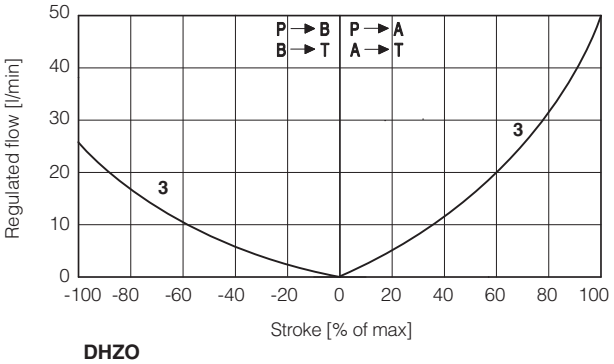
7.1 Regulation diagrams (values measure at Δp 30 bar P-T)



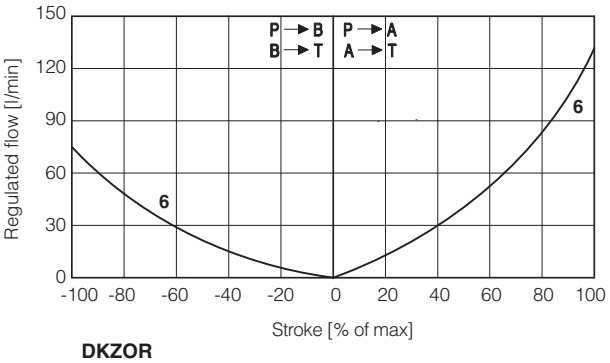
DHZO
1 = L3 **2** = L5



DKZOR
4 = L3 **5** = L5



DHZO
3 = D5



DKZOR
6 = D5

Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B)

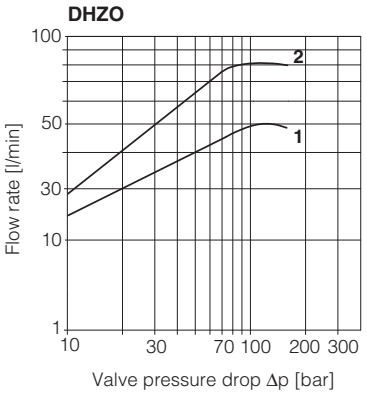
Reference signal $\left.\begin{matrix}0 \div +10\ V\\ 12 \div 20\ mA\end{matrix}\right\}$ P → A / B → T Reference signal $\left.\begin{matrix}0 \div -10\ V\\ 12 \div 4\ mA\end{matrix}\right\}$ P → B / A → T

7.2 Flow /Δp diagrams
stated at 100% of valve stroke

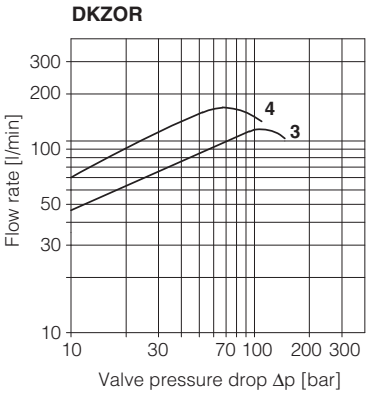
DHZO
1 = spool L3,
2 = spool L5, D5

DKZOR
3 = spool L3
4 = spool L5, D5

DHZO



DKZOR

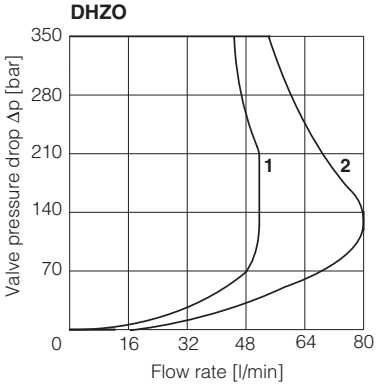


7.3 Operating limits

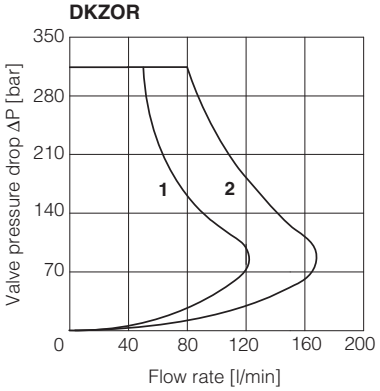
DHZO
1 = spool L3
2 = spool L5, D5

DKZOR
3 = spool L3
4 = spool L5, D5

DHZO

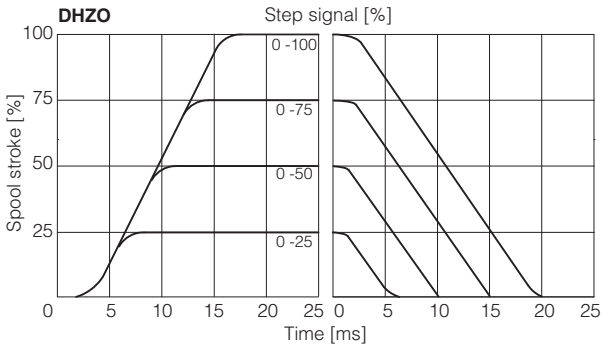


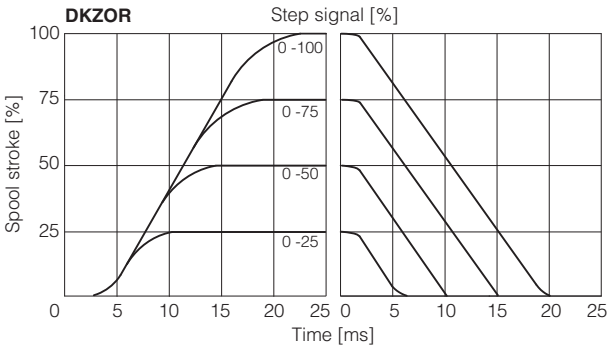
DKZOR



7.4 Response time

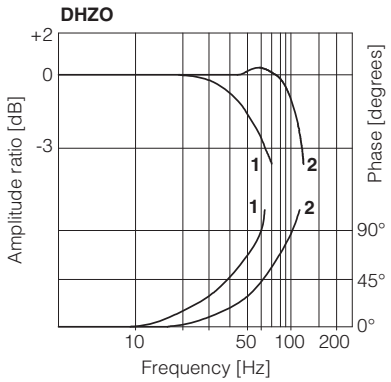
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

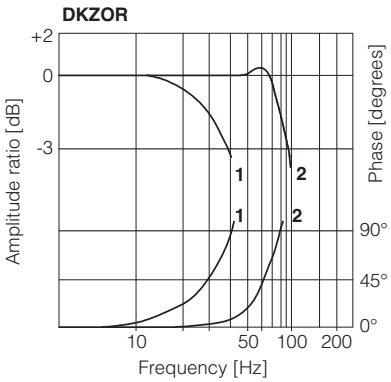




7.5 Bode diagrams

1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke





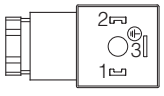
8 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 7.1

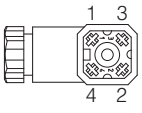
Y = This option is mandatory if the pressure in port T exceeds 210 bar.

9 ELECTRICAL CONNECTION

9.1 Solenoid connector - supplied with the valve

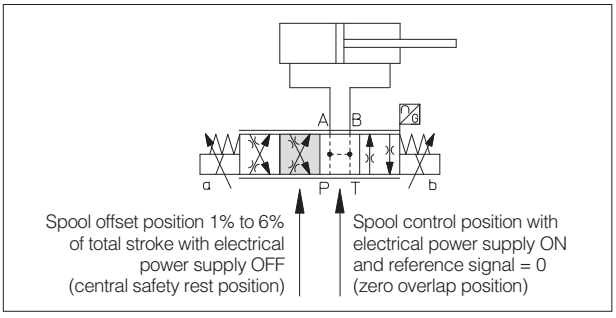
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

9.2 LVDT transducer connector - supplied with the valve

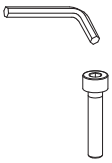
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

10 SAFETY REST POSITION - configuration 70

In absence of power supply to the solenoids, the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.
This is specifically designed to avoid that in case of accidental interruption of power supply to the valve solenoids, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



11 FASTENING BOLTS AND SEALS

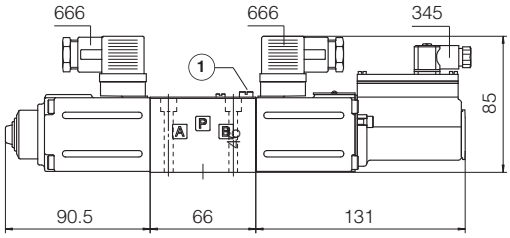
	DHZO	DKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

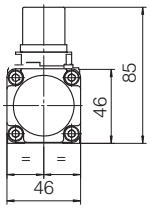
12 INSTALLATION DIMENSIONS [mm]

DHZO-T

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO-T-07	2,6



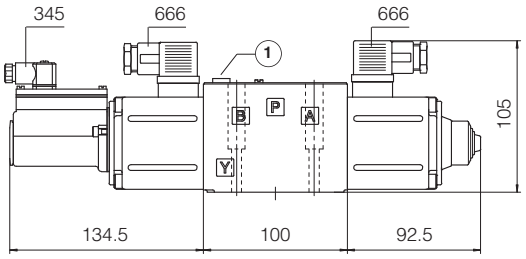


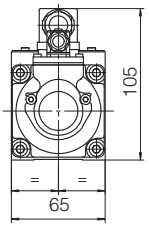
(1) = Air bleeding  3

DKZOR-T

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR-T-17	4,5





(1) = Air bleeding  4 13

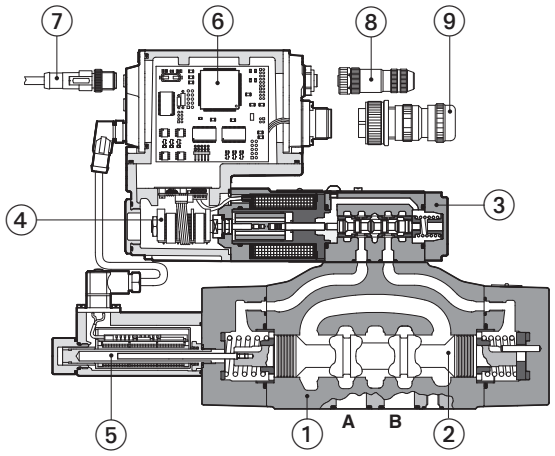
Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS330**	Z-BM-TEZ digital axis card
FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
GS230	E-BM-TEB digital driver	**GS510**	Fieldbus
GS235	E-BM-TID digital driver	**K800**	Electric and electronic connectors
GS240	E-BM-TES digital driver	**P005**	Mounting surfaces for electrohydraulic valves

Digital servoproportional directional valves

piloted, with on-board driver, two LVDT transducers and zero spool overlap



DPZO-LES-SN-BP-270

① Valve body
② Main stage Spool
③ Pilot valve
④ Pilot valve LVDT transducer
⑤ Main stage LVDT transducer
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connectors
⑨ Main connector

DPZO-LEB, DPZO-LES

Digital servoproportional directional valves, piloted, with two LVDT position transducer and zero spool overlap for position closed loop controls.

LEB basic execution with analog reference signals and USB port for software functional parameters setting.

LES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Digital LEZ version (see tech. table FS630) integrates on-board driver and axis card, while LEB and LES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

Size: **10** ÷ **35** - ISO 4401
Max flow: **180** ÷ **3500 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPZO	-	LES	-	SN	-	NP	-	2	70	-	L	5	/	*	*	/	*

Servoproportional directional valve, piloted

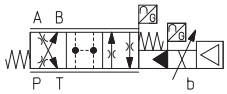
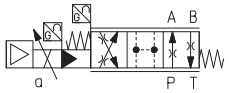
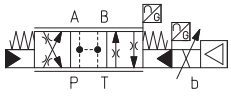
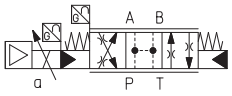
LEB = basic on-board digital driver **(1)**
LES = full on-board digital driver

Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32 **8** = 35

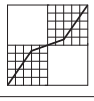
Configuration:

	Standard	Option **/B**
60 =		
70 =		

Spool type, regulating characteristics:

L =  linear

DL =  differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

T =  non linear **(2)**

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (3):
B = solenoid with on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronics options (3):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **LES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(4)**

Safety options TÜV certified - only **LES (3)**:
U = safe double power supply
K = safe on/off signals
See section 7

SAFETY CERTIFIED

Spool size:	**3** (L)	**5** (L,DL)	**5** (L)	**5** (T)
DPZO-1 =	-	100	-	-
DPZO-2 =	160	250	-	190
DPZO-4 =	-	480	-	-
DPZO-4M =	-	550	-	-
DPZO-6 =	-	-	640	-
DPZO-8 =	-	-	1200	-

Nominal flow (l/min) at Δp 10bar P-T

(1) Only in version **SN-NP**
(2) Only for DPZO-*-270
(3) For possible combined options, see section 15
(4) Double power supply only for **LES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

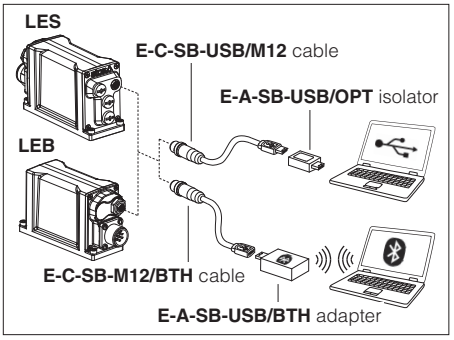
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for **LES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for **LES**, see tech. table **FS500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 AXIS CONTROLLER - see tech. table **FS630**

Digital servoproportional with integral electronics **LEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. S* option add alternated P/Q control to the basic position ones.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 SAFETY OPTIONS - only for **LES**

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** , designed to accomplish a safety function, intended to reduce the risk in process control systems.
They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

SAFETY CERTIFIED

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**
Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-*-1	DPZO-*-2			DPZO-*-4	DPZO-*-4M	DPZO-*-6	DPZO-*-8
Pressure limits [bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;							
Spool type	L5, DL5	L3	L5, DL5	T5	L5, DL5		L5	
Nominal flow Δp P-T [l/min] **(1)** Δp= 10 bar	100	160	250	190	480	550	640	1200
Δp= 30 bar	160	270	430	330	830	950	1100	2000
Max permissible flow [l/min]	180	400	550	550	1000	1100	1600	3500
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)							
Piloting volume [cm³/min]	1,4	3,7			9	11,3	21,6	39,8
Piloting flow **(2)** [l/min]	3,5	9			18	20	19	24
Leakage **(3)** Pilot [cm³/min]	100 / 300	150 / 450			200 / 600	200 / 600	900 / 2800	900 / 2800
Main stage [l/min]	0,4 / 1,2	0,6 / 2,5			1,0 / 4,0	1,0 / 4,0	3,0 / 9,0	6,0 / 20
Response time **(4)** [ms]	≤ 25	≤ 25			≤ 30	≤ 35	≤ 80	≤ 100
Hysteresis	≤ 0,1 [%of max regulation]							
Repeatability	± 0,1 [%of max regulation]							
Thermal drift	zero point displacement < 1% at ΔT = 40°C							

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal, see detailed diagrams in section 12.3

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

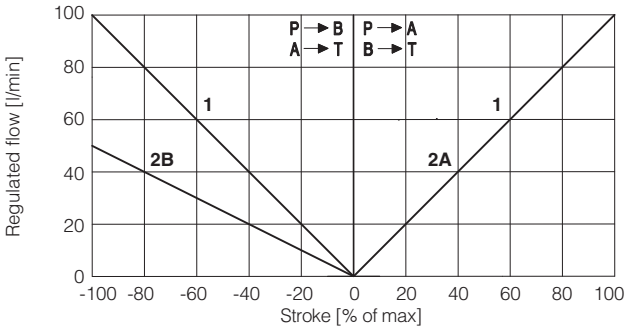
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

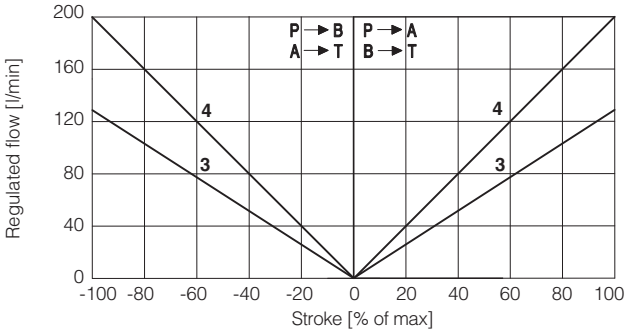
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

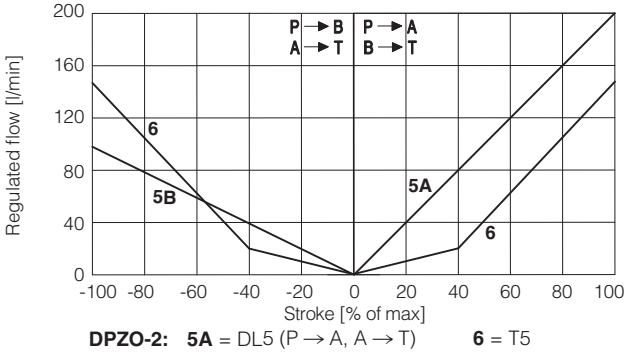
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



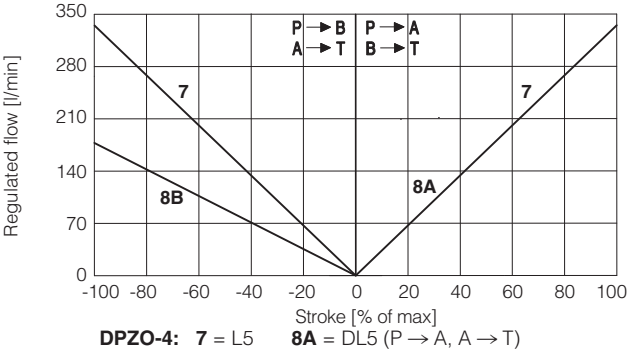
DPZO-1: **1** = L5 **2A** = DL5 (P → A, A → T)
2B = DL5 (P → B, B → T)



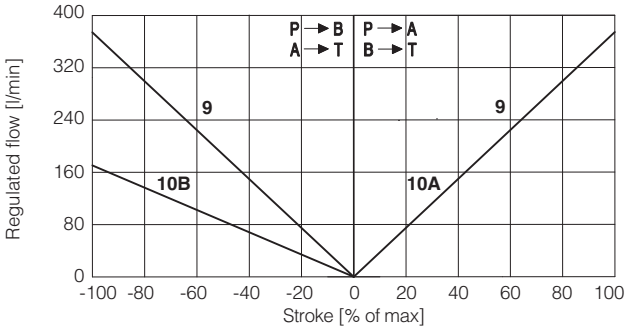
DPZO-2: **3** = L3 **4** = L5



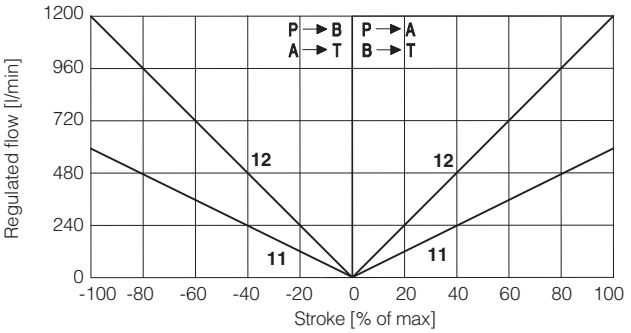
DPZO-2: **5A** = DL5 (P → A, A → T) **6** = T5
5B = DL5 (P → B, B → T)



DPZO-4: **7** = L5 **8A** = DL5 (P → A, A → T)
8B = DL5 (P → B, B → T)

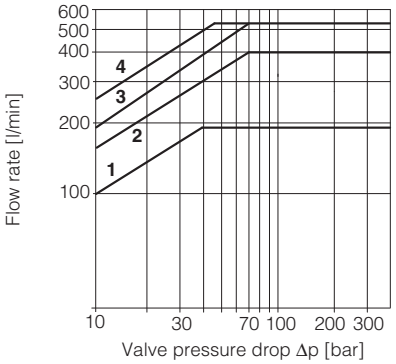


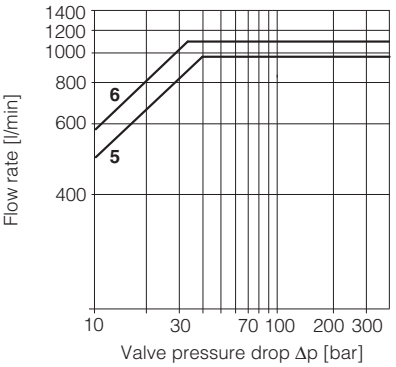
DPZO-4M: **9** = L5 **10A** = DL5 (P → A, A → T)
10B = DL5 (P → B, B → T)

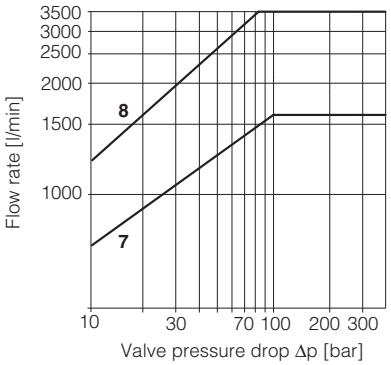


DPZO-6: **11** = L5
DPZO-8: **12** = L5

12.2 Flow /Δp diagram - stated at 100% of spool stroke







DPZO-1:
1 = spools L5, DL5

DPZO-2:
2 = spools L3
3 = spool T5
4 = spools L5, DL5

DPZO-4:
5 = spools L5, DL5

DPZO-4M:
6 = spools L5, DL5

DPZO-6:
7 = L5

DPZO-8:
8 = L5

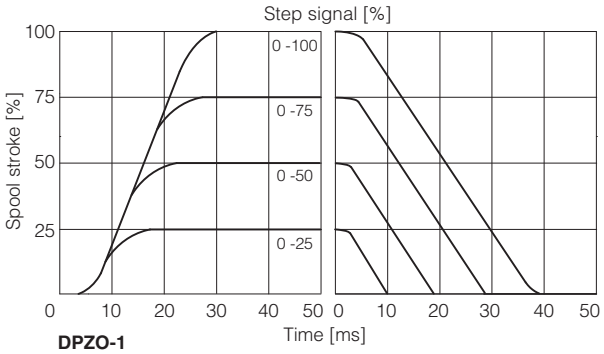
Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option /B)

Reference signal $\begin{matrix} 0 \div +10\ V \\ 12 \div 20\ mA \end{matrix}\Big\}$ P → A / B → T

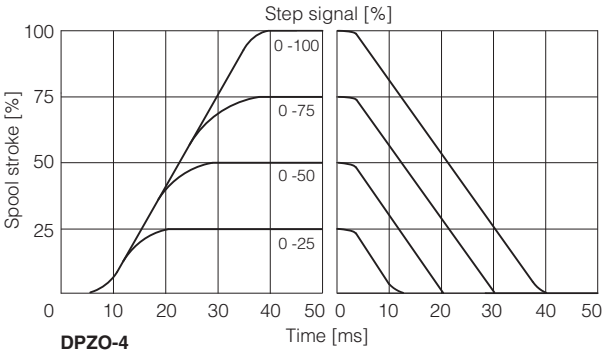
Reference signal $\begin{matrix} 0 \div -10\ V \\ 4 \div 12\ mA \end{matrix}\Big\}$ P → B / A → T

12.3 Response time

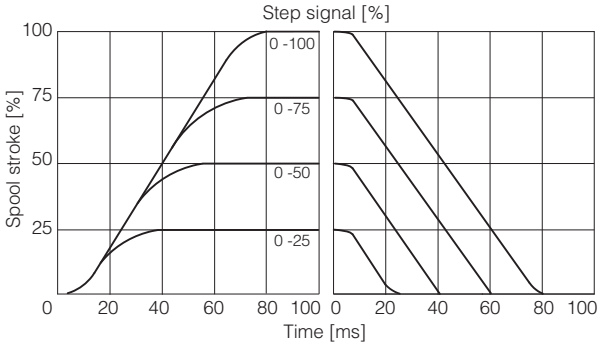
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



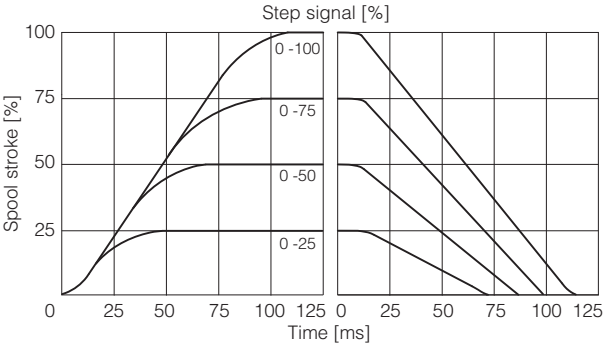
DPZO-1
DPZO-2



DPZO-4
DPZO-4M



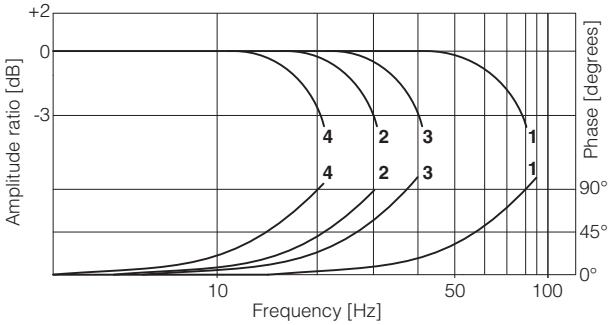
DPZO-6

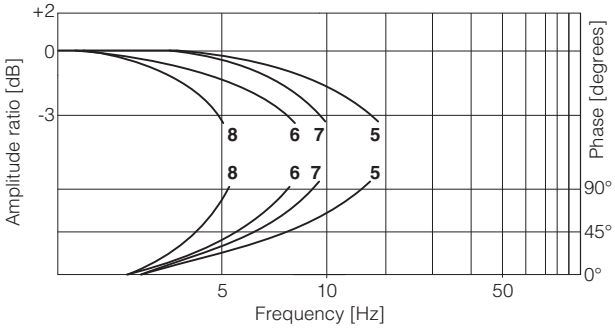


DPZO-8

12.4 Bode diagrams

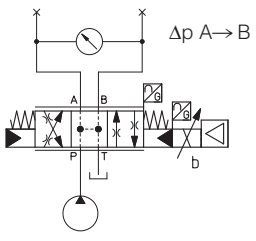
Stated at nominal hydraulic conditions.





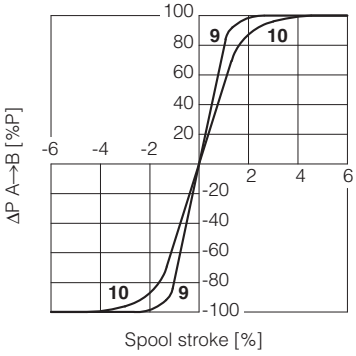
1 = DPZO-1, DPZO-2 } ± 5%
2 = DPZO-1, DPZO-2 } ± 100%
3 = DPZO-4, DPZO-4M } ± 5%
4 = DPZO-4, DPZO-4M } ± 100%
5 = DPZO-6 ± 5%
6 = DPZO-6 ± 100%
7 = DPZO-8 ± 5%
8 = DPZO-8 ± 100%

12.5 Pressure gain



9 = DPZO-1

10 = DPZO-2
DPZO-4
DPZO-4M
DPZO-6
DPZO-8



13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 12.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 21
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 21
The valve's standard configuration provides internal pilot and external drain.

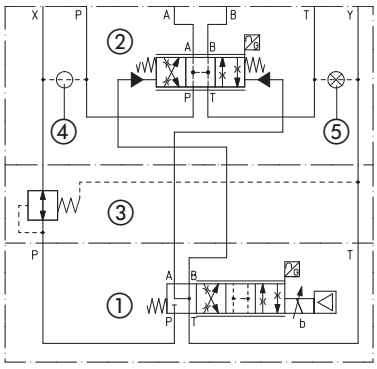
G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = **28 bar**

DPZO-1, DPZO-2, DPZO-4(M), DPZO-6 and DPZO-8 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 70



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 17.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **LEB** (see 17.8)
Power supply for driver's logics and communication - only for **LES** (see 17.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Hydraulic options:
all combination possible

Electronics options - Standard versions:

LEB-SN, **LES-SN**
/FI, /IQ, /IZ

LES-SP, SF, SL
/CI

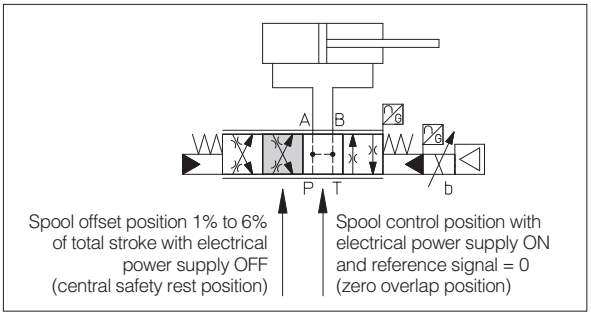
Electronics options - Safety certified versions:

LES-SN
/IU, /IK

LES-SP, SF, SL
/CU, /IU, /CIU, /CK, /IK, /CIK

16 SAFETY REST POSITION - configuration 70

In absence of electric power supply (+24 VDC), the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.
This is specifically designed to avoid that in case of accidental interruption of the electrical power supply to the valve, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.
The main spool moves to the closed loop control position (zero overlap) when the pilot pressure is activated, the valve is fed with power supply +24 VDC and reference input = 0V (or 12 mA for option /I) is applied to the driver.



17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option and **TES-SP, SF, SL** with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only for **TES-SP, SF, SL**

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Flow monitor output signal (Q_MONITOR) - not for **/F**

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for **TES-SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE) - not for standard and **/F**

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.8 Repeat enable output signal (R_ENABLE) - only for **TEB** with **/Z** option

Repeat enable is used as output repeater signal of enable input signal (see 17.7).

17.9 Fault output signal (FAULT) - not for standard and **/Q**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.10 Remote pressure/force transducer input signal - only for **TES-SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver (see 18.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

17.11 Multiple PID selection (D_IN0 and D_IN1) - only **NP** execution for **TES-SP, SF, SL**

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	SET 1	SET 2	SET 3	SET 4
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) **Standard**, **/Q** and **/F** options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

18.2 Main connector signals - 12 pin (A2) **/Z** option and **LES-SP, SF, SL**

PIN	LEB-SN /Z	LES-SN /Z	LES-SP, SF, SL Fieldbus	LES-SP, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communications connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

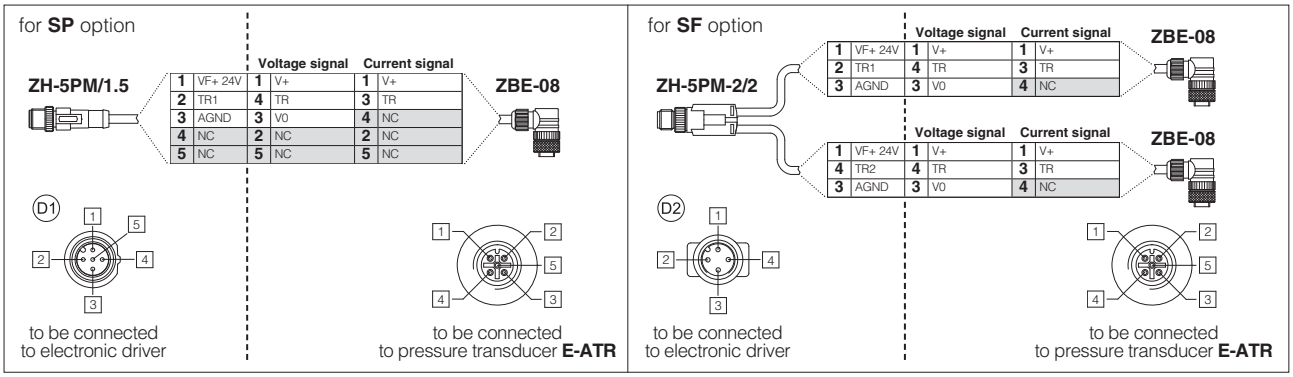
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.4 Remote pressure/force transducer connector - M12 - 5 pin - only for **SP, SF, SL** (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

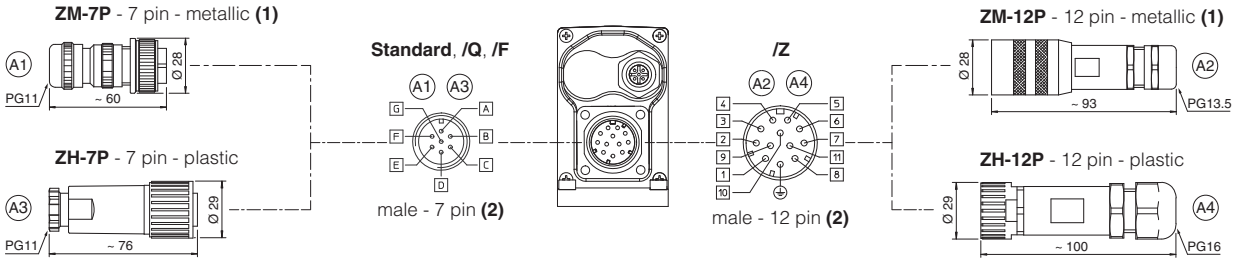
Remote pressure transducers connection - example



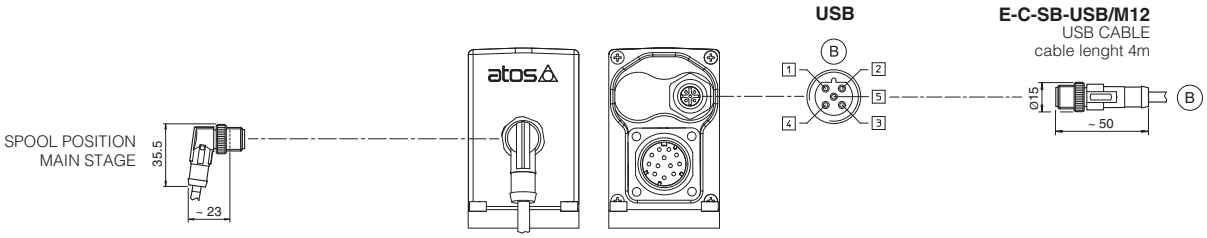
Note: pin layout always referred to driver's view

18.5 LEB connections layout

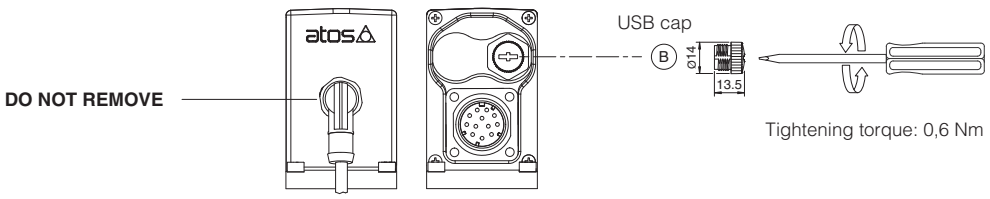
MAIN CONNECTORS



TRANSDUCER AND USB CONNECTOR

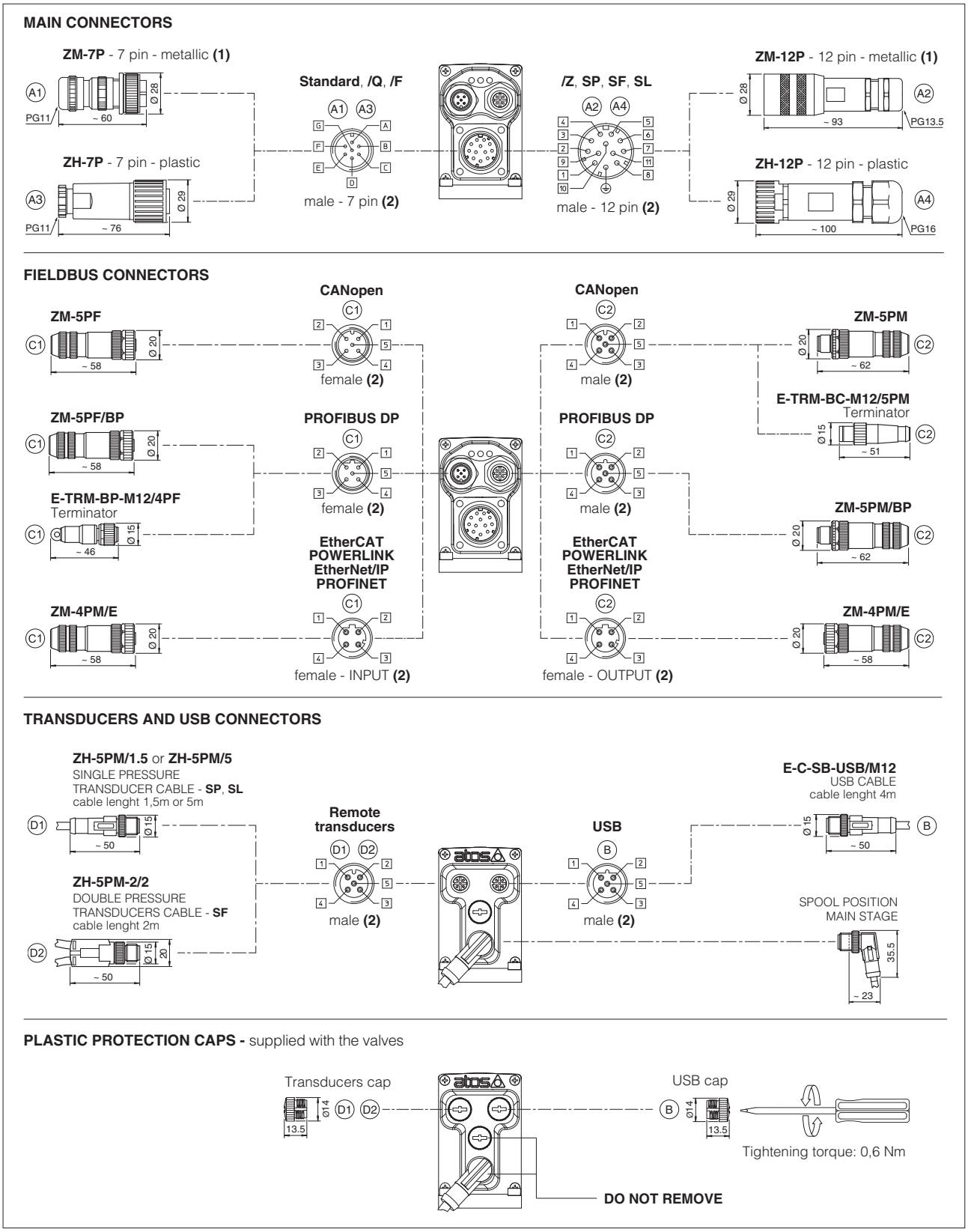


PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

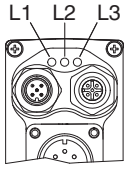
18.6 LES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 Diagnostic LEDs - only for **LES**

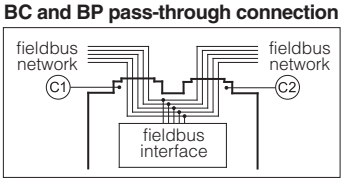
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

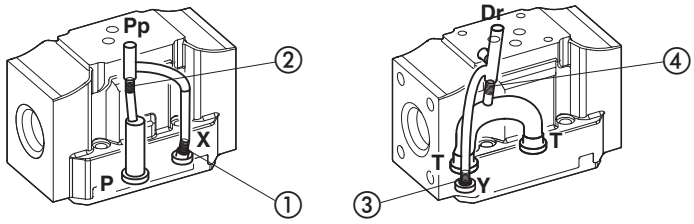
20.4 Pressure/Force transducer connectors - only for **SP, SF, SL**

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

21 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

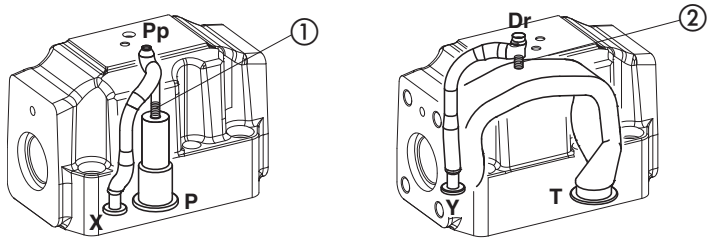
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain.

DPZO-1 **Pilot channels** **Drain channels**



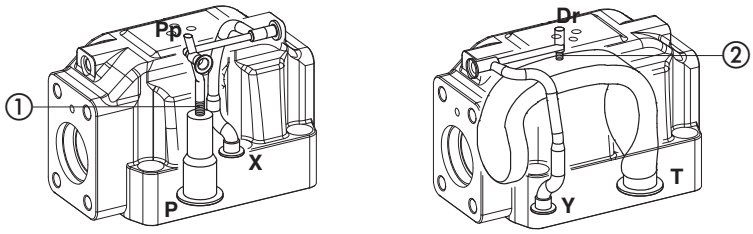
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels** **Drain channels**



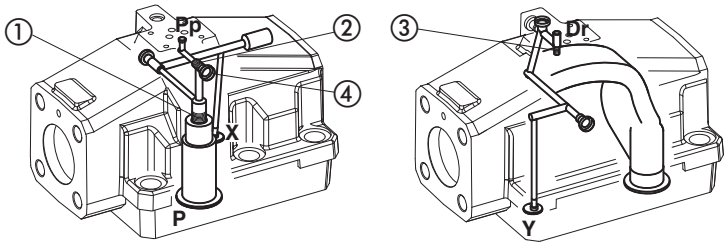
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels** **Drain channels**



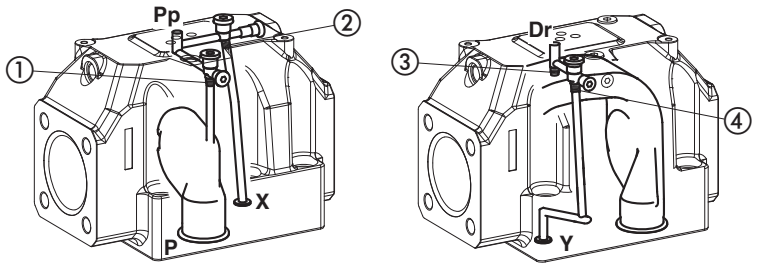
Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels** **Drain channels**



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-8 **Pilot channels** **Drain channels**



Internal piloting: Without plug ①;
External piloting: Add NPTF 1/8 in pos ①;
plug NPTF 1/8 in pos ②;
Internal drain: Without plug NPTF 1/8 in pos ③;
Add plug NPTF 1/8 in pos ④;
External drain: Add plug NPTF 1/8 in pos ③.

22 FASTENING BOLTS AND SEALS

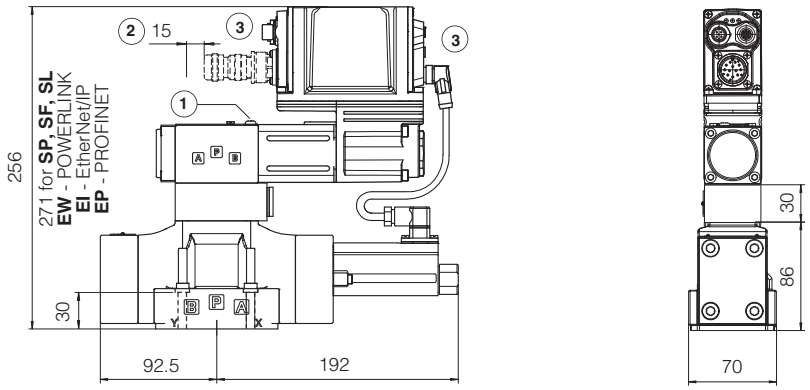
Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156; Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

23 INSTALLATION DIMENSIONS [mm]

DPZO-LEB-*-1
DPZO-LES-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-*-1	9,5



(1) = Air bleeding 3

(2) = Space to remove the connectors

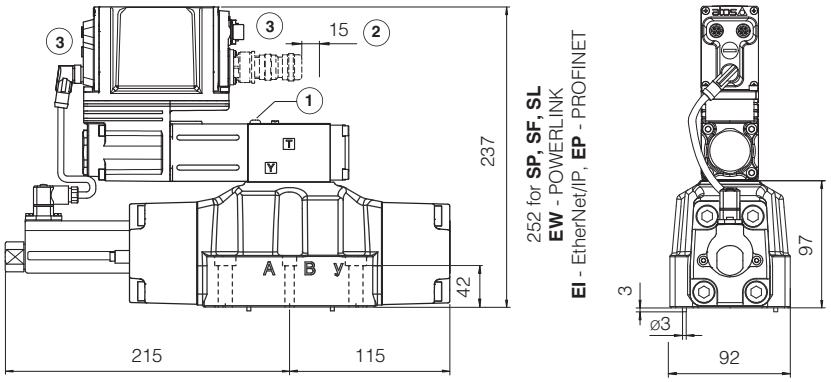
(3) = The dimensions of all connectors must be considered, see section 18.5 and 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

DPZO-LEB-*-2
DPZO-LES-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-*-2	14



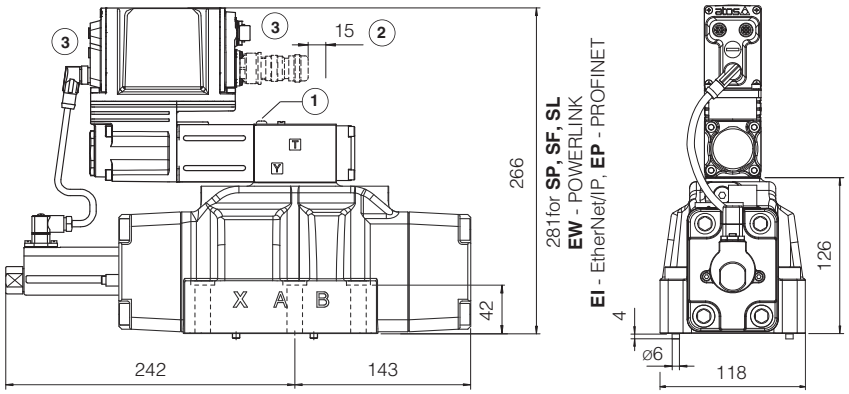
DPZO-LEB-*-4
DPZO-LES-*-4

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

DPZO-LEB-*-4M
DPZO-LES-*-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm

Mass [kg]	
DPZO-*-4	19



(1) = Air bleeding 3

(2) = Space to remove the connectors

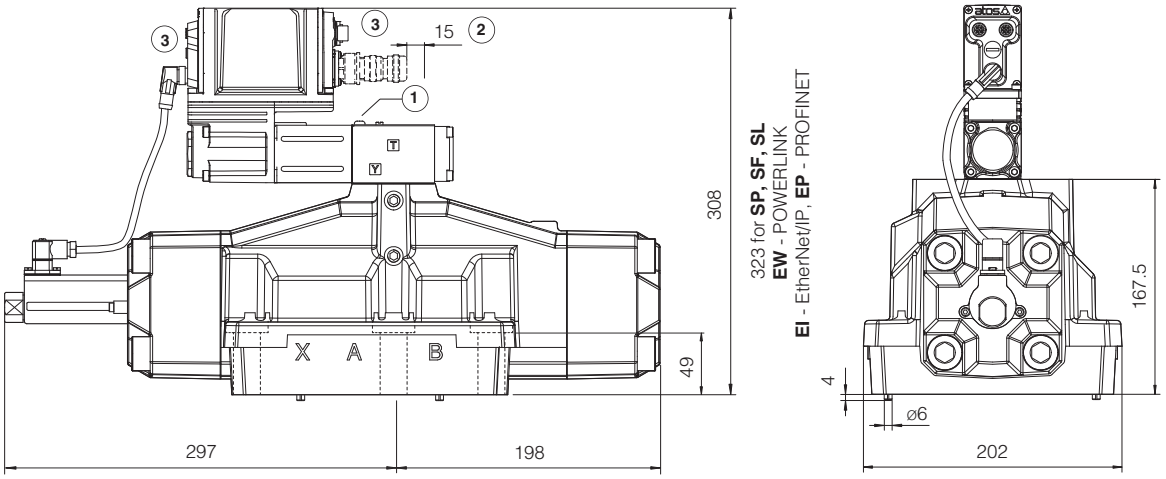
(3) = The dimensions of all connectors must be considered, see section 18.5 and 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

DPZO-LEB-*-6
DPZO-LES-*-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

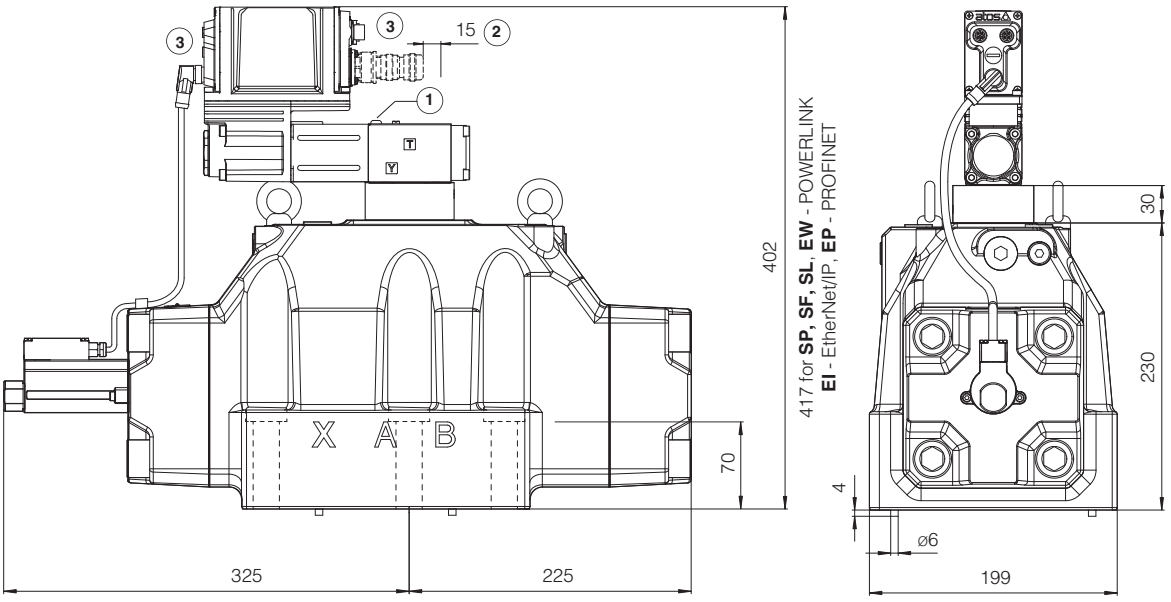
Mass [kg]	
DPZO-*-6	43



DPZO-LEB-*-8
DPZO-LES-*-8

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-8	80



(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 18.5 and 18.6

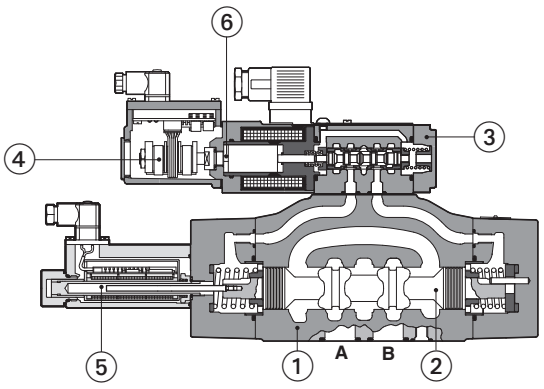
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS500	Digital proportional valves with P/Q control	**K800**	Electric and electronic connectors
FS630	Digital proportional valves with integral axis controller	**P005**	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	**QB320**	Quickstart for LEB valves commissioning
FY100	Safety proportional valves - option /U	**QF320**	Quickstart for LES valves commissioning
FY200	Safety proportional valves - option /K	**Y010**	Basics for safety components
GS500	Programming tools		

Servoproportional directional valves

piloted, with two LVDT transducers and zero spool overlap



DPZO-L-270

① Valve body
② Main stage Spool
③ Pilot valve
④ Pilot valve LVDT transducer
⑤ Main stage LVDT transducer
⑥ Pilot valve solenoid

DPZO-L

Servoproportional directional valves, piloted, with two LVDT position transducer and zero spool overlap for position closed loop controls.

The valves operate in association with digital off-board divers or axis card, see section 2.

The two LVDT transducers (pilot and main stage) grant very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, full open position of the main stage spool is performed by configuration 60 or central position is performed by configuration 70, see section 10.

Spools regulation characteristics:
L = linear
DL = differential-linear, for control of actuators with area ratio 1:2
T = non linear, for fine low flow control

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

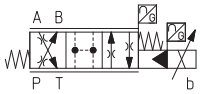
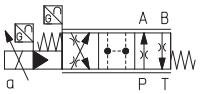
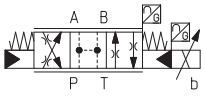
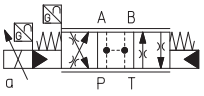
DPZO	-	L	-	2	70	-	L	5	/	*	*	/	*

DPZO: Servoproportional directional valve, piloted

L = two LVDT transducers

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32

Configuration:

	Standard	Option **/B**
60 =		
70 =		

Spool type, regulating characteristics:

L =  linear

DL =  differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

T =  non linear **(2)**

Seals material, see section 6:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Spool size:	**3** (L)	**5** (L,DL)	**5** (L)	**5** (T)
DPZO-1 =	-	100	-	-
DPZO-2 =	160	250	-	190
DPZO-4 =	-	480	-	-
DPZO-4M =	-	550	-	-
DPZO-6 =	-	-	640	-

Nominal flow (l/min) at Δp 10bar P-T

(1) All combination possible
(2) Only for DPZO-L-270

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LEB	E-BM-LID	E-BM-LES	Z-BM-LEZ
Type	Digital	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS235	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DPZO-L-1**	**DPZO-L-2**			**DPZO-L-4**	**DPZO-L-4M**	**DPZO-L-6**
Pressure limits [bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;						
Spool type	**L5, DL5**	**L3**	**L5, DL5**	**T5**	**L5, DL5**		**L5**
Nominal flow Δp P-T [l/min] **(1)**							
Δp= 10 bar	100	160	250	190	480	550	640
Δp= 30 bar	160	270	430	330	830	950	1100
Max permissible flow [l/min]	180	400	550	550	1000	1100	1600
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)						
Piloting volume [cm³/min]	1,4	3,7			9	11,3	21,6
Piloting flow **(2)** [l/min]	3,5	9			18	20	19
Leakage **(3)** Pilot [cm³/min]	100 / 300	150 / 450			200 / 600	200 / 600	900 / 2800
Main stage [l/min]	0,4 / 1,2	0,6 / 2,5			1,0 / 4,0	1,0 / 4,0	3,0 / 9,0
Response time **(4)** [ms]	≤ 25	≤ 25			≤ 30	≤ 35	≤ 80
Hysteresis	≤ 0,1 [%of max regulation]						
Repeatability	± 0,1 [%of max regulation]						
Thermal drift	zero point displacement < 1% at ΔT = 40°C						

(1) For different Δp, the max flow is in accordance to the diagrams in section 7.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal, see detailed diagrams in section 7.3

5 ELECTRICAL CHARACTERISTICS

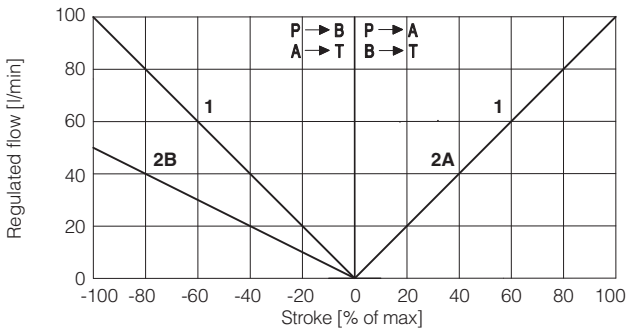
Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

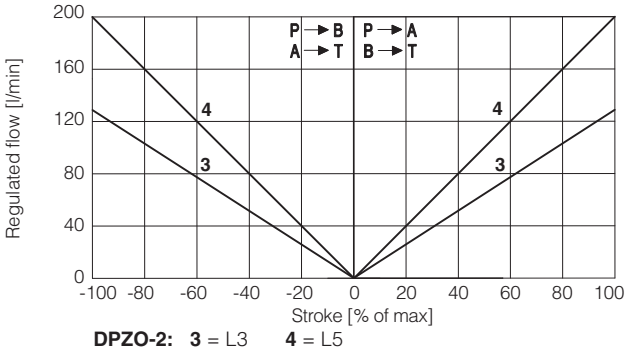
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

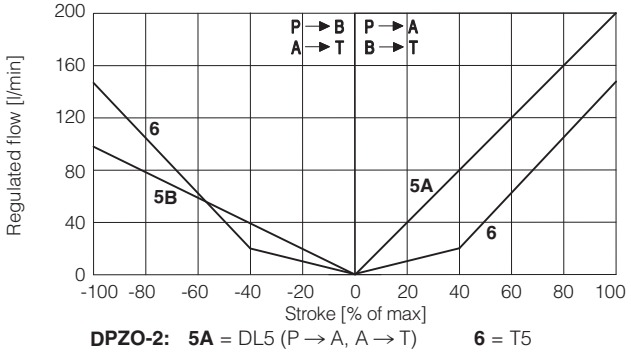
7.1 Regulation diagrams (values measure at Δp 10 bar P-T)



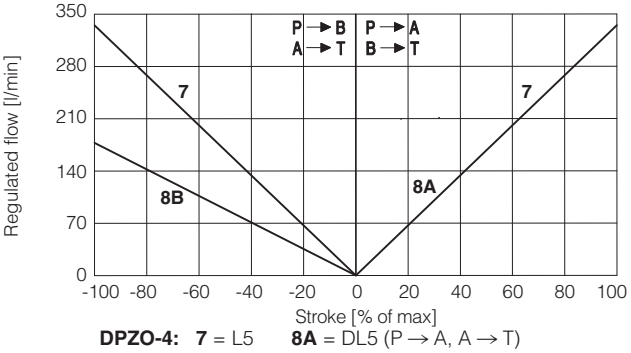
DPZO-1: **1** = L5 **2A** = DL5 (P → A, A → T)
2B = DL5 (P → B, B → T)



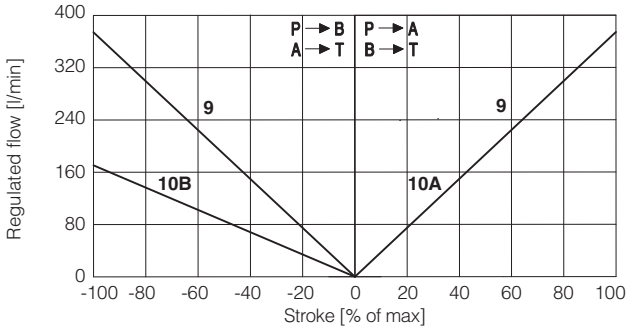
DPZO-2: **3** = L3 **4** = L5



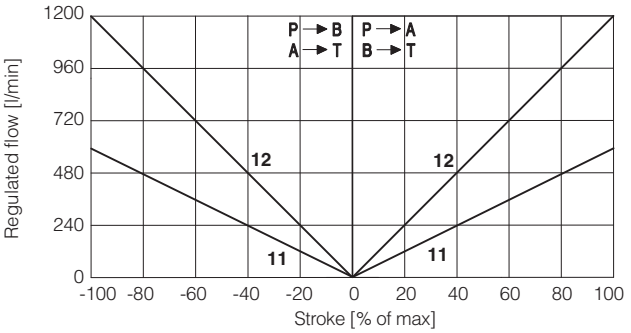
DPZO-2: **5A** = DL5 (P → A, A → T) **6** = T5
5B = DL5 (P → B, B → T)



DPZO-4: **7** = L5 **8A** = DL5 (P → A, A → T)
8B = DL5 (P → B, B → T)

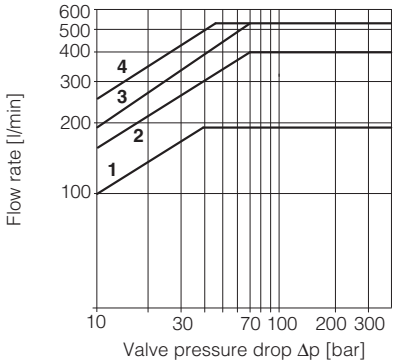


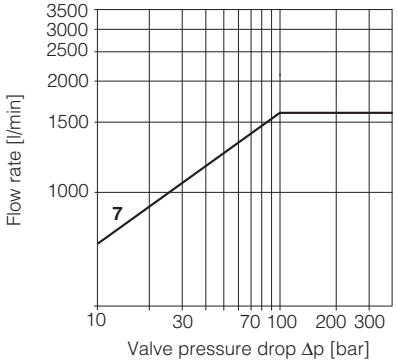
DPZO-4M: **9** = L5 **10A** = DL5 (P → A, A → T)
10B = DL5 (P → B, B → T)

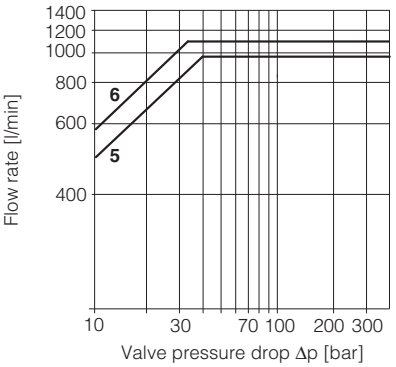


DPZO-6: **11** = L5
DPZO-8: **12** = L5

7.2 Flow /Δp diagram - stated at 100% of spool stroke







DPZO-1:
1 = spools L5, DL5

DPZO-2:
2 = spools L3
3 = spool T5
4 = spools L5, DL5

DPZO-4:
5 = spools L5, DL5

DPZO-4M:
6 = spools L5, DL5

DPZO-6:
7 = L5

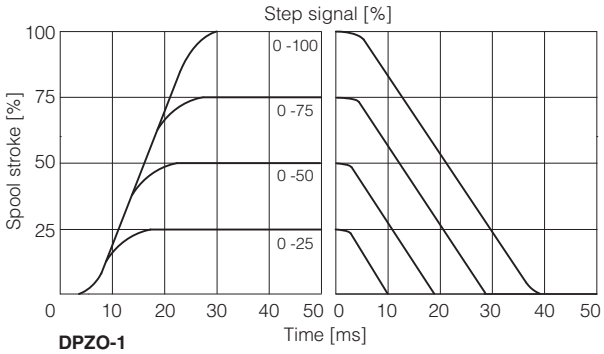
Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option /B)

Reference signal $\begin{matrix}0 \div +10\ V \\ 12 \div 20\ mA\end{matrix}\Big\}$ P → A / B → T

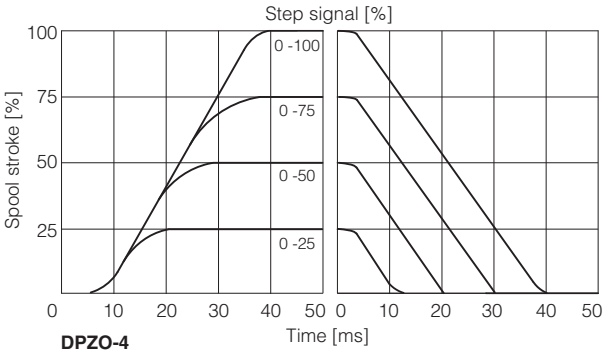
Reference signal $\begin{matrix}0 \div -10\ V \\ 4 \div 12\ mA\end{matrix}\Big\}$ P → B / A → T

7.3 Response time

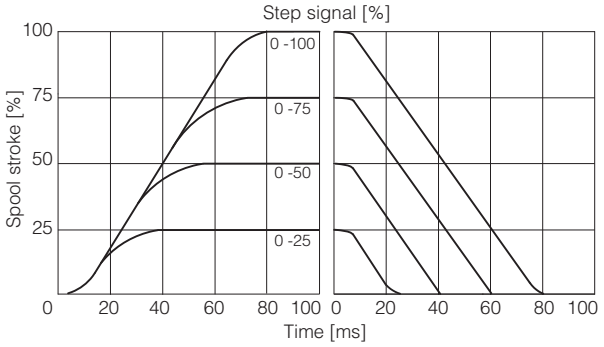
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



DPZO-1
DPZO-2



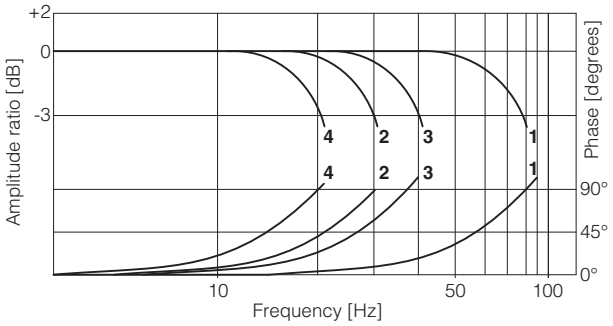
DPZO-4
DPZO-4M

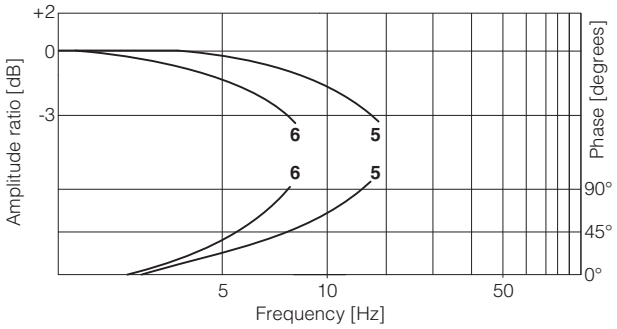


DPZO-6

7.4 Bode diagrams

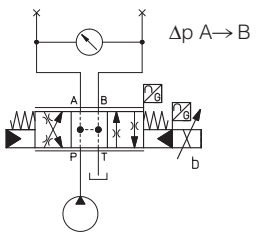
Stated at nominal hydraulic conditions.





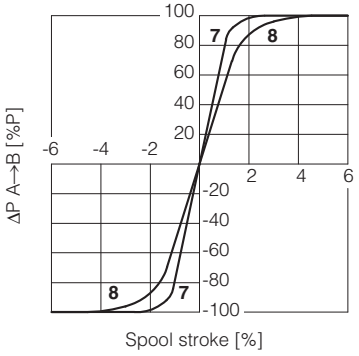
1 = DPZO-1 / DPZO-2 } ± 5%
2 = DPZO-1 / DPZO-2 } ± 100%
3 = DPZO-4 / DPZO-4M } ± 5%
4 = DPZO-4 / DPZO-4M } ± 100%
5 = DPZO-6 ± 5%
6 = DPZO-6 ± 100%

7.5 Pressure gain



7 = DPZO-1

8 = DPZO-2
DPZO-4
DPZO-4M
DPZO-6



8 HYDRAULIC OPTIONS

B = Solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 7.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.

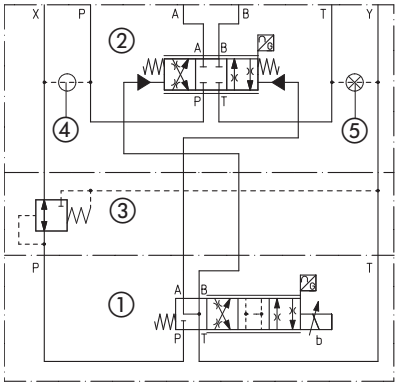
G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = **28 bar**

DPZO-1, DPZO-2, DPZO-4(M) and DPZO-6 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

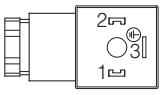
Functional Scheme - example of configuration 70



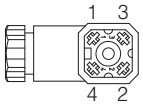
① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

9 ELECTRICAL CONNECTION

9.1 Solenoid connector - supplied with the valve

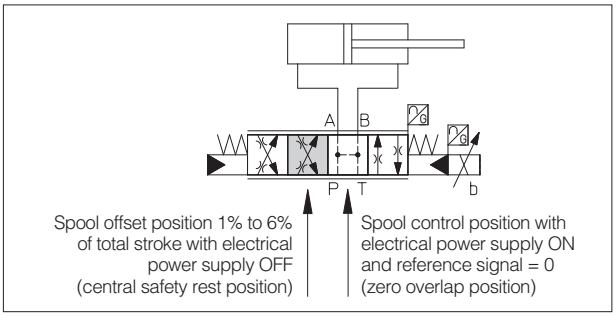
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

9.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

10 SAFETY REST POSITION - configuration 70

In absence of power supply to the solenoids, the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration. This is specifically designed to avoid that in case of accidental interruption of power supply to the valve solenoids, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



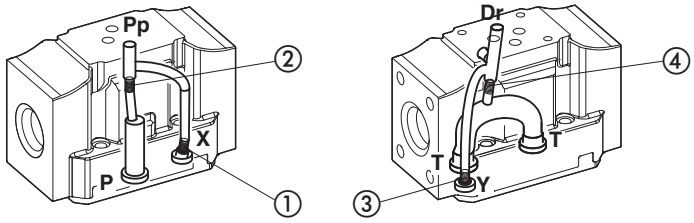
11 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

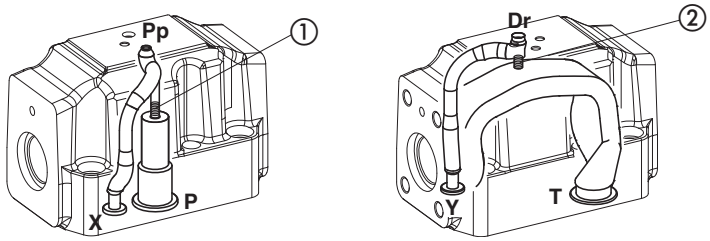
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain.

DPZO-1 **Pilot channels** **Drain channels**



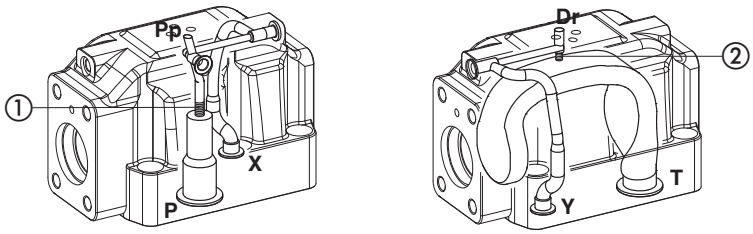
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels** **Drain channels**



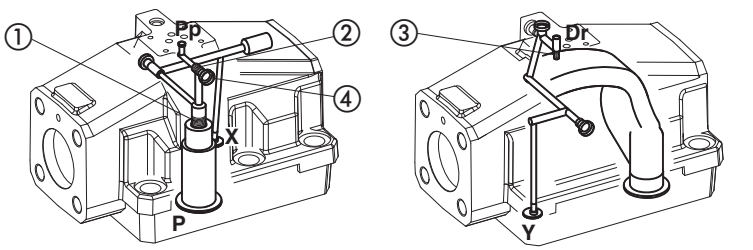
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels** **Drain channels**



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels** **Drain channels**

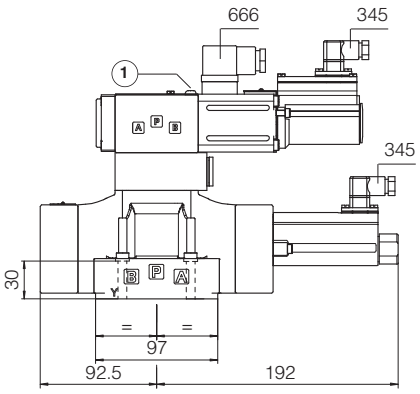


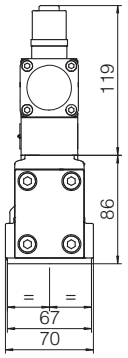
Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-L-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-L-1	9



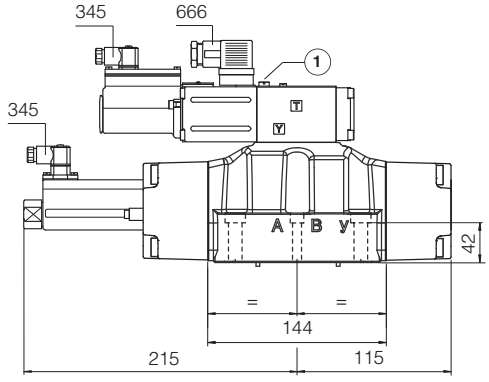


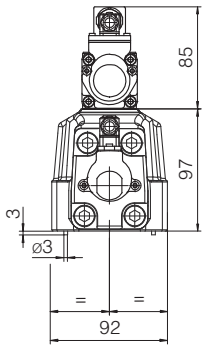
(1) = Air bleeding 3

DPZO-L-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-L-2	13,5





(1) = Air bleeding 3

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

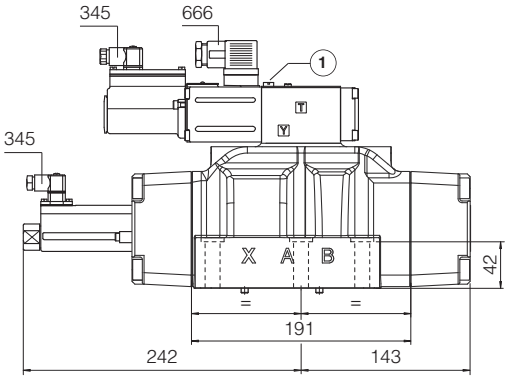
DPZO-L-4

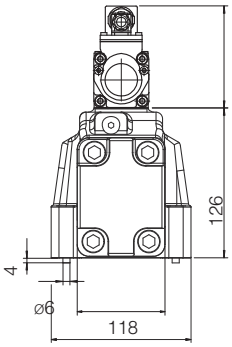
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

Mass [kg]	
DPZO-L-4*	17,5

DPZO-L-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm



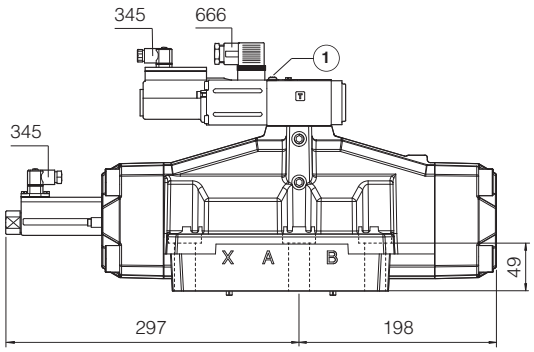


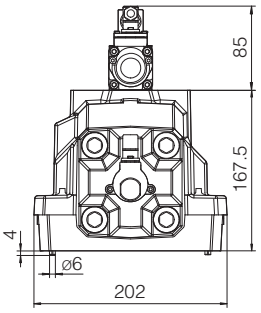
(1) = Air bleeding 3

DPZO-L-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-L-6	42,5





(1) = Air bleeding 3

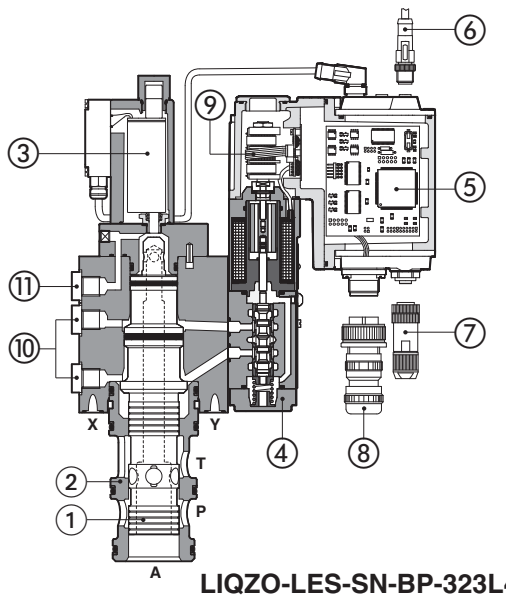
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS330**	Z-BM-LEZ digital axis card
FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
GS230	E-BM-LEB digital driver	**GS510**	Fieldbus
GS235	E-BM-LID digital driver	**K800**	Electric and electronic connectors
GS240	E-BM-LES digital driver	**P005**	Mounting surfaces for electrohydraulic valves

Digital servoproportional 3-way cartridges

piloted, with on-board driver and two LVDT transducers



① zMain spool
② Sleeve
③ Main stage LVDT transducer
④ Pilot valve
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector
⑨ Pilot valve LVDT transducer
⑩ Air bleeding
⑪ Air suction port

LIQZO-LES-SN-BP-323L4/A

LIQZO-LEB, LIQZP-LEB
LIQZO-LES, LIQZP-LES

Digital servoproportional 3-way cartridges specifically designed for high speed closed loop controls. They are equipped with two LVDT position transducers for best dynamics in directional controls and not compensated flow regulations. The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

LEB basic execution with analog reference signal and USB port for software functional parameters setting.

LES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

LIQZO: Size: **25** ÷ **40**
Max flow: **500** ÷ **1050 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50** ÷ **80**
Max flow: **2000** ÷ **5000 l/min**
Max pressure: **420 bar**

1 **MODEL CODE**

LIQZO	-	**LES**	-	**SN**	-	**NP**	-	**25**	**3**	**L4**	/	*	*	/	*

Servoproportional 3-way cartridge, piloted
LIQZO = size 25 to 40, Pmax 350 bar
LIQZP = size 50 to 80, Pmax 420 bar

LEB = basic on-board digital driver **(1)**
LES = full on-board digital driver

Alternated P/Q controls:
SN = none
SP = pressure control (1 pressure transducer)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size, see section 7 :

LIQZO =	**25**	**32**	**40**
l/min	185	330	420
LIQZP =	**50**	**63**	**80**
l/min	780	1250	2100

Nominal flow (l/min) at Δp 5 bar

Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

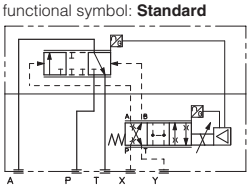
Hydraulic options (2):
A = reversal hydraulic configuration of main spool: P-A in rest position

Electronic options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **LES-SP, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

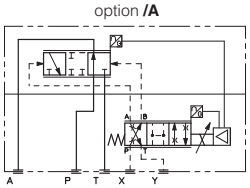
Spool type
regulating characteristics:
L4 = linear

Configuration: **3** = 3 way

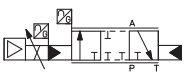
functional symbol: **Standard**



option **/A**



simplified symbol: **Standard**



option **/A**

(1) Only in version **SN-NP**

(2) For possible combined options, see section 13

(3) Double power supply only for **LES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage.
In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z).
A safety fuse 2,5 A installed on 24VDC power supply of each valve is always recommended, see also power supply note at sections 15 .

WARNING

The loss of the pilot pressure causes the undefined position of the main spool.
The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A).
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

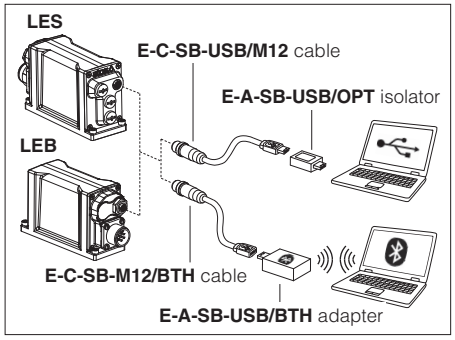
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for **LES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for **LES**, see tech. table **FS500**

S* options add the closed loop control of pressure (**SP**) or force (**SL**) to the basic functions of proportional directional valves flow regulation.
A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP or 1 load cell for SL).
The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size		25	32	40	50	63	80
Nominal flow Δp P-A or A-T	[l/min]						
	Δp = 5 bar	185	330	420	780	1250	2100
	Δp = 10 bar	260	470	590	1100	1750	3000
	Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]	**LIQZO**	Ports P, A, T = **350** X = 350 Y ≤ 10					
	LIQZP	Ports P, A, T = **420** X = 350 Y ≤ 10					
Nominal flow of pilot valve at Δp = 70 bar [l/min]		4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar [l/min]		0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure [bar]		min: 40% of system pressure max 350 recommended 140 ÷ 160					
Piloting volume [cm³]		2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow **(1)** [l/min]		6,5	20	25	43	68	76
Response time 0 ÷ 100% step signal **(2)** [ms]		21	22	22	25	30	34
Hysteresis [% of the max regulation]		≤ 0,1					
Repeatability [% of the max regulation]		± 0,1					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) With step reference input 0÷100%
(2) With pilot pressure = 140 bar, see datailed diagrams in section 10.2

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

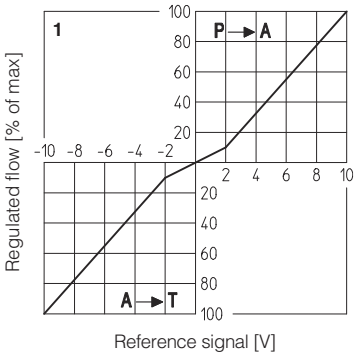
10 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

10.1 Regulation diagrams, see note

1 = LIQZO, LIQZP (all sizes)

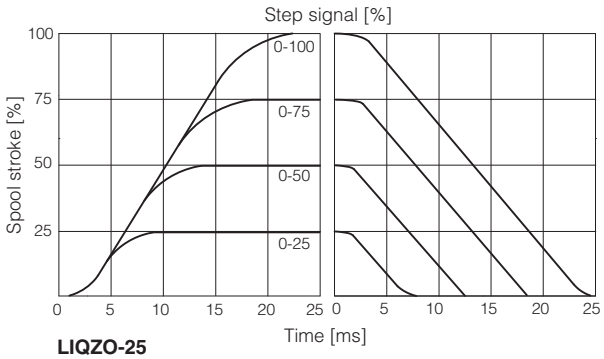
Hydraulic configuration vs. reference signal:

		standard	option /A
Reference signal	0 ÷+10 V 12÷20 mA	P → A	A → T
Reference signal	0 ÷-10 V 4÷12 mA	A → T	P → A

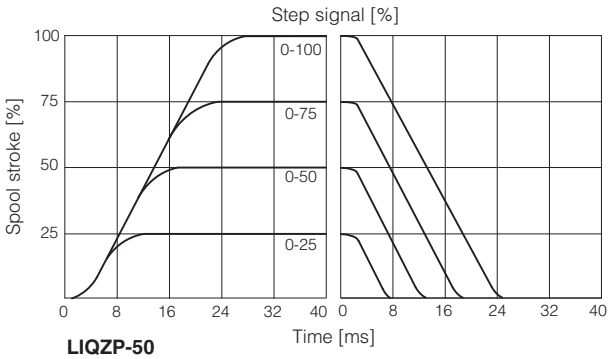


10.2 Response time

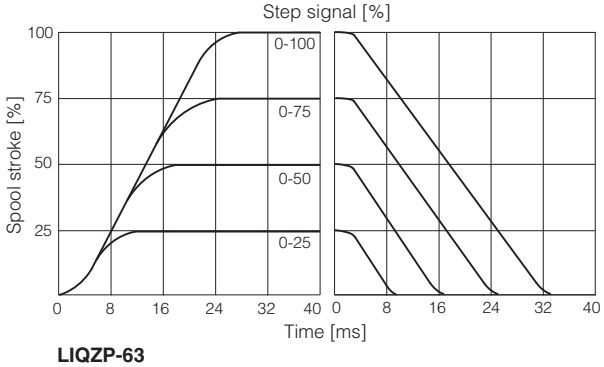
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



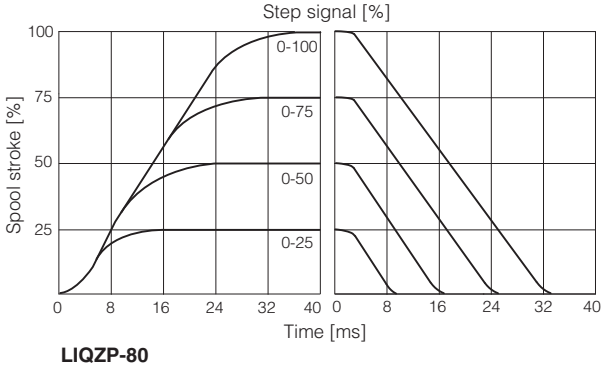
LIQZO-25
LIQZO-32
LIQZO-40



LIQZP-50

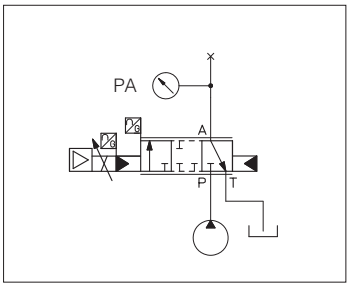


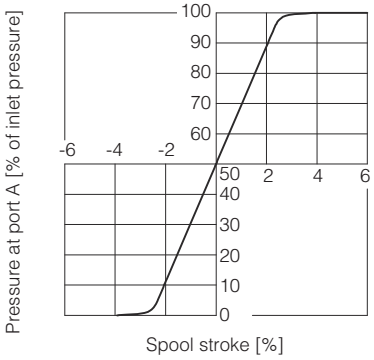
LIQZP-63



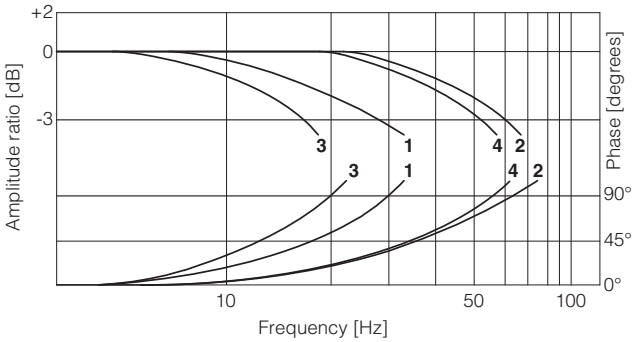
LIQZP-80

10.3 Pressure gain diagram

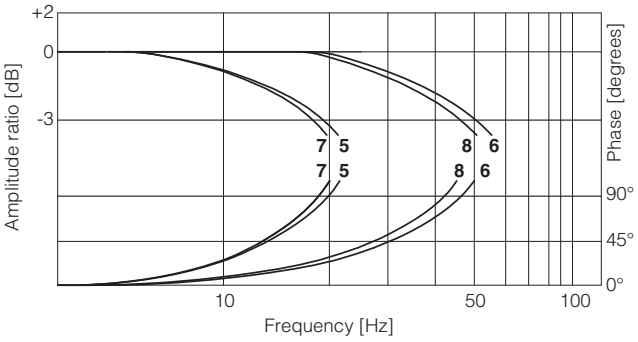




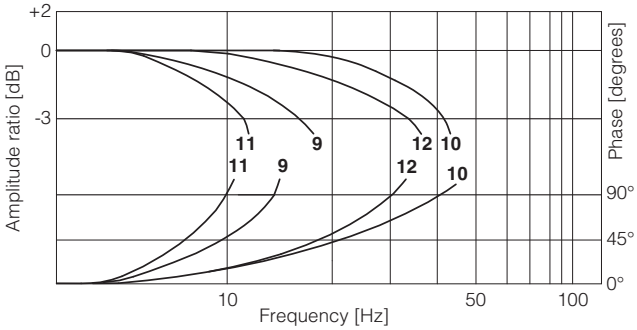
10.4 Bode diagrams



1 = LIQZO-L*-253L4: ± 90%
2 = LIQZO-L*-253L4: ± 5%
3 = LIQZO-L*-323L4: ± 90%
4 = LIQZO-L*-323L4: ± 5%



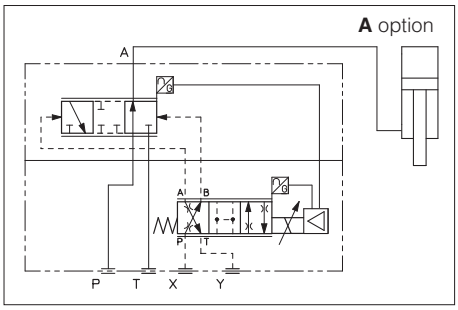
5 = LIQZO-L*-403L4: ± 90%
6 = LIQZO-L*-403L4: ± 5%
7 = LIQZP-L*-503L4: ± 90%
8 = LIQZP-L*-503L4: ± 5%



9 = LIQZP-L*-633L4: ± 90%
10 = LIQZP-L*-633L4: ± 5%
11 = LIQZP-L*-803L4: ± 90%
12 = LIQZP-L*-803L4: ± 5%

11 HYDRAULIC OPTIONS

A = The standard valve version provides the hydraulic configuration A-T of main spool in absence of electric power supply to the valve.
The option /A provides the reverse configuration P-A of main spool in absence of electric power supply to the valve.
This execution is particularly requested in vertical presses for safety reasons, because in case of electric power breakdown the P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.



12 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 13.7 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 13.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **LEB** (see 13.6)
Power supply for driver's logics and communication - only for **LES** (see 13.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

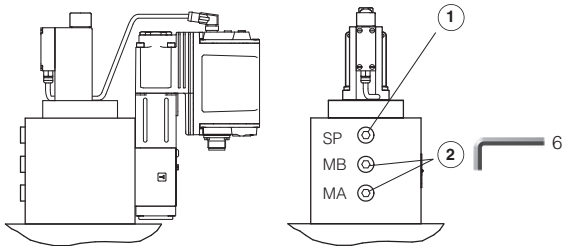
13 POSSIBLE COMBINED OPTIONS

LEB-SN, **LES-SN**
/AF, /AI, /AQ, /AZ, /FI, /IQ, /IZ, /AFI, /AIQ, /AIZ

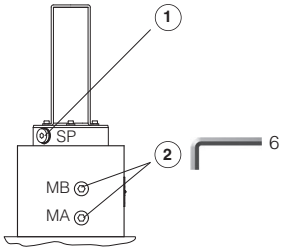
LES-SP, SL
/AC, /CI, /ACI

14 AIR BLEEDING

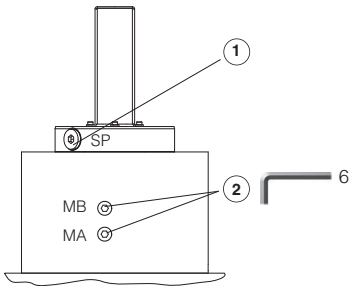
Size 25 to 40



Size 50



Sizes 63 to 80



(1) **Plugged port - do not open**

(2) **Air bleeding:**
N° 2 plugs G1/4"
At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.
Operate the valve for few seconds at low pressure and then lock the plugs.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option and **LES-SP, SL** with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Pressure or force reference input signal (F_INPUT+) - only for **LES-SP, SL**

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.5 Flow monitor output signal (Q_MONITOR) - not for **/F**

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

15.6 Pressure or force monitor output signal (F_MONITOR) - only for **LES-SP, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

15.7 Enable input signal (ENABLE) - not for standard and **/F**

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.8 Repeat enable output signal (R_ENABLE) - only for **LEB** with **/Z** option

Repeat enable is used as output repeater signal of enable input signal (see 15.7).

15.9 Fault output signal (FAULT) - not for standard and **/Q**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

15.10 Remote pressure/force transducer input signal - only for **LES-SP, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver (see 16.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

15.11 Multiple PID selection (D_IN0 and D_IN1) - only **NP** execution for **LES-SP, SL**

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	SET 1	SET 2	SET 3	SET 4
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

16 ELECTRONIC CONNECTIONS AND LEDS

16.1 Main connector signals - 7 pin - standard, **/F** and **/Q** options (A1)

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

16.2 Main connector signals - 12 pin - **/Z** option and **SP, SL** (A2)

PIN	LEB-SN /Z	LES-SN /Z	LES-SP, SL Fieldbus	LES-SP, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

16.3 Communications connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

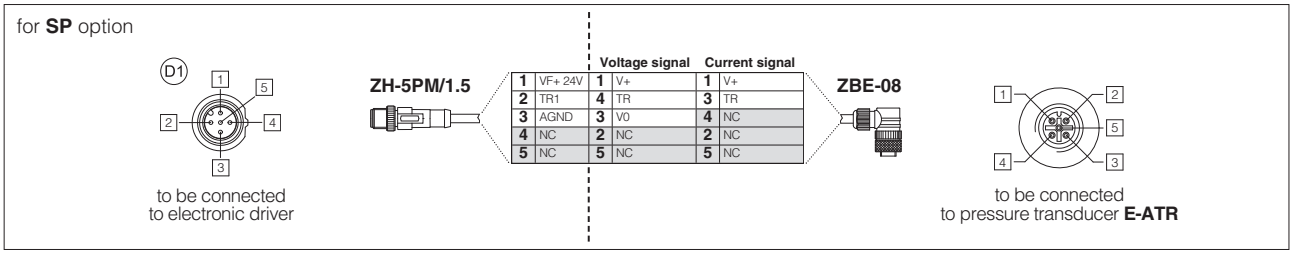
(2) Pin 2 can be fed with external +5V supply of CAN interface

16.4 Remote pressure transducer connector - M12 - 5 pin - only for **SP, SL** (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Connect	Connect
2	**TR**	Signal transducer ±10 VDC / ±20 mA maximum range, software selectable Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option	Connect	Connect
3	**AGND**	Common GND for transducer power and signals	Connect	/
4	**NC**	Not Connect	/	/
5	**NC**	Not Connect	/	/

(1) Single/double transducer configuration is software selectable

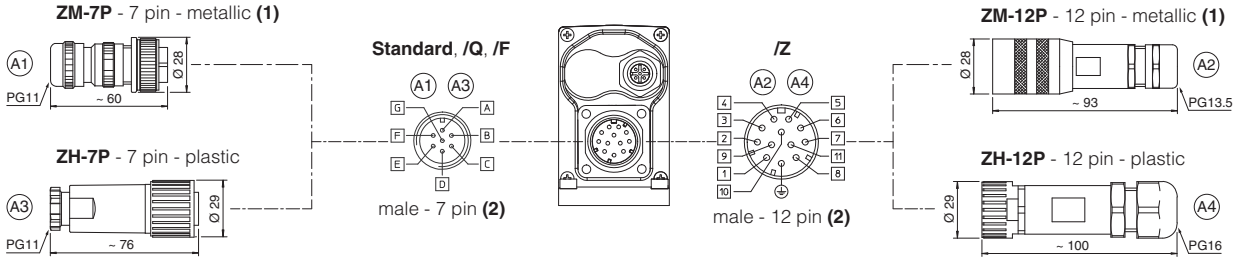
Remote pressure transducers connection - example



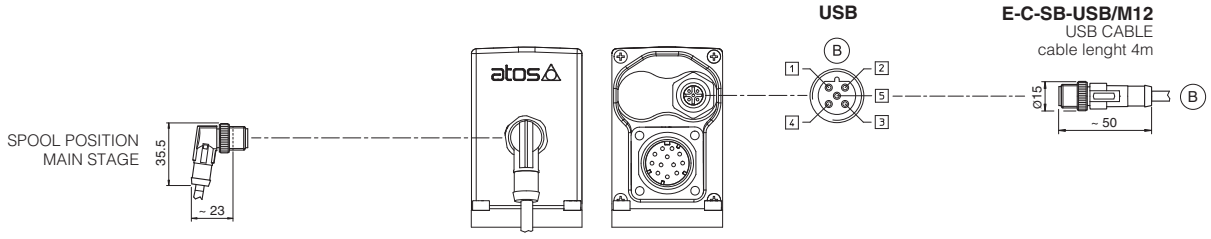
Note: pin layout always referred to driver's view

16.5 LEB connections layout

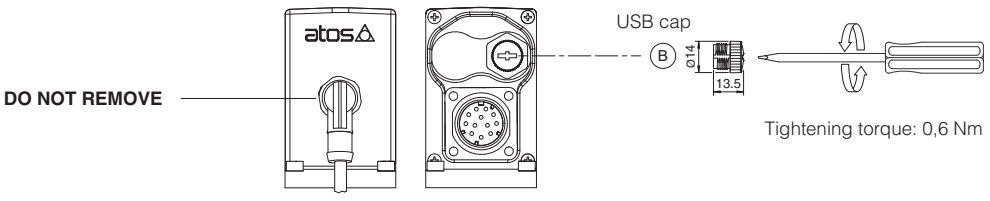
MAIN CONNECTORS



TRANSDUCER AND USB CONNECTOR

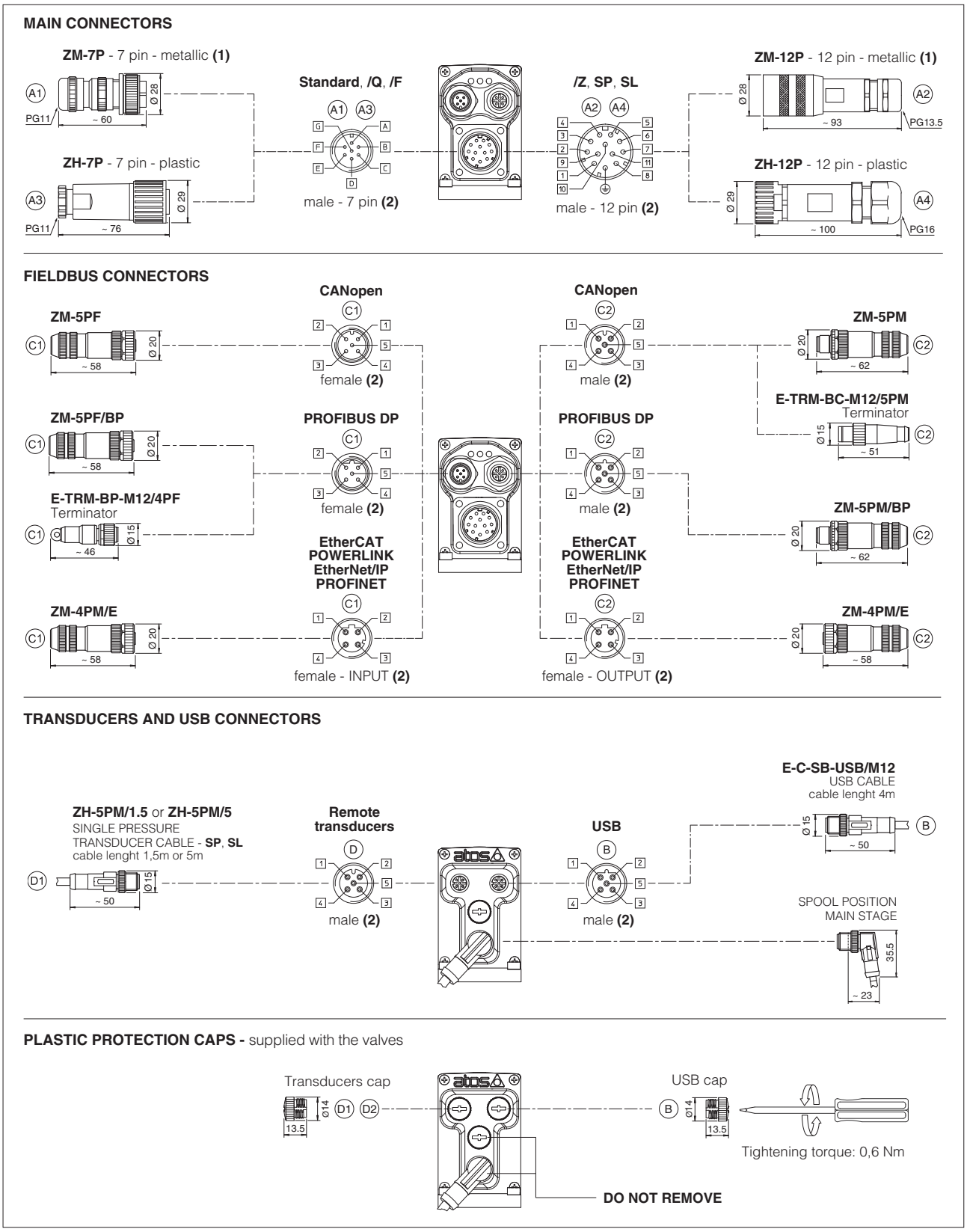


PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

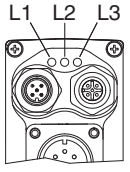
16.6 LES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

16.7 Diagnostic LEDs - only for **LES**

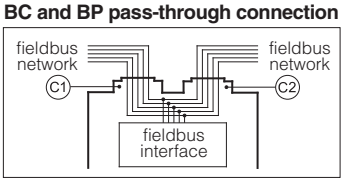
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

17 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

18.4 Pressure/Force transducer connectors - only for **SP, SL**

CONNECTOR TYPE	SP, SL - Single transducer	
CODE	(D) ZH-5PM/1.5	(D) ZH-5PM/5
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm²	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

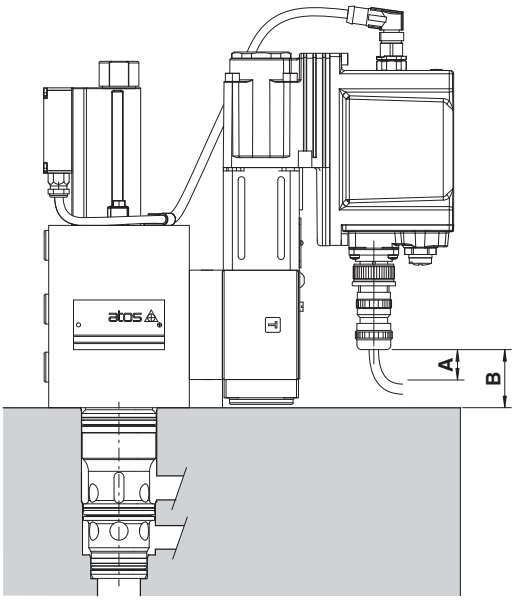
19 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	11,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	17,3
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	24,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	72,2

(1) Fastening bolts supplied with the valve

20 MAIN CONNECTORS INSTALLATION DIMENSIONS

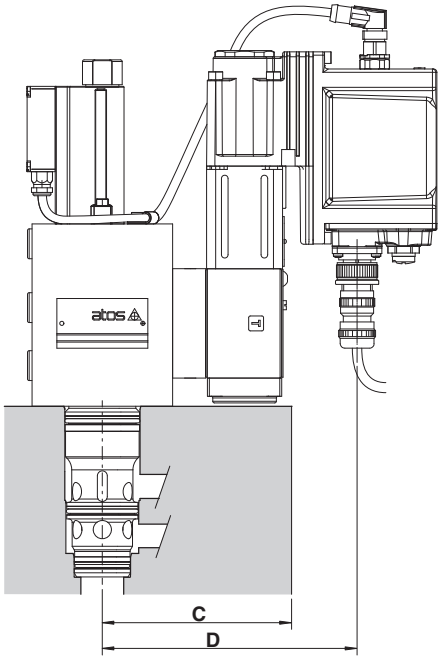
Installation 1 - possible interference between manifold and main connector



A = 15 mm space to remove the 7 or 12 pin main connectors

B = Clearance between main connector to valve's mounting surface. See the below table to verify eventual interferences, depending to the valve size and connector type

Installation 2 - no interference



C = Max manifold dimension to avoid interference with the main connector, see below table

Reference dimension	Main connector code	Valve size					
		25	32	40	50	63	80
B	ZM-7P	32	32	32	45	68	68
	ZH-7P	**(1)**	**(1)**	**(1)**	29	52	52
	ZM-12P	**(1)**	**(1)**	**(1)**	**(1)**	35	35
	ZH-12P	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(2)**
C (max) for **standard valve**	-	134	141	154	161	192	222
C (max) for **/A option**	-	114	121	134	141	172	202
D for **standard valve**	-	154	161	174	181	212	242
D for **/A option**	-	134	141	154	161	192	222

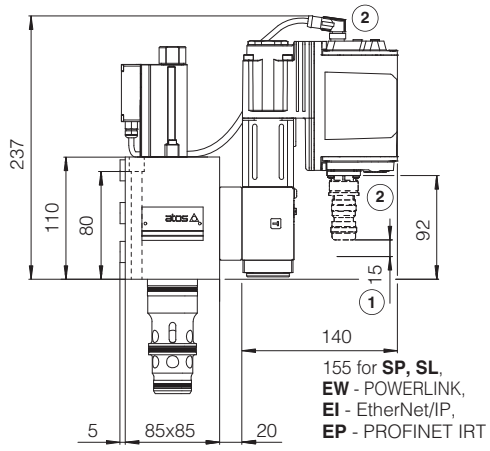
Above dimenions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered

(1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as rapresented in above "Installation 2"

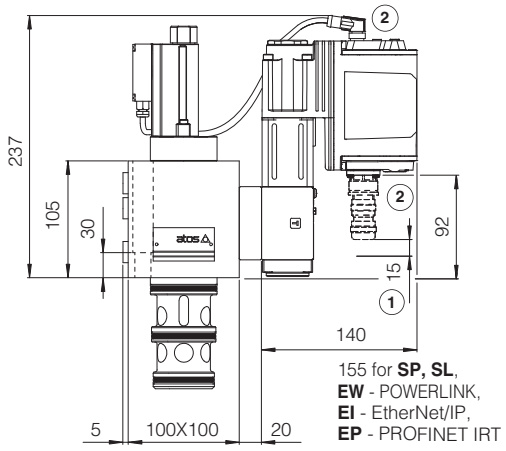
(2) The connector installation may be critic, depending to the cable size and bending radius

21 INSTALLATION DIMENSIONS [mm]

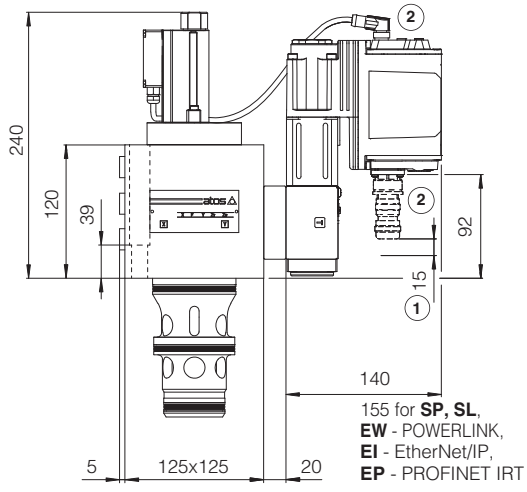
LIQZO-LEB-253
LIQZO-LES-253



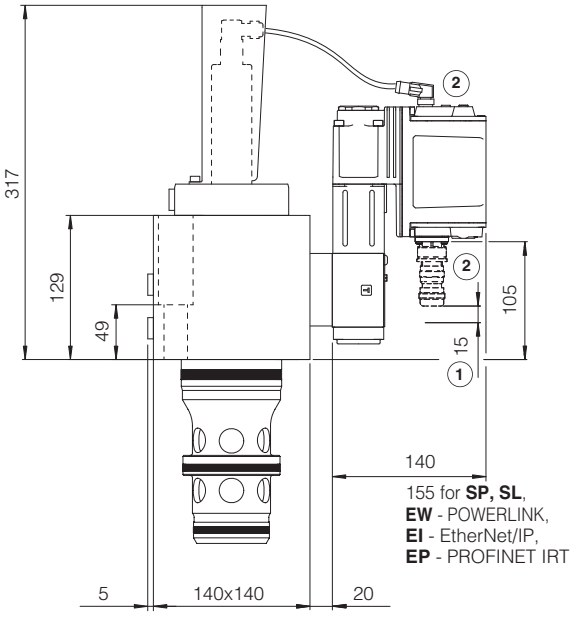
LIQZO-LEB-323
LIQZO-LES-323



LIQZO-LEB-****-403**
LIQZO-LES-****-403**



LIQZP-LEB-503
LIQZP-LES-503

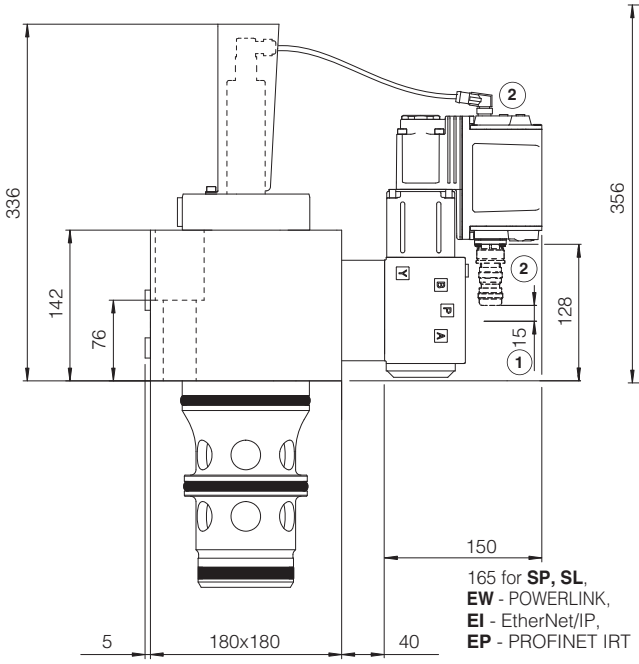


(1) = Space to remove the connectors

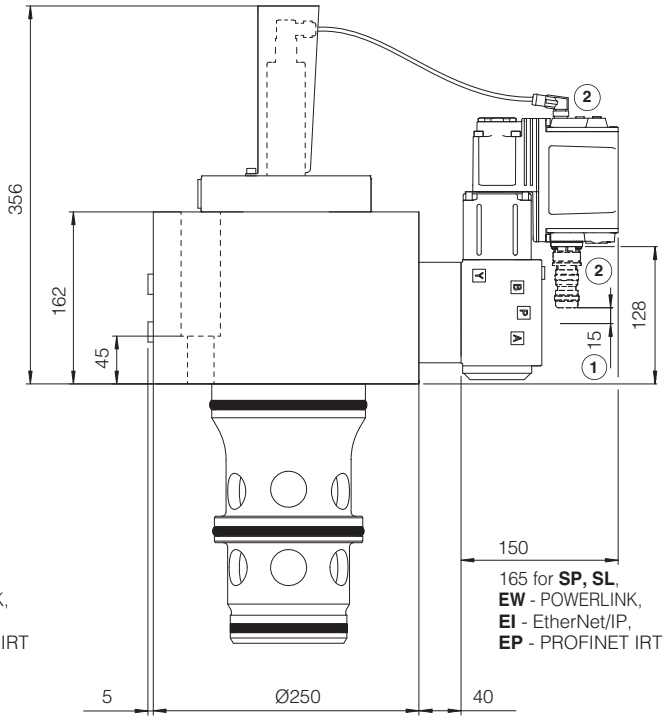
(2) = The dimensions of all connectors must be considered, see section 16.5 and 16.6
For main connectors installation, see also section 20 .

Note: for mounting surface and cavity dimensions, see table P006

LIQZP-LEB-633
LIQZP-LES-633



LIQZP-LEB-803
LIQZP-LES-803



(1) = Space to remove the connectors

(2) = The dimensions of all connectors must be considered, see section 16.5 and 16.6
For main connectors installation, see also section [20].

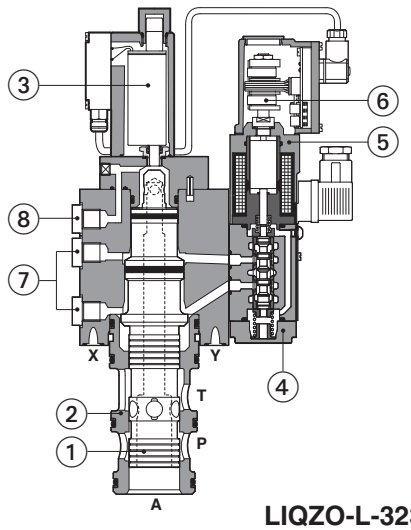
Note: for mounting surface and cavity dimensions, see table P006

[22] RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS500	Digital proportional valves with P/Q control	**P006**	Mounting surfaces and cavities for cartridge valves
FS900	Operating and maintenance information for proportional valves	**QB340**	Quickstart for LEB valves commissioning
GS500	Programming tools	**QF340**	Quickstart for LES valves commissioning
GS510	Fieldbus		

Servoproportional 3-way cartridges

piloted, with two LVDT transducers, sizes from 25 to 80



① Poppet
② Sleeve
③ Main stage LVDT transducer
④ Pilot valve
⑤ Proportional solenoid
⑥ Pilot valve LVDT transducer
⑦ Air bleeding
⑧ Air suction port

LIQZO-L-323L4/A

LIQZO-L, LIQZP-L

Servoproportional 3-way cartridge valves specifically designed for high speed closed loop controls.

The valves operate in association with digital off-board divers, see section [2].

The two LVDT transducers (pilot and main stage) grant very high regulation accuracy and response sensitivity.

The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

Spool regulation characteristics: L = linear

LIQZO: Size: **25 ÷ 40**
Max flow: **500 ÷ 1050 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50 ÷ 80**
Max flow: **2000 ÷ 5000 l/min**
Max pressure: **420 bar**

[1] MODEL CODE

LIQZO	-	L	-	25	3	L4	/	*	*	/	*

Servoproportional cartridge, piloted
LIQZO = size 25 to 40, Pmax 350 bar
LIQZP = size 50 to 80, Pmax 420 bar

L = two LVDT transducers

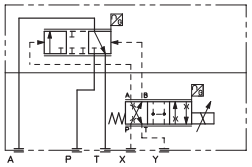
Valve size, see section [4]:

LIQZO =	**25**	**32**	**40**
l/min	185	330	420
LIQZP =	**50**	**63**	**80**
l/min	780	1250	2100

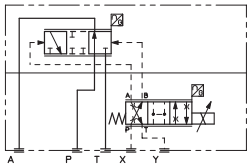
Nominal flow (l/min) at Δp 5 bar

Configuration: **3** = 3 way

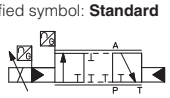
functional symbol: **Standard**



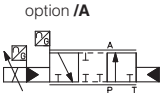
option **/A**



simplified symbol: **Standard**



option **/A**



Spool type, regulating characteristics:

L4 = linear

Hydraulic options:
A = reversal hydraulic configuration of main spool: P-A in rest position

Series number

Seals material, see section [6]:
- = NBR
PE = FKM
BT = HNBR

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LID	E-BM-LEB	E-BM-LES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage.
In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver.

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size		**25**	**32**	**40**	**50**	**63**	**80**
Nominal flow Δp P-A or A-T [l/min]							
	Δp = 5 bar	185	330	420	780	1250	2100
	Δp = 10 bar	260	470	590	1100	1750	3000
	Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]	**LIQZO**	Ports P, A, T = **350** X = 350 Y ≤ 10					
	LIQZP	Ports P, A, T = **420** X = 350 Y ≤ 10					
Nominal flow of pilot valve at Δp = 70 bar [l/min]		4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar [l/min]		0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure [bar]		min: 40% of system pressure max 350 recommended 140 ÷ 160					
Piloting volume [cm^3]		2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow **(1)** [l/min]		6,5	20	25	43	68	76
Response time 0 ÷ 100% step signal **(2)** [ms]		21	22	22	25	30	34
Hysteresis [% of the max regulation]		≤ 0,1					
Repeatability [% of the max regulation]		± 0,1					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) With step reference input 0÷100%
(2) With pilot pressure = 140 bar, see datailed diagrams in section 7.2

WARNING

The loss of the pilot pressure causes the undefined position of the main spool.
The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A).
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 **SEALS AND HYDRAULIC FLUIDS** - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

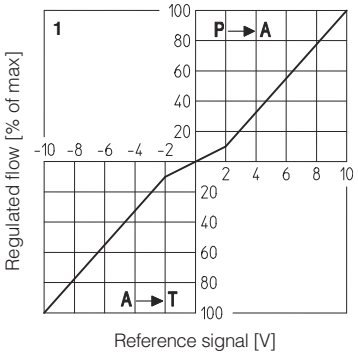
7 **DIAGRAMS** (based on mineral oil ISO VG 46 at 50 °C)

10.1 Regulation diagrams, see note

1 = LIQZO, LIQZP (all sizes)

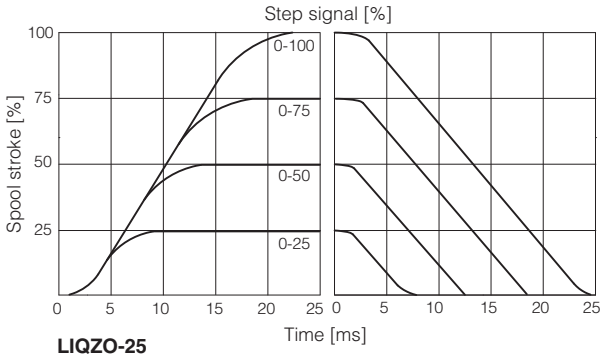
Hydraulic configuration vs. reference signal:

		standard	option /A
Reference signal	0 ÷+10 V 12÷20 mA	P → A	A → T
Reference signal	0 ÷-10 V 4÷12 mA	A → T	P → A

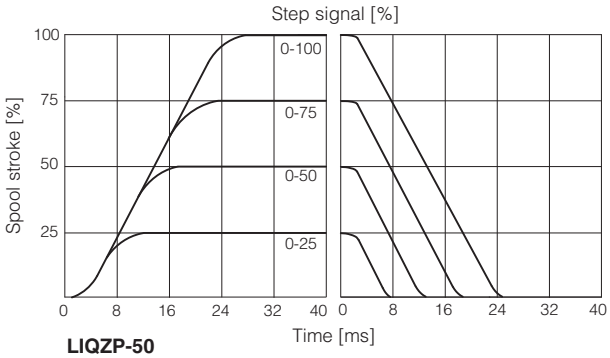


7.2 Response time

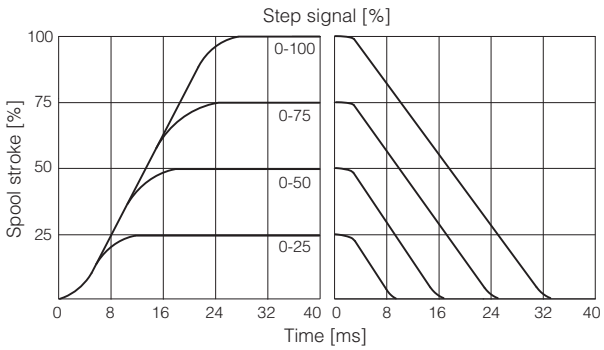
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



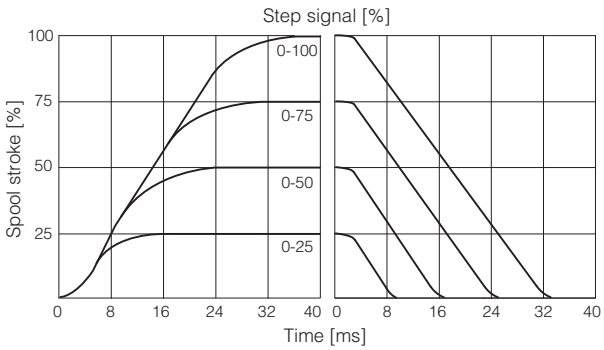
LIQZO-25
LIQZO-32
LIQZO-40



LIQZP-50

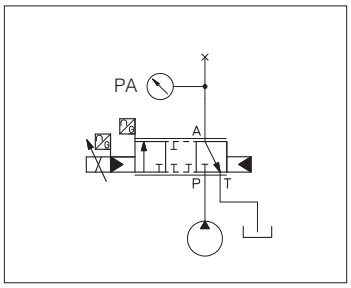


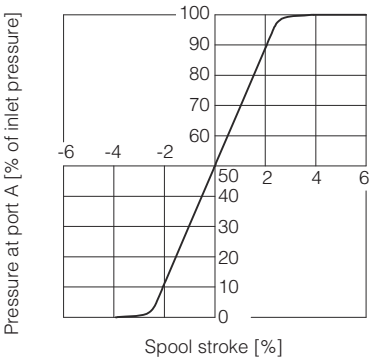
LIQZP-63



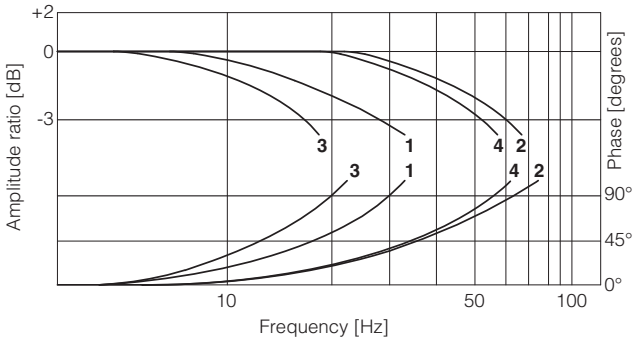
LIQZP-80

7.3 Pressure gain diagram

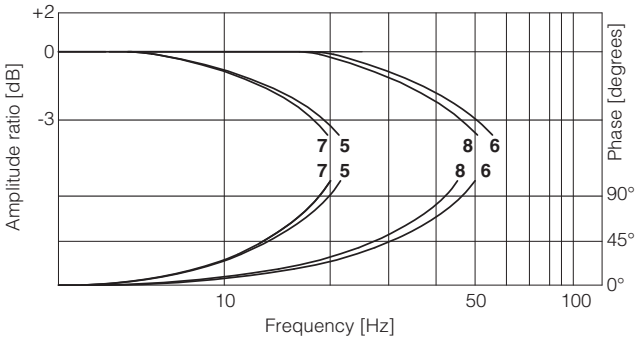




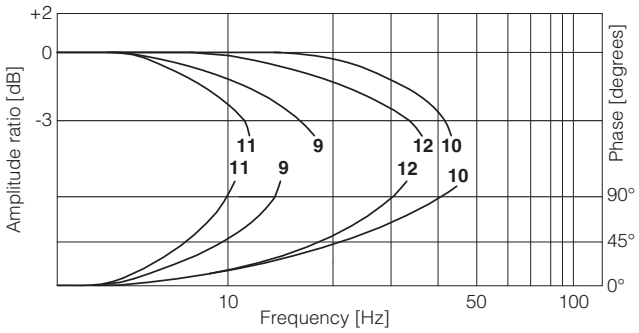
7.4 Bode diagrams



1 = LIQZO-L-253L4: ± 90%
2 = LIQZO-L-253L4: ± 5%
3 = LIQZO-L-323L4: ± 90%
4 = LIQZO-L-323L4: ± 5%



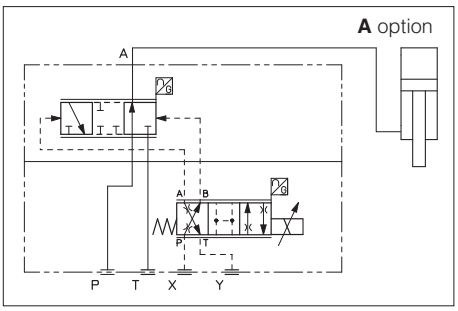
5 = LIQZO-L-403L4: ± 90%
6 = LIQZO-L-403L4: ± 5%
7 = LIQZP-L-503L4: ± 90%
8 = LIQZP-L-503L4: ± 5%



9 = LIQZP-L-633L4: ± 90%
10 = LIQZP-L-633L4: ± 5%
11 = LIQZP-L-803L4: ± 90%
12 = LIQZP-L-803L4: ± 5%

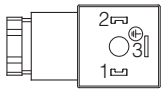
8 HYDRAULIC OPTIONS

A = The standard valve version provides the hydraulic configuration A-T of main spool in absence of electric power supply to the valve.
The option /A provides the reverse configuration P-A of main spool in absence of electric power supply to the valve.
This execution is particularly requested in vertical presses for safety reasons, because in case of electric power breakdown the P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.

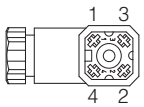


9 ELECTRICAL CONNECTION - connectors supplied with the valve

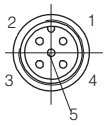
9.1 Solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

9.2 LVDT transducer connector - for LIQZO

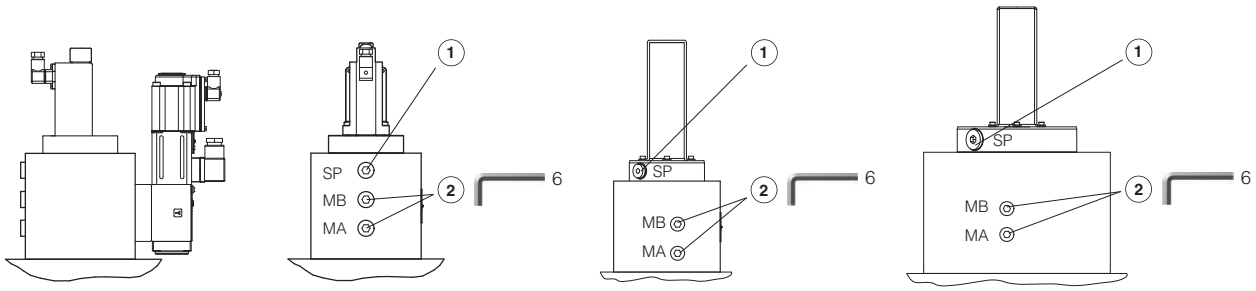
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

9.3 LVDT transducer connector - for LIQZP

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**PROG**	Do not connect	
2	**VT+**	Power supply +15VDC	
3	**AGND**	Ground	
4	**TR**	Output signal	
5	**VT-**	Power supply -15VDC	

10 AIR BLEEDING

Size 25 to 40 **Size 50** **Sizes 63 to 80**



(1) **Plugged port - do not open**

(2) **Air bleeding:**

N° 2 plugs G1/4"

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.

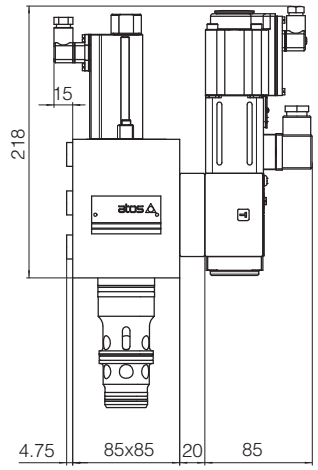
11 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	**25**	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	11,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	17,3
LIQZP	**50**	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	24,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	72,2

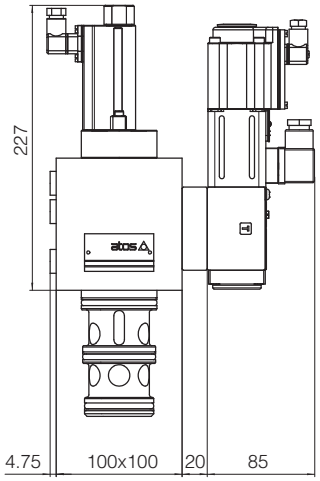
(1) Fastening bolts supplied with the valve

12 INSTALLATION DIMENSIONS [mm]

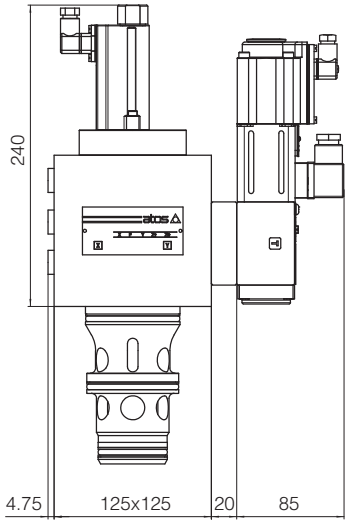
LIQZO-L-253



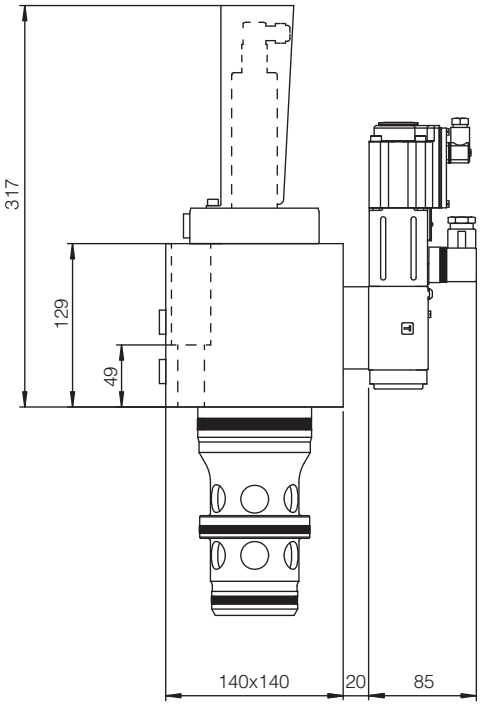
LIQZO-L-353



LIQZO-L-403

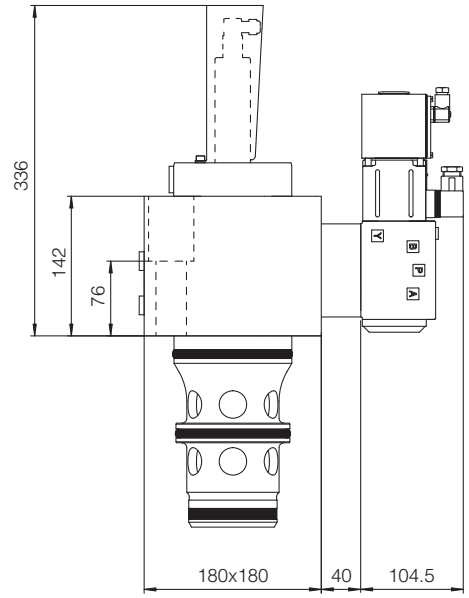


LIQZP-L-503

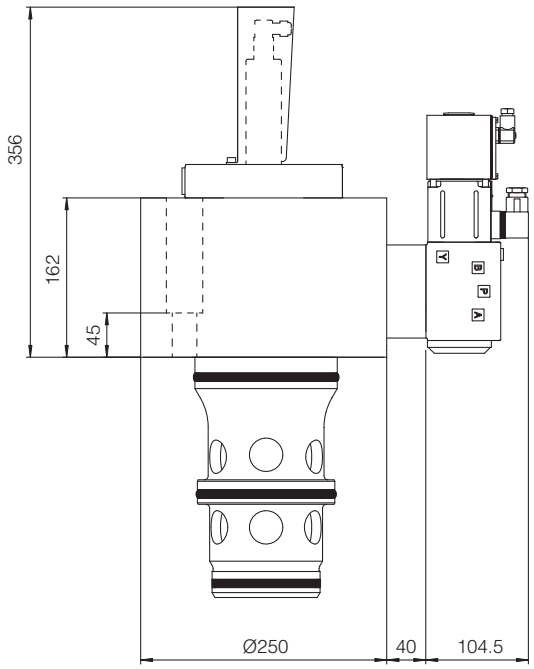


Note: for mounting surface and cavity dimensions, see table P006

LIQZP-L-603



LIQZP-L-803



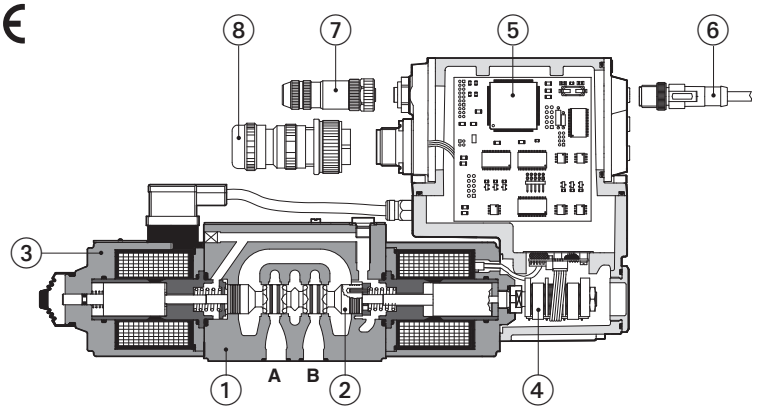
Note: for mounting surface and cavity dimensions, see table P006

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
GS230	E-BM-LEB digital driver	**K800**	Electric and electronic connectors
GS235	E-BM-LID digital driver	**P006**	Mounting surfaces and cavities for cartridge valves
GS240	E-BM-LES digital driver		

Digital proportional directional valves **high performance**

direct, with on-board driver, LVDT transducer and positive spool overlap



DKZOR-TES-SN-BC-171

① Valve body
② Spool
③ Proportional solenoid
④ LVDT transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector

DHZO-TEB, DHZO-TES
DKZOR-TEB, DKZOR-TES

Digital high performance directional proportional valves, direct, specifically designed for high speed closed loop controls.

They are equipped with LVDT position transducer and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

TEB basic execution with analog reference signals and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 **MODEL CODE OF STANDARD SPOOLS**

DHZO	-	TES	-	SN	-	NP	-	0	71	-	L	5	/	*	*	/	*

DHZO = size 06
DKZOR = size 10

TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

Alternated P/Q controls, see section 6 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401: **0** = 06 **1** = 10

Series number

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (2):
B = solenoid with on-board digital driver and LVDT transducer at side of port A
Y = external drain

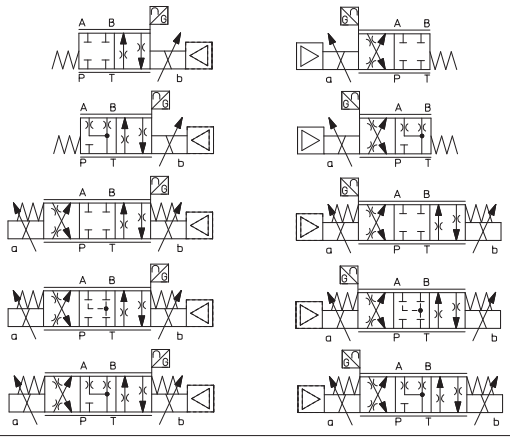
Electronics options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **TES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

Safety options TÜV certified - only **TES (2)**:
U = safe double power supply
K = safe on/off signals
See section 7

SAFETY CERTIFIED

Configuration: **Standard** Option **/B**

51 = (5)
53 =
71 = (5)
72 = (5) (6)
73 =

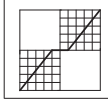


Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZO =	1	4,5	8	17	28
DKZOR =	-	-	-	45	75

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics **(4)**:

L = linear
S = progressive
D = differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q



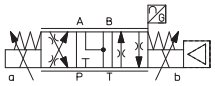
(1) Only in version **SN-NP**
(2) For possible combined options, see section 15
(3) Double power supply only for **TES**
(4) Spools for P/Q control, see section 2
(5) Do not use for P/Q control
(6) Only for **DKZOR-*-S5** the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas

2 MODEL CODE OF SPOOLS FOR ALTERNATED P/Q CONTROL - for valve model code and options, see section 1

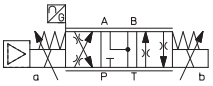
DHZO	-	TES	-	SP	-	NP	-	0	73 - V9	/	*	*	/	*

Configuration and spool:

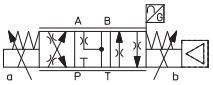
73-Q5



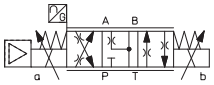
73-Q5/B



73-V9



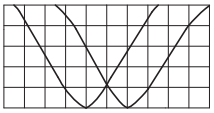
73-V9/B



Spool size:		**Q5**	**V9**
DHZO	=	30	30
DKZOR	=	75	75

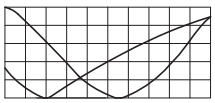
Nominal flow (l/min) at Δp 10 bar P-T

Q5



For alternated P/Q control
see 12.1 - diagram 16

V9



For alternated P/Q control of injection cycle in plastic machinery
see 12.1 - diagram 17

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

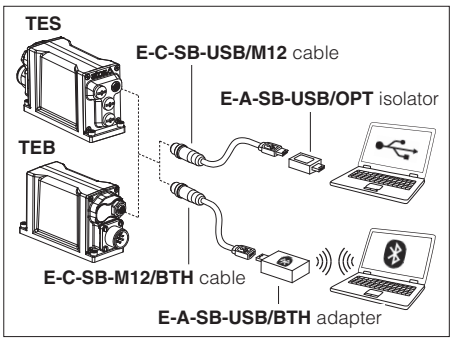
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 ALTERNATED P/Q CONTROLS - only for TES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

7 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** ,
designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DHZO**						**DKZOR**			
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10						ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10			
Configuration		**51, 53, 71, 73**					**73**	**51, 53, 71, 73**		**72**	**73**
Spool type	standard	**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**		**L3,S3,D3**	**L5,S5,D5**	**S5**	
	P/Q						**Q5,V9**				**Q5,V9**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	1	4,5	8	18	28	30	45	75	75	75
	Δp= 30 bar	1,7	8	14	30	50	52	80	130	130	130
	Δp= 70 bar	2,6	12	21	45	75	80	120	170	170	170
Max permissible flow **(2)**		4	18	30	50	80	80	130	180	180	180
Leakage [cm³/min]		<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (at p = 315 bar)			
Response time **(3)** [ms]		≤ 15						≤ 20			
Hysteresis		≤ 0,2 [% of max regulation]									
Repeatibility		± 0,1 [% of max regulation]									
Thermal drift		zero point displacement < 1% at ΔT = 40°C									

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) See detailed diagrams in section 12.3
(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**DHZO** = 2,6 A **DKZOR** = 3 A			
Coil resistance R at 20°C	**DHZO** = 3 ÷ 3,3 Ω **DKZOR** = 3,8 ÷ 4,1 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

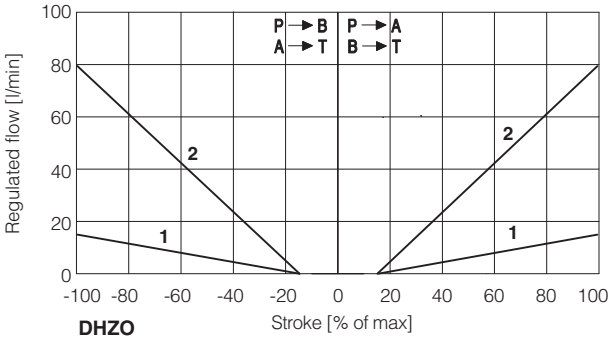
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 **SEALS AND HYDRAULIC FLUIDS** - for other fluids not included in below table, consult our technical office

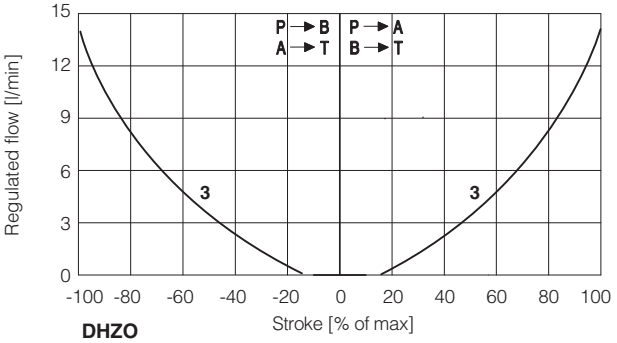
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

12 **DIAGRAMS** - based on mineral oil ISO VG 46 at 50 °C

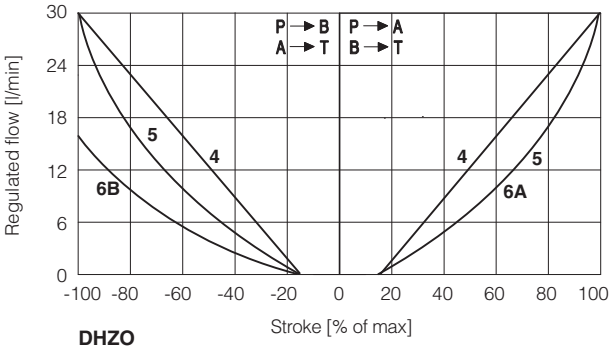
12.1 Regulation diagrams - values measure at Δp 30 bar P-T



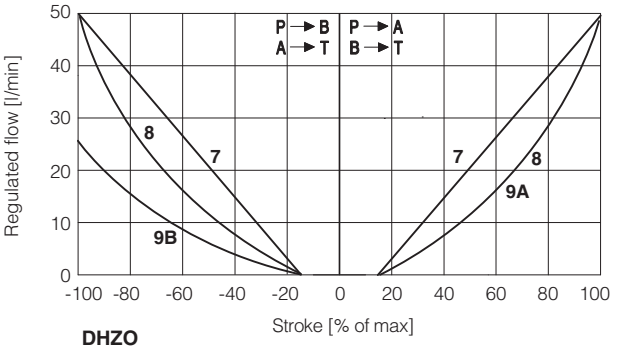
DHZO
1 = L14 **2** = L1



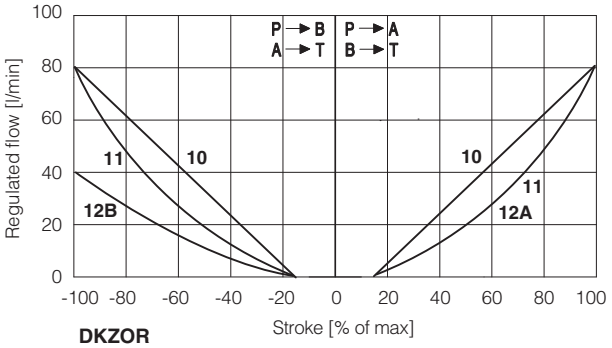
DHZO
3 = S2



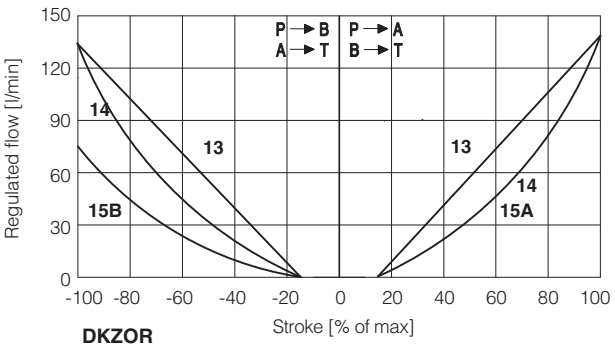
DHZO
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZO
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZOR
10 = L3 **11** = S3 **12A** = D3 (P → A, A → T)
12B = D3 (P → B, B → T)



DKZOR
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

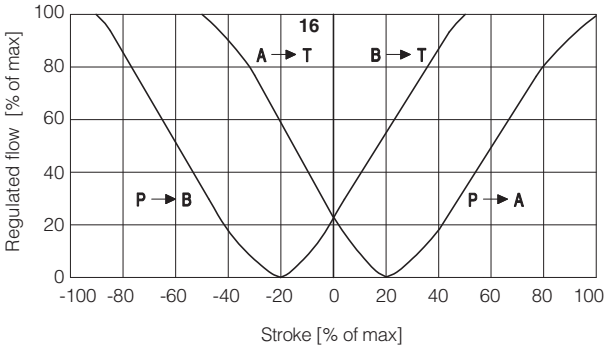
Note:
Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

Reference signal $\begin{matrix}0 \div +10\ V\\12 \div 20\ mA\end{matrix}\Big\}$ P → A / B → T

Reference signal $\begin{matrix}0 \div -10\ V\\12 \div 4\ mA\end{matrix}\Big\}$ P → B / A → T

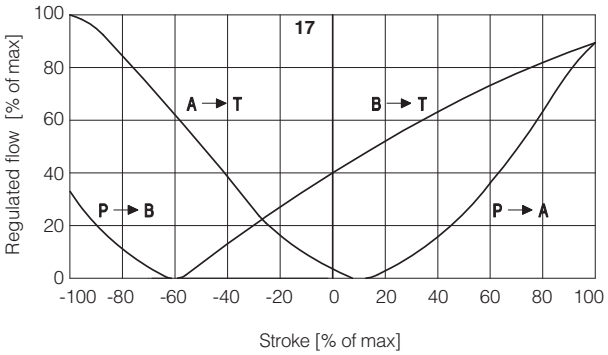
16 = linear spool **Q5**

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers (see tech table **FS500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



17 = differential - progressive spool **V9**

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers (see tech table **FS500**).
This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



12.2 Flow /Δp diagrams

stated at 100% of valve stroke

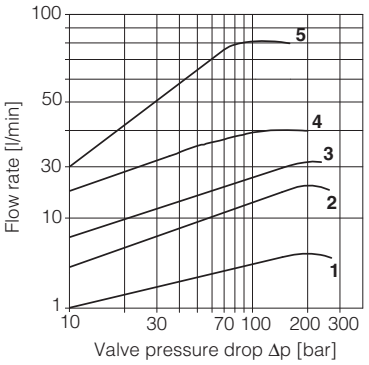
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9

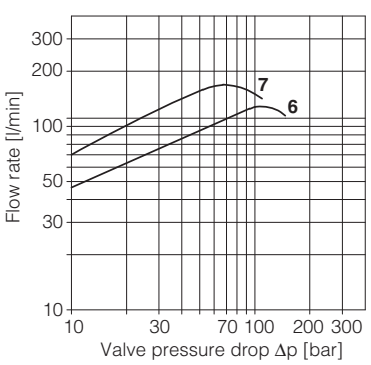
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO



DKZOR



12.3 Operating limits

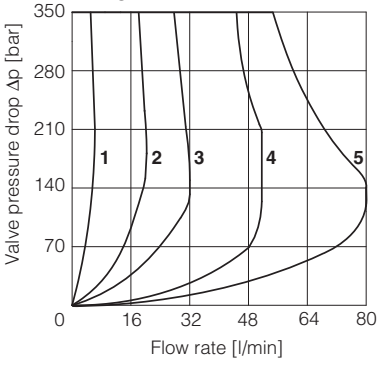
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9

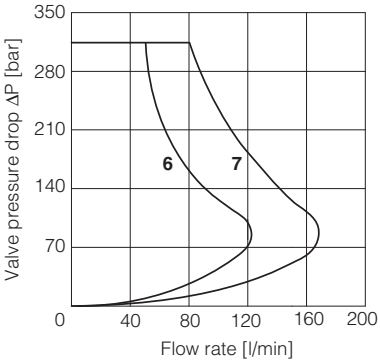
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO

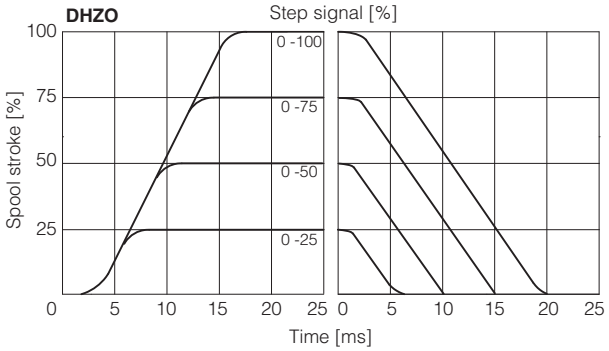


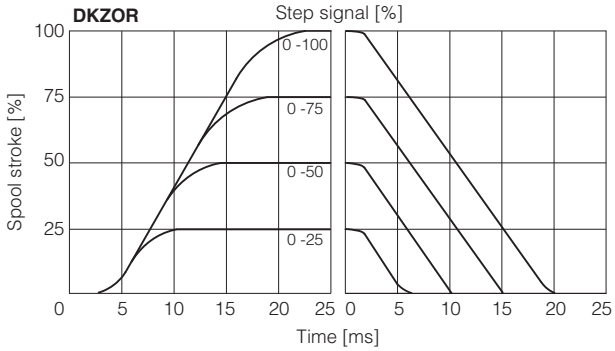
DKZOR



12.4 Response time

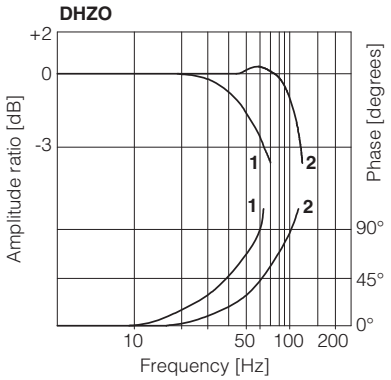
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

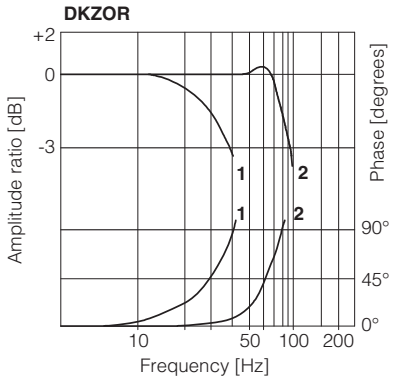




12.5 Bode diagrams

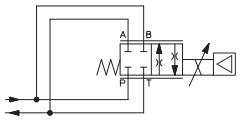
1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke





12.6 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



Max flow Δp= 15 bar [l/min]	SPOOL TYPE				
	L14	**L1**	**S2**	**L3 S3**	**L5 S5**
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	260

13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 16.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 16.8)
Power supply for driver's logics and communication - only for **TES** (see 16.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Standard versions for **TEB-SN** and **TES-SN**:
/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ,
/BQY /BY, /BYZ, /BZ,
/FI, /FIY, /FY, /IQ, /IQY,
/IY, /IYZ, /IZ,
/QY, /YZ

Standard versions for **TES-SP, SF, SL**:
/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **TES-SN**:
/BIU, /BIUY, /BU, /BUY,/IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Safety certified versions for **TES-SP, SF, SL**:
/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCIK, /BCIKY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option and **TES-SP, SF, SL** with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Pressure or force reference input signal (F_INPUT+) - only for **TES-SP, SF, SL**

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.5 Flow monitor output signal (Q_MONITOR) - not for **/F**

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.6 Pressure or force monitor output signal (F_MONITOR) - only for **TES-SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE) - not for standard and **/F**

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.8 Repeat enable output signal (R_ENABLE) - only for **TEB** with **/Z** option

Repeat enable is used as output repeater signal of enable input signal (see 16.7).

16.9 Fault output signal (FAULT) - not for standard and **/Q**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16.10 Remote pressure/force transducer input signal - only for **TES-SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver (see 17.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

16.11 Multiple PID selection (D_IN0 and D_IN1) - only **NP** execution for **TES-SP, SF, SL**

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) **Standard**, **/Q** and **/F** options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

17.2 Main connector signals - 12 pin (A2) **/Z** option and **TES-SP, SF, SL**

PIN	TEB-SN /Z	TES-SN /Z	TES-SP, SF, SL Fieldbus	TES-SP, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

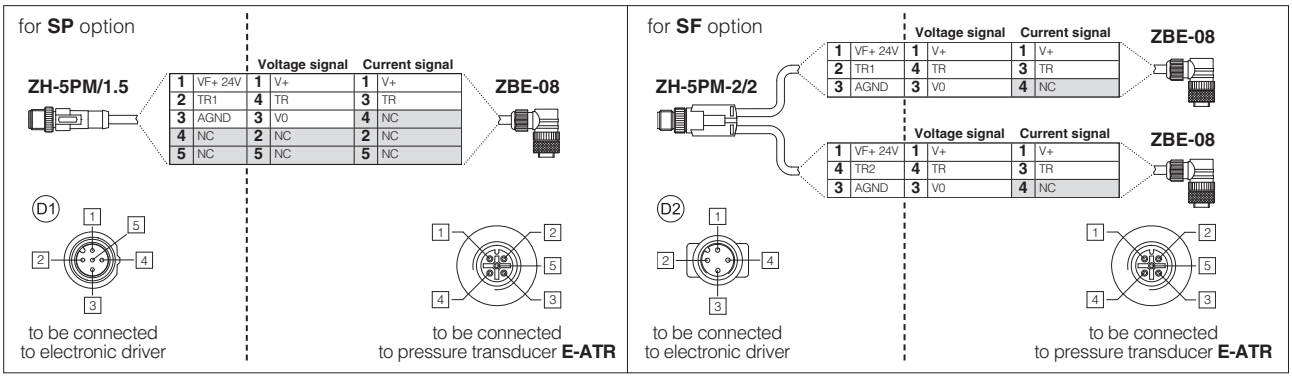
(2) Pin 2 can be fed with external +5V supply of CAN interface

17.4 Remote pressure/force transducer connector - M12 - 5 pin - only for **SP, SF, SL** (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

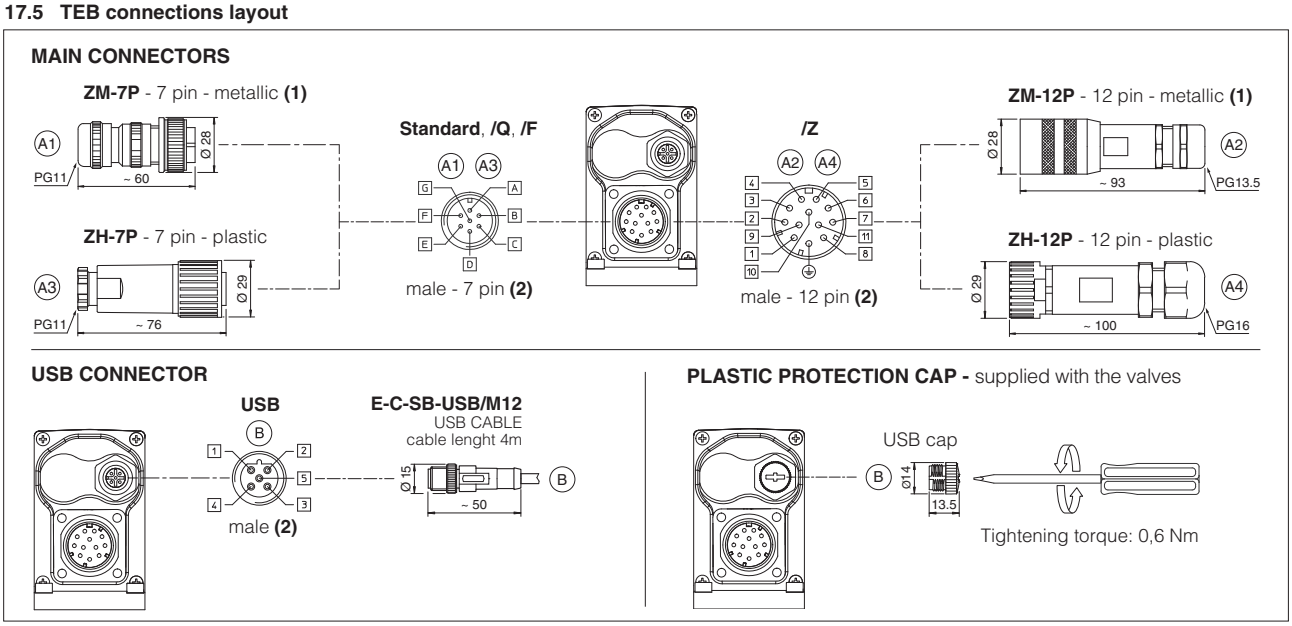
(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

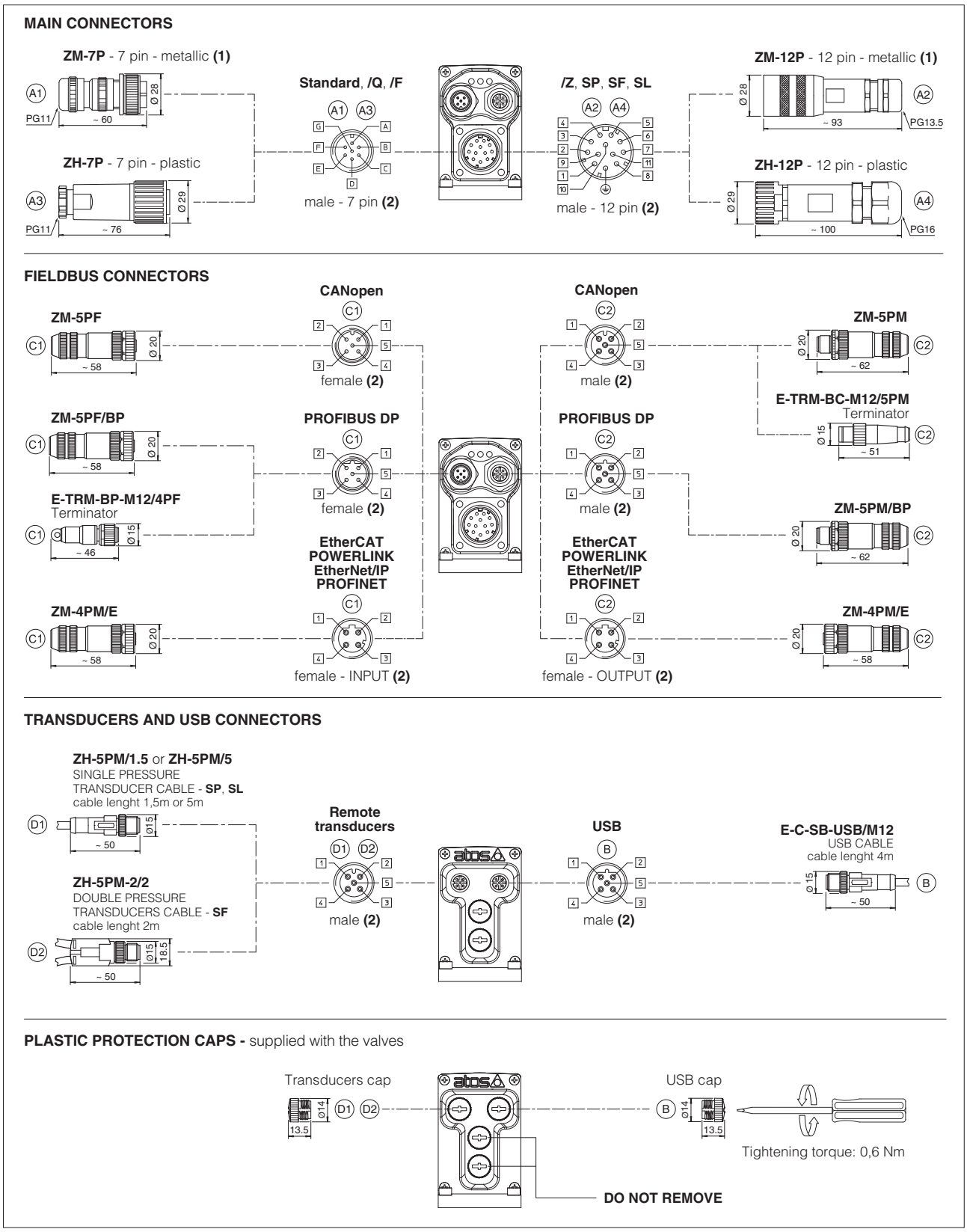
17.5 TEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

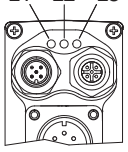
17.6 TES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.7 Diagnostic LEDs - only for **TES**

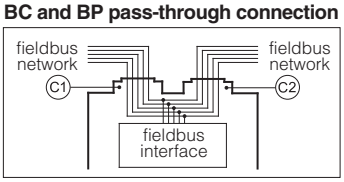
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

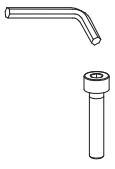
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19.4 Pressure/Force transducer connectors - only for **SP, SF, SL**

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

20 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

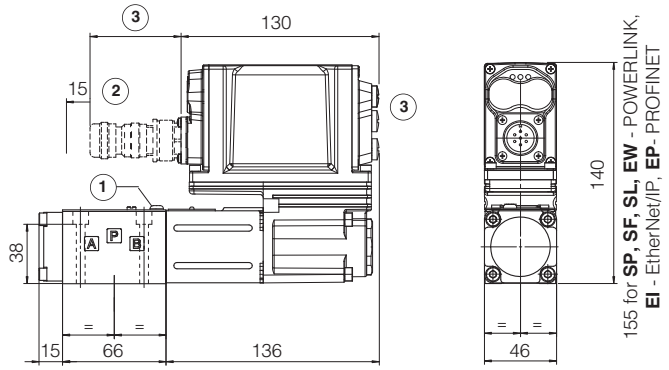
21 INSTALLATION DIMENSIONS [mm]

DHZO-TEB, DHZO-TES

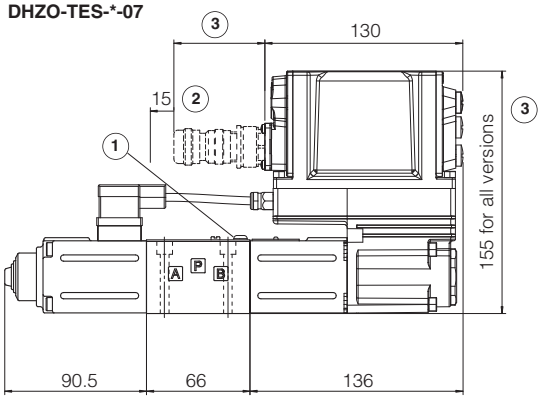
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO-*-05	2,3
DHZO-*-07	3,1

DHZO-TEB-*-05
DHZO-TES-*-05



DHZO-TEB-*-07
DHZO-TES-*-07



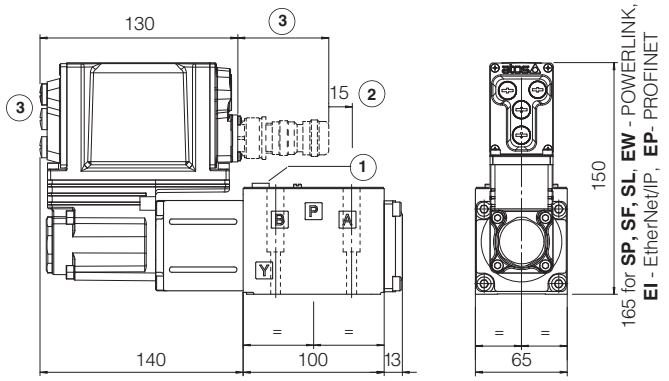
(1) = Air bleeding 3
(2) = Space to remove the connectors
(3) = The dimensions of all connectors must be considered, see section 18.5 and 18.6

DKZOR-TEB, DKZOR-TES

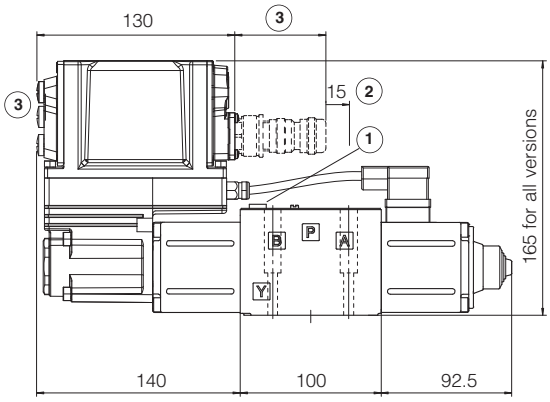
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR-*-15	4,3
DKZOR-*-17	5,0

DKZOR-TEB-*-15
DKZOR-TES-*-15



DKZOR-TEB-*-17
DKZOR-TES-*-17



(1) = Air bleeding 4 13
(2) = Space to remove the connectors
(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

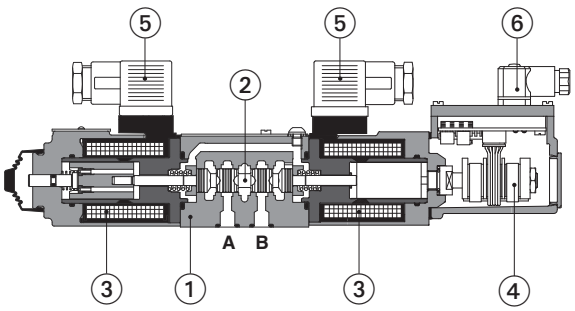
Note: for option /B the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS900	Operating and maintenance information for proportional valves
FY100	Safety proportional valves - option /U
FY200	Safety proportional valves - option /K
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB300	Quickstart for TEB valves commissioning
QF300	Quickstart for TES valves commissioning
Y010	Basics for safety components

Proportional directional valves high performance

direct, with LVDT transducer and positive spool overlap



DHZO-T-071

① Valve body
② Spool
③ Proportional solenoid
④ LVDT transducer
⑤ Solenoid connector
⑥ Transducer connector

DHZO-T, DKZOR-T

Proportional directional valves, direct, with LVDT position transducer and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

The valves operate in association with digital off-board divers, see section 3.

The LVDT transducer grants very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:
L = linear
S = progressive, for fine low flow control
D = differential-progressive, for control of actuators with area ratio 1:2
Q5 and Q6 = for P/Q control

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE OF STANDARD SPOOLS

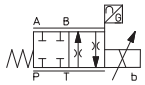
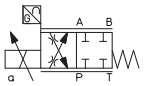
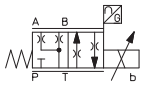
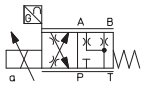
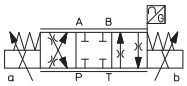
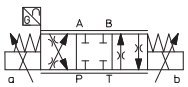
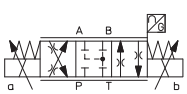
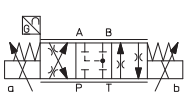
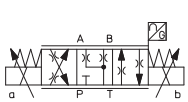
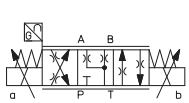
DHZO	-	T	-	0	71	-	L	5	/	*	*	/	*

DHZO = size 06
DKZOR = size 10

T = with LVDT transducer

Valve size ISO 4401:
0 = 06 **1** = 10

Configuration:

	Standard	Option **/B**
51 =		
53 =		
71 =		
72 = (1)		
73 =		

Series number

Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (2):
B = solenoid and LVDT transducer at side of port A
Y = external drain

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZO =	1	4,5	8	17	28
DKZOR =	-	-	-	45	75

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics **(3)**:

L = linear 

S = progressive 

D = differential-progressive 
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

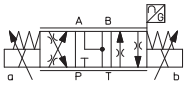
(1) Only for **DKZOR-*-S5** the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas
(2) Possible combined options: /BY
(3) Spools for P/Q control, see section 2

2 MODEL CODE OF SPOOLS FOR ALTERNATED P/Q CONTROL - for valve model code and options, see section 1

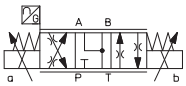
DHZO	-	T	-	0	73 - V9	/	*	*	/	*

Configuration and spool:

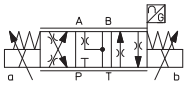
73-Q5



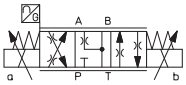
73-Q5/B



73-V9



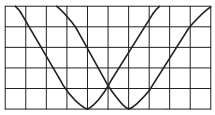
73-V9/B



Spool size:		**Q5**	**V9**
DHZO	=	30	30
DKZOR	=	75	75

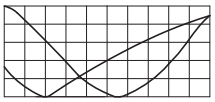
Nominal flow (l/min) at Δp 10 bar P-T

Q5



For alternated P/Q control
see 8.1 - diagram 16

V9



For alternated P/Q control of injection cycle in plastic machinery
see 8.1 - diagram 17

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DHZO**						**DKZOR**			
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10						ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10			
Configuration		**51, 53, 71, 73**					**73**	**51, 53, 71, 73**		**72**	**73**
Spool type	standard	**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**		**L3,S3,D3**	**L5,S5,D5**	**S5**	
	P/Q						**Q5,V9**				**Q5,V9**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	1	4,5	8	18	28	30	45	75	75	75
	Δp= 30 bar	1,7	8	14	30	50	52	80	130	130	130
	Δp= 70 bar	2,6	12	21	45	75	80	120	170	170	170
Max permissible flow **(2)**		4	18	30	50	80	80	130	180	180	180
Leakage [cm³/min]		<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (at p = 315 bar)			
Response time **(3)** [ms]		≤ 15						≤ 20			
Hysteresis		≤ 0,2 [% of max regulation]									
Repeatibility		± 0,1 [% of max regulation]									
Thermal drift		zero point displacement < 1% at ΔT = 40°C									

(1) For different Δp, the max flow is in accordance to the diagrams in section 8.2
(2) See detailed diagrams in section 8.3
(3) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

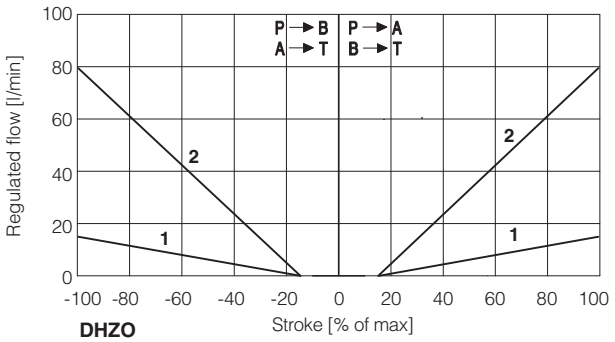
Max power consumption	30 W
Max. solenoid current	**DHZO** = 2,6 A **DKZOR** = 3 A
Coil resistance R at 20°C	**DHZO** = 3 ÷ 3,3 Ω **DKZOR** = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

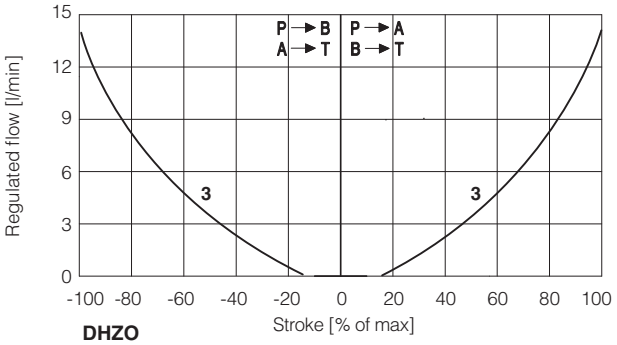
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5		see also filter section at www.atos.com or KTF catalog
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	ISO 12922

8 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

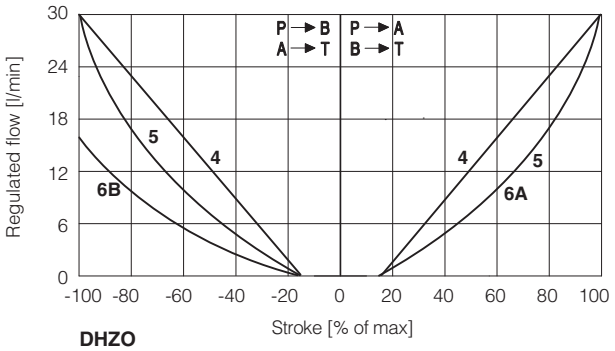
8.1 Regulation diagrams - values measure at Δp 30 bar P-T



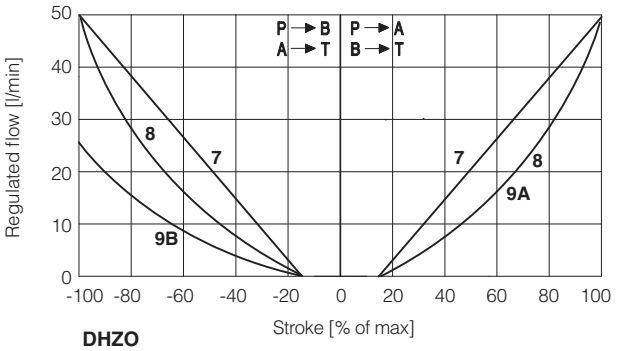
DHZO
1 = L14 **2** = L1



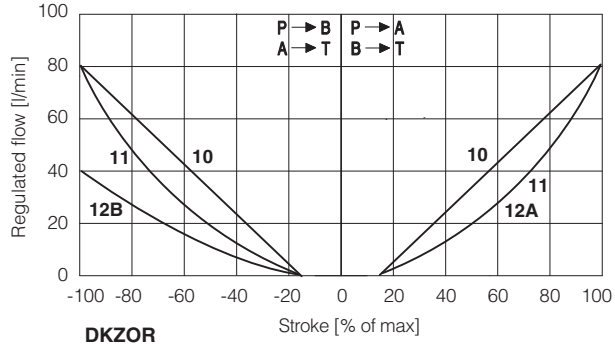
DHZO
3 = S2



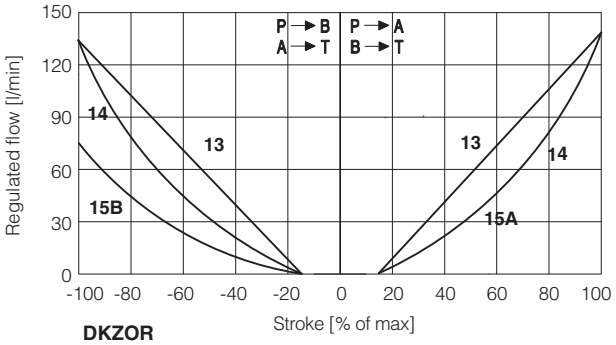
DHZO
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZO
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZOR
10 = L3 **11** = S3 **12A** = D3 (P → A, A → T)
12B = D3 (P → B, B → T)



DKZOR
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

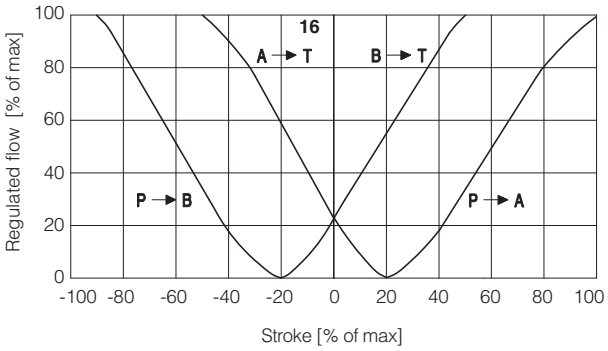
Note:
Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

Reference signal $\begin{matrix}0 \div +10\ V\\12 \div 20\ mA\end{matrix}\Big\}$ P → A / B → T

Reference signal $\begin{matrix}0 \div -10\ V\\12 \div 4\ mA\end{matrix}\Big\}$ P → B / A → T

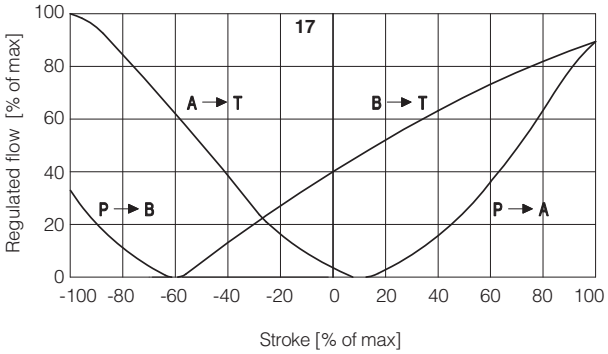
16 = linear spool **Q5**

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



17 = differential - progressive spool **V9**

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**).
This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



8.2 Flow /Δp diagrams

stated at 100% of valve stroke

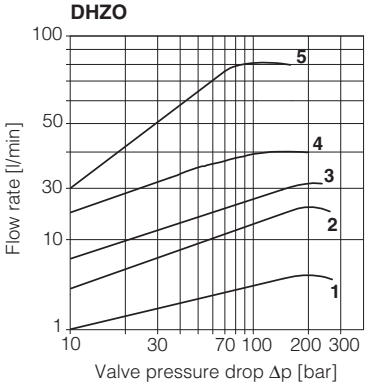
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9

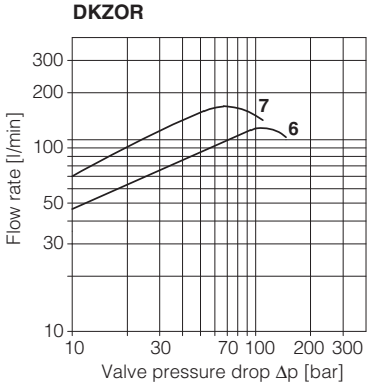
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO



DKZOR



8.3 Operating limits

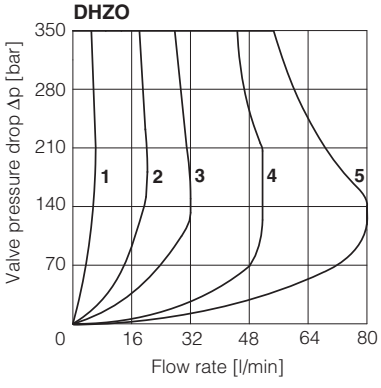
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9

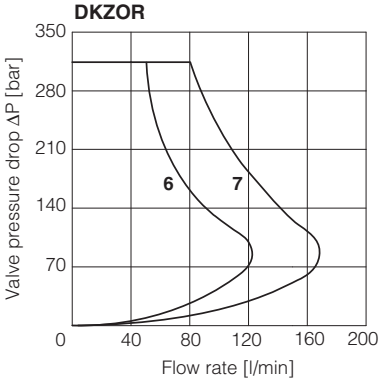
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO

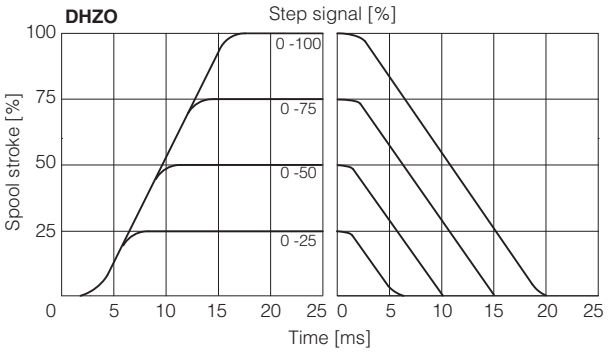


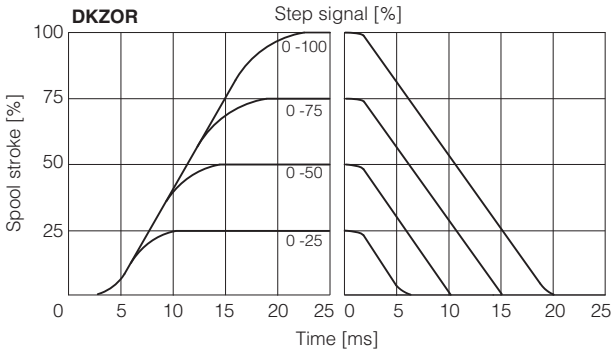
DKZOR



8.4 Response time

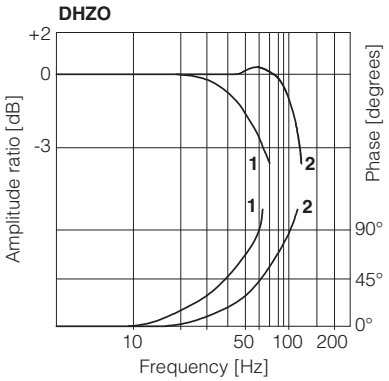
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

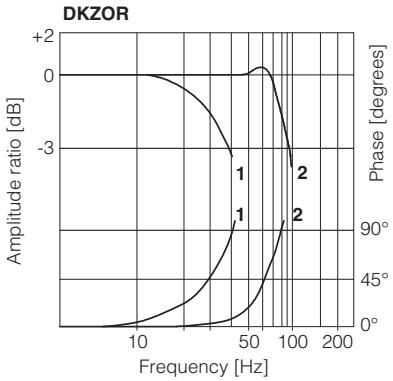




8.5 Bode diagrams

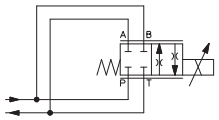
1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke





8.6 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



Max flow Δp= 15bar [l/min]	SPOOL TYPE				
	L14	**L1**	**S2**	**L3 S3**	**L5 S5**
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	260

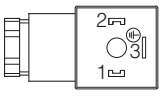
9 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 8.1

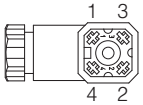
Y = This option is mandatory if the pressure in port T exceeds 210 bar.

10 ELECTRICAL CONNECTION

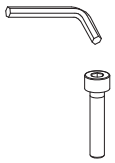
10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

11 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

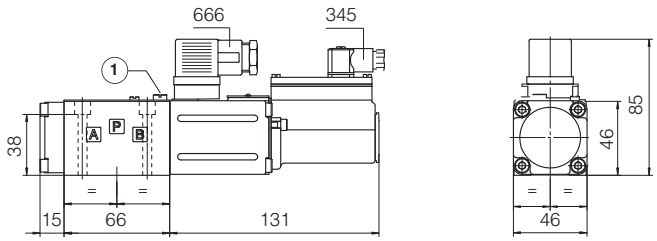
12 INSTALLATION DIMENSIONS [mm]

DHZO-T

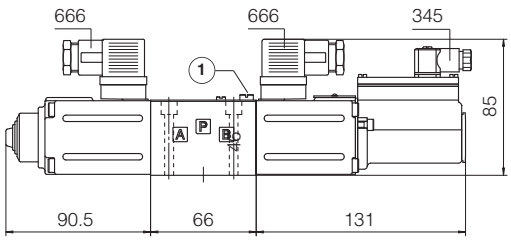
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO-T-05	1,9
DHZO-T-07	2,6

DHZO-T-05



DHZO-T-07



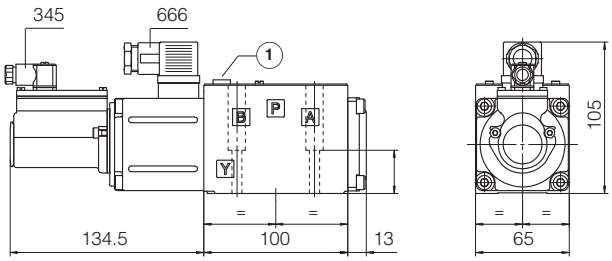
(1) = Air bleeding  3

DKZOR-T

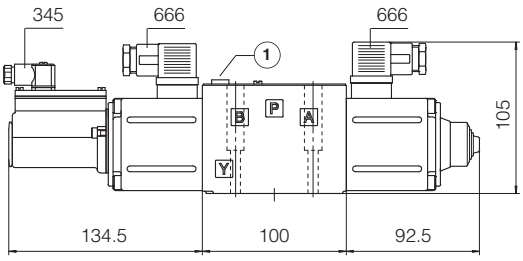
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR-T-15	3,8
DKZOR-T-17	4,5

DKZOR-T-15



DKZOR-T-17



(1) = Air bleeding  4  13

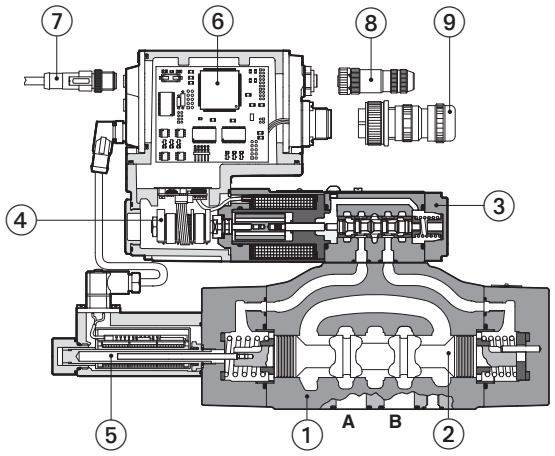
Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
GS230	E-BM-TEB digital driver	**K800**	Electric and electronic connectors
GS235	E-BM-TID digital driver	**P005**	Mounting surfaces for electrohydraulic valves
GS240	E-BM-TES digital driver		

Digital proportional directional valves **high performance**

piloted with on-board driver, two LVDT transducers and positive spool overlap



DPZO-LES-SN-BP-271

① Valve body
② Main stage Spool
③ Pilot valve
④ Pilot valve LVDT transducer
⑤ Main stage LVDT transducer
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connectors
⑨ Main connector

DPZO-LEB, DPZO-LES

Digital proportional directional valves high performance, piloted, specifically designed for high speed closed loop controls.

They are equipped with two LVDT position transducers (pilot valve and main stage) and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

LEB basic execution with analog reference signals and USB port for software functional parameters setting.

LES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** ÷ **35** - ISO 4401
Max flow: **180** ÷ **3500 l/min**
Max pressure: **350 bar**

1 **MODEL CODE OF STANDARD SPOOLS**

DPZO	-	LES	-	SN	-	NP	-	2	71	-	L	5	/	*	*	/	*

DPZO — Proportional directional valve, piloted

LES = basic on-board digital driver **(1)**
LES = full on-board digital driver

Alternated P/Q controls, see section **6**:
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32 **8** = 35

Configuration:

Standard — Option **/B**

71 = (4)

73 =

Spool type, regulating characteristics **(5)**:

L = linear
S = progressive
DL = differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q
D = differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Series number

Seals material, see section **11**:
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (2):
B = solenoid with on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronics options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **LES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

Safety options TÜV certified - only **LES (2)**:
U = safe double power supply
K = safe on/off signals
See section **7**

SAFETY CERTIFIED

Spool size:	**3** (L,S,D)	**5** (L,DL,S,D)	**5** (L,S,D)
DPZO-1 =	-	100	-
DPZO-2 =	160	250	-
DPZO-4 =	-	480	-
DPZO-4M =	-	550	-
DPZO-6 =	-	-	640
DPZO-8 =	-	-	1200

Nominal flow (l/min) at Δp 10bar P-T

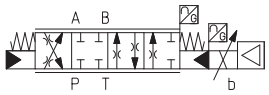
(1) Only in version **SN-NP**
(2) For possible combined options, see section **15**
(3) Double power supply only for **LES**
(4) Do not use for P/Q control
(5) Spools for regenerative circuit or alternated P/Q control, see section **2**

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT OR ALTERNATED P/Q CONTROL - for valve model code and options, see sect. 1

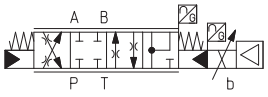
DPZO	-	LES	-	SN	-	NP	-	2	71 - L9	/	*	*	/	*

Configuration and spool for regenerative circuit:

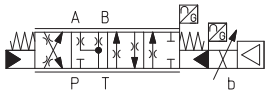
71-D9



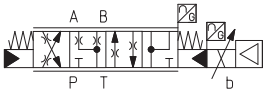
71-L9



73-D9

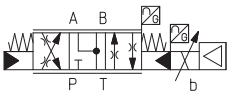


73-L9

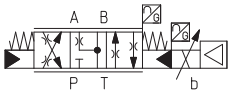


Configuration and spool for alternated P/Q control:

73-Q5



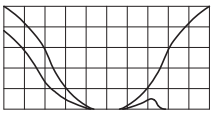
73-V9



Spool size:	**D9**	**L9**	**V9**	**Q5**
DPZO-1 =	100	-	100	100
DPZO-2 =	250	250	250	250
DPZO-4 =	480	-	480	480
DPZO-4M =	550	-	550	550
DPZO-6 =	-	-	640	-
DPZO-8 =	-	-	1200	-

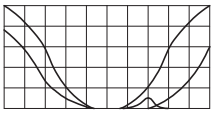
Nominal flow (l/min) at Δp 10bar P-T

D9



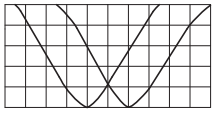
For regenerative circuit (additional external check valve required)
see 12.1 - diagram 26

L9



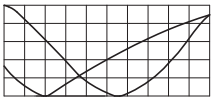
For regenerative circuit internal to the valve
see 12.1 - diagram 27

Q5



For alternated P/Q control
see 12.1 - diagram 28

V9



For alternated P/Q control of injection cycle in plastic machinery
see 12.1 - diagram 29

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

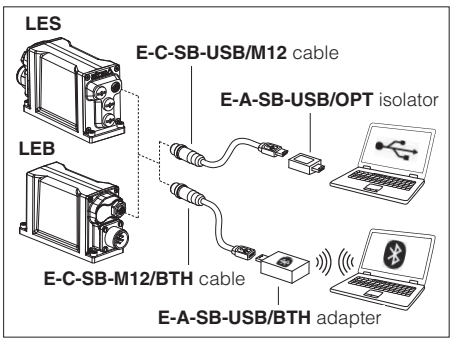
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 ALTERNATED P/Q CONTROLS - only for LES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

7 SAFETY OPTIONS - only for LES

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** ,
designed to accomplish a safety function, intended to reduce the risk in process control systems.
They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

SAFETY CERTIFIED

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-*-1	DPZO-*-2		DPZO-*-4	DPZO-*-4M	DPZO-*-6	DPZO-*-8
Pressure limits [bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;						
Spool type standard	**L5, DL5, S5, D5**	**L3, S3, D3**	**L5, DL5, S5, D5**			**L5, S5, D5**	
Spool type regenerative or P/Q	**D9, V9, Q5**		**D9, L9, V9, Q5**	**D9, V9, Q5**		**V9**	
Nominal flow Δp P-T [l/min] **(1)**							
Δp= 10 bar	100	160	250	480	550	640	1200
Δp= 30 bar	160	270	430	830	950	1100	2000
Max permissible flow	180	400	550	1000	1100	1600	3500
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)						
Piloting volume [cm³]	1,4	3,7		9,0	11,3	21,6	39,8
Piloting flow **(2)** [l/min]	1,7	3,7		6,8	8	14,4	20
Leakage **(3)** Pilot [cm³/min]	100 / 300	100 / 300		200 / 500	200 / 600	900 / 2800	900 / 2800
Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	0,3 / 1,0	1,0 / 3,0	1,2 / 3,6
Response time **(4)** [ms]	≤ 50	≤ 60		≤ 80	≤ 85	≤ 90	≤ 120
Hysteresis	≤ 0,1 [% of max regulation]						
Repeatability	± 0,1 [% of max regulation]						
Thermal drift	zero point displacement < 1% at ΔT = 40°C						

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal see detailed diagrams in section 12.3

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

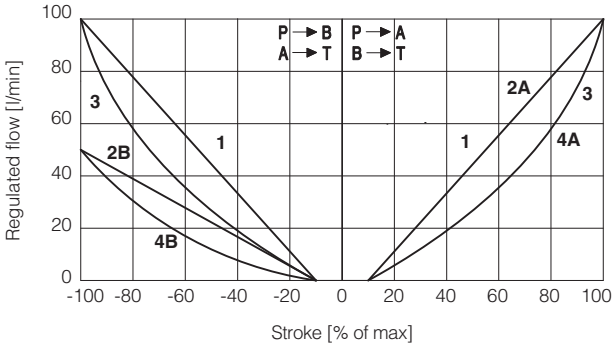
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

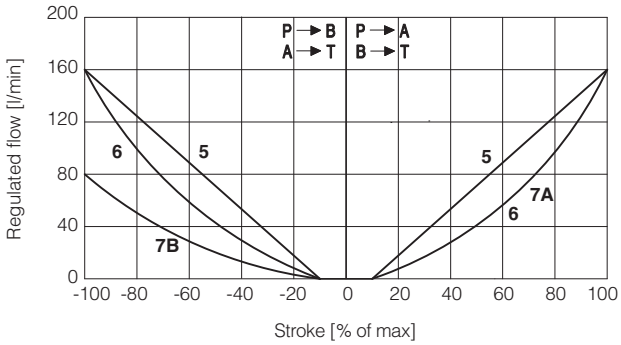
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

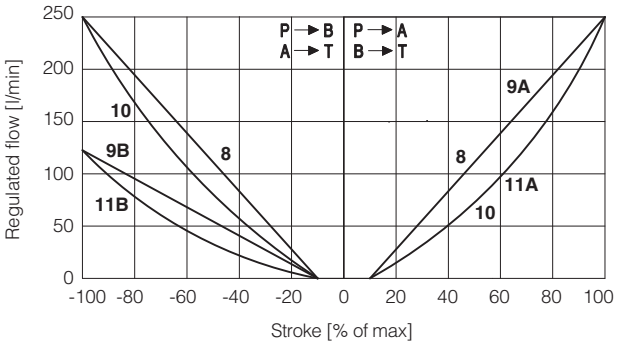
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



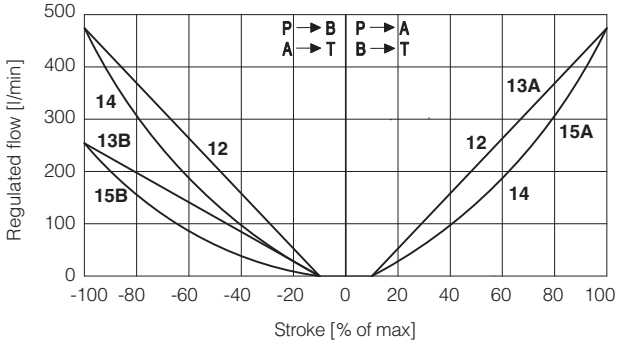
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T)
4A = D5 (P → A, A → T)
4B = D5 (P → B, B → T)



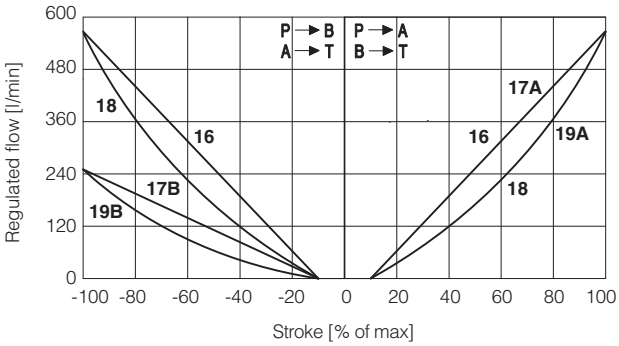
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



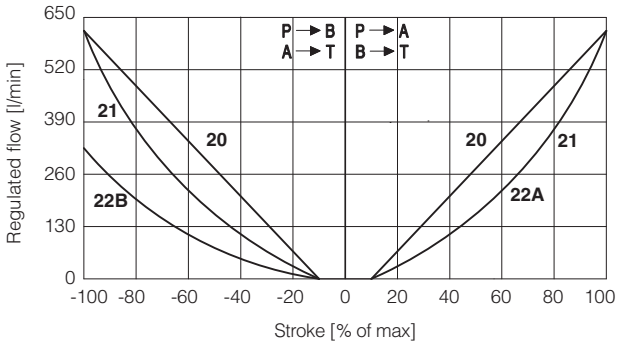
DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T)
11A = D5 (P → A, A → T)
11B = D5 (P → B, B → T)



DPZO-4:
12 = L5 **13A** = DL5 (P → A, A → T)
14 = S5 **13B** = DL5 (P → B, B → T)
15A = D5 (P → A, A → T)
15B = D5 (P → B, B → T)



DPZO-4M:
16 = L5 **17A** = DL5 (P → A, A → T)
18 = S5 **17B** = DL5 (P → B, B → T)
19A = D5 (P → A, A → T)
19B = D5 (P → B, B → T)



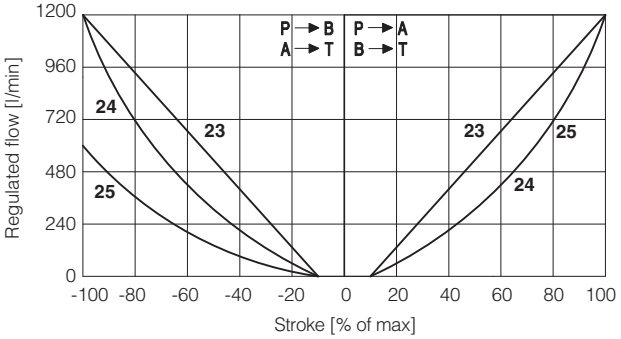
DPZO-6:
20 = L5 **22A** = D5 (P → A, A → T)
21 = S5 **22B** = D5 (P → B, B → T)

Note:

Hydraulic configuration vs. reference signal (standard and option /B)

Reference signal $\left.\begin{matrix}0 \div +10\ V\\12 \div 20\ mA\end{matrix}\right\}$ P → A / B → T

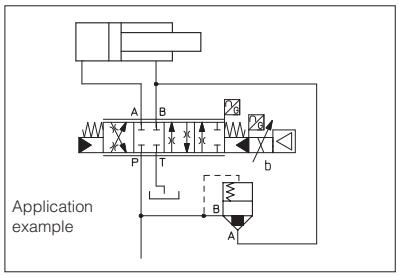
Reference signal $\left.\begin{matrix}0 \div -10\ V\\12 \div 4\ mA\end{matrix}\right\}$ P → B / A → T

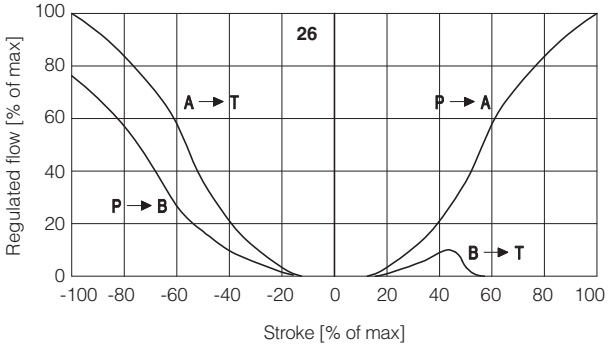


DPZO-8:
23 = L5 **24** = S5
25 = D5

26 = differential - regenerative spool **D9**
(not available for valve size 32 and 35)

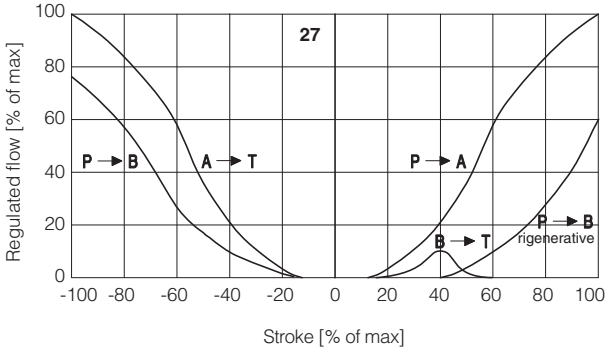
D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.





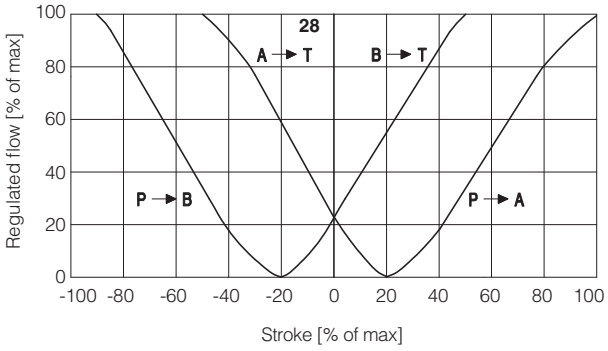
27 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



28 = linear spool **Q5**
(not available for valve size 32 and 35)

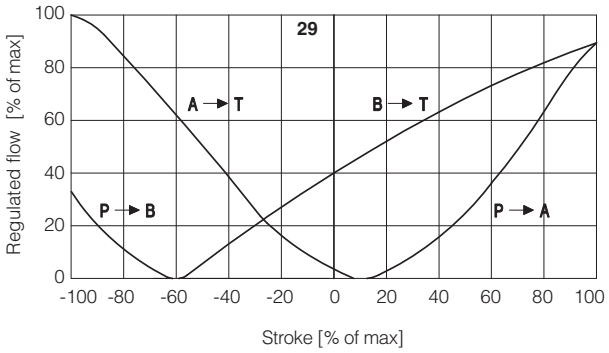
Q5 spool type is specific for alternate P/Q controls in combination with /S* option of digital on-board drivers, (see tech. table **FS500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



29 = differential - progressive spool **V9**

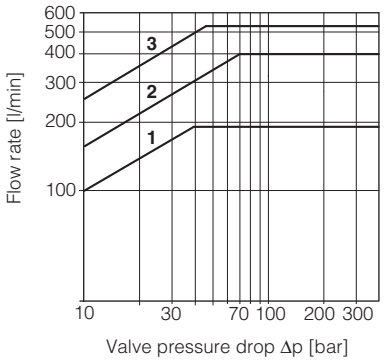
V9 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers, (see tech. table **FS500**).
This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

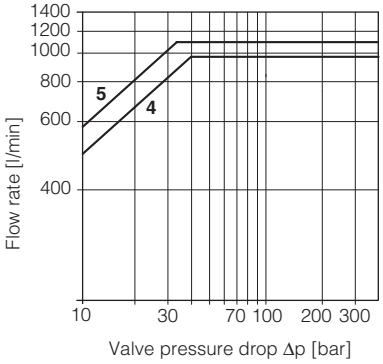
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank

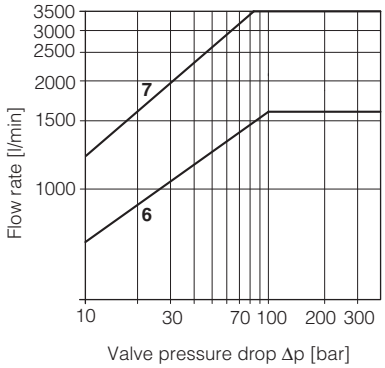


12.2 Operating diagrams

Flow /Δp diagram
stated at 100% of spool stroke







DPZO-1:
1 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9, V9, Q5

DPZO-4:
4 = spools L5, S5, D5, DL5, D9, V9, Q5

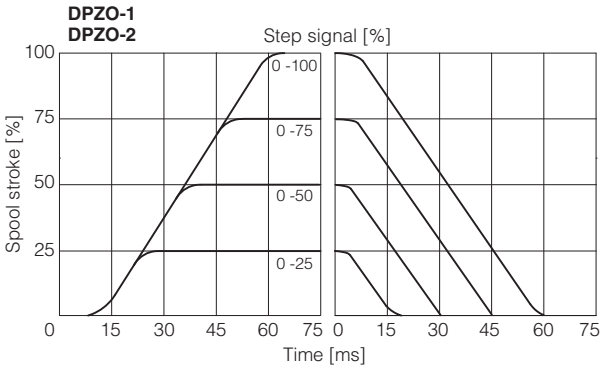
DPZO-4M:
5 = spools L5, S5, D5,DL5, D9, V9, Q5

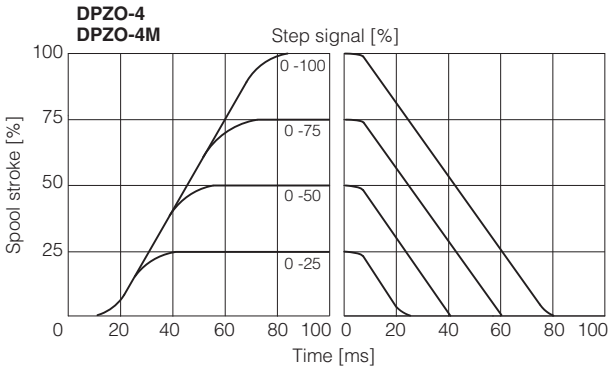
DPZO-6:
6 = L5, S5, D5, V9

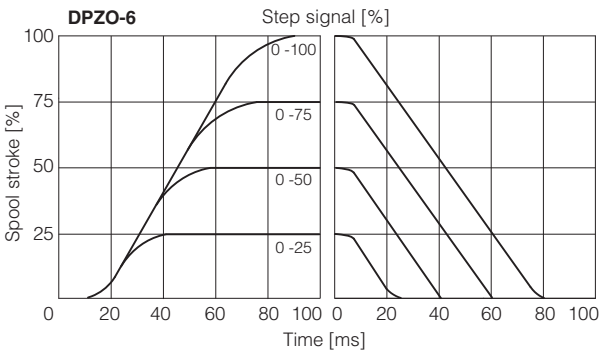
DPZO-8:
7 = L5, S5, D5, V9

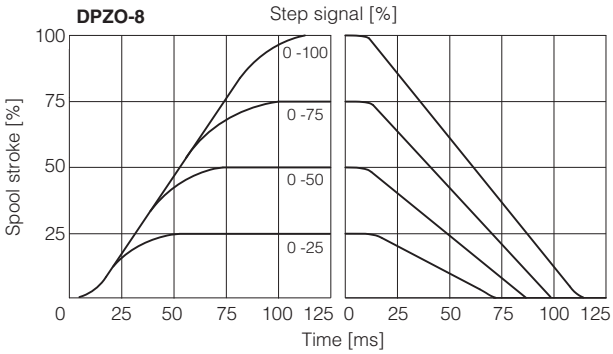
12.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.









13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 12.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 20
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 20
The valve's standard configuration provides internal pilot and external drain.

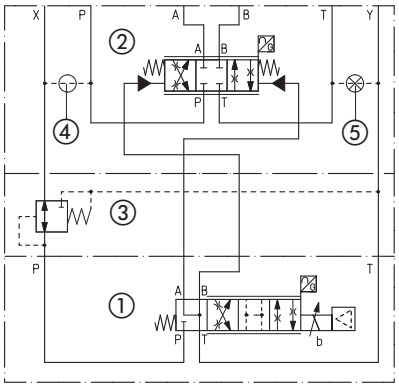
G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = **28 bar**

DPZO-1, DPZO-4(M), DPZO-6 and DPZO-8 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 71



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 16.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **LEB** (see 16.8)
Power supply for driver's logics and communication - only for **LES** (see 16.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Hydraulic options:
all combination possible

Electronics options - Standard versions:		**Electronics options** - Safety certified versions:	
LEB-SN, **LES-SN**	**LES-SP, SF, SL**	**LES-SN**	**LES-SP, SF, SL**
/FI, /IQ, /IZ	/CI	/IU, /IK	/CU, /IU, /CIU, /CK, /IK, /CIK

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option and **LES-SP, SF, SL** with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Pressure or force reference input signal (F_INPUT+) - only for **LES-SP, SF, SL**

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.5 Flow monitor output signal (Q_MONITOR) - not for **/F**

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.6 Pressure or force monitor output signal (F_MONITOR) - only for **LES-SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE) - not for standard and **/F**

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.8 Repeat enable output signal (R_ENABLE) - only for **LEB** with **/Z** option

Repeat enable is used as output repeater signal of enable input signal (see 16.7).

16.9 Fault output signal (FAULT) - not for standard and **/Q**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16.10 Remote pressure/force transducer input signal - only for **LES-SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver (see 17.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

16.11 Multiple PID selection (D_IN0 and D_IN1) - only **NP** execution for **LES-SP, SF, SL**

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) **Standard**, **/Q** and **/F** options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

17.2 Main connector signals - 12 pin (A2) **/Z** option and **LES-SP, SF, SL**

PIN	LEB-SN /Z	LES-SN /Z	LES-SP, SF, SL Fieldbus	LES-SP, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communications connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

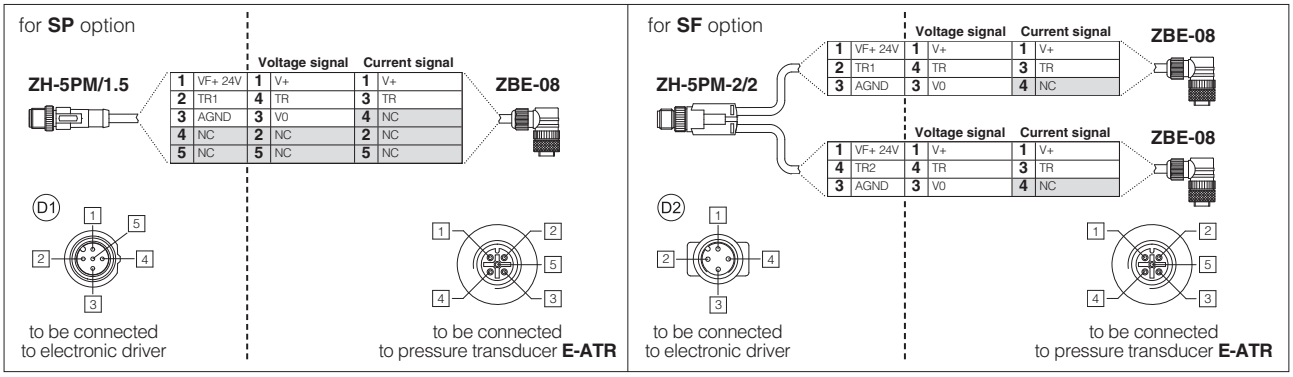
(2) Pin 2 can be fed with external +5V supply of CAN interface

17.4 Remote pressure/force transducer connector - M12 - 5 pin - only for **SP, SF, SL** (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

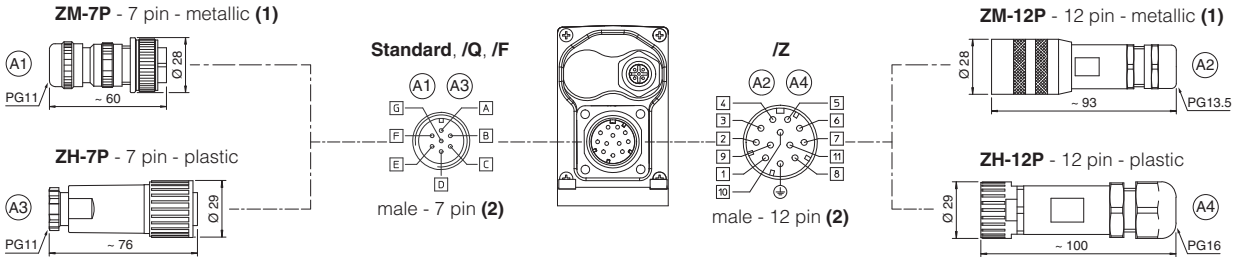
Remote pressure transducers connection - example



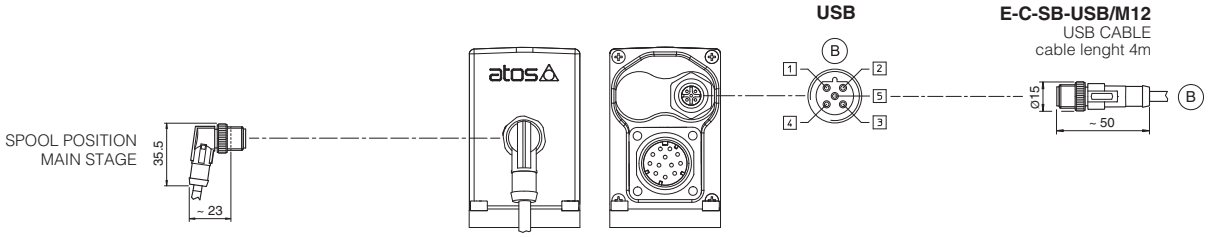
Note: pin layout always referred to driver's view

17.5 LEB connections layout

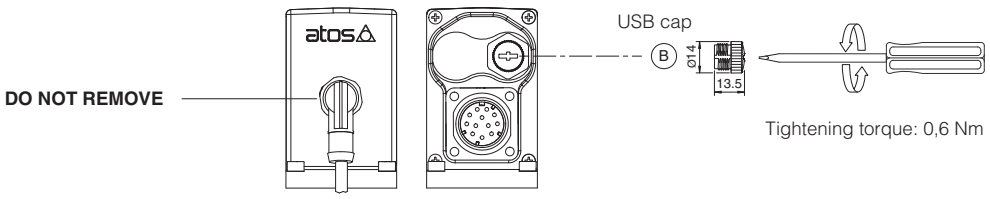
MAIN CONNECTORS



TRANSDUCER AND USB CONNECTOR

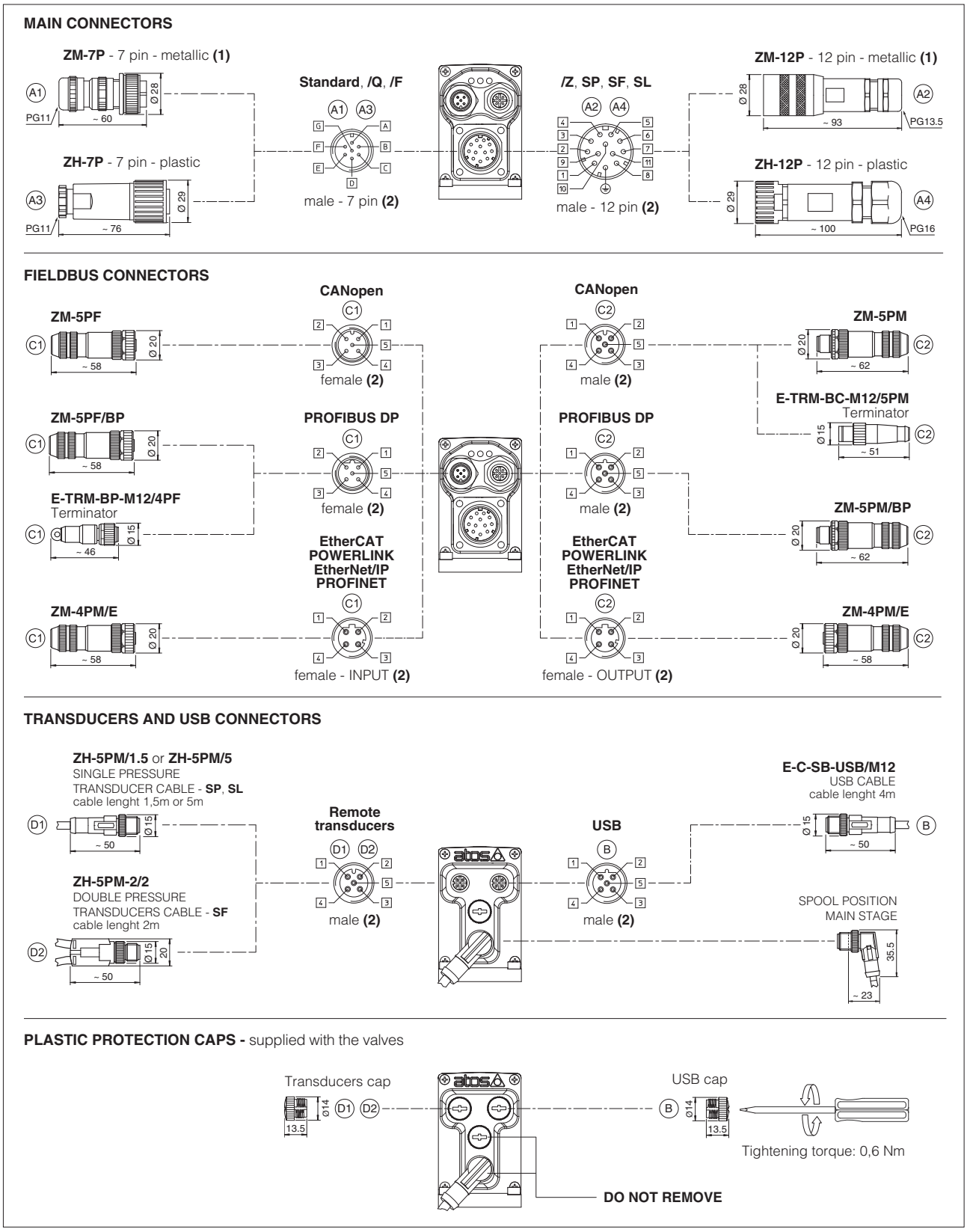


PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

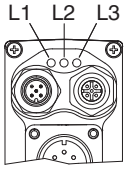
17.6 LES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.7 Diagnostic LEDs - only for LES

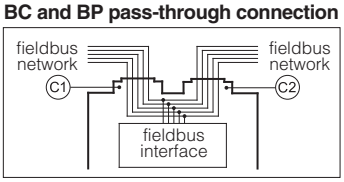
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500** **(2)** Internally terminated

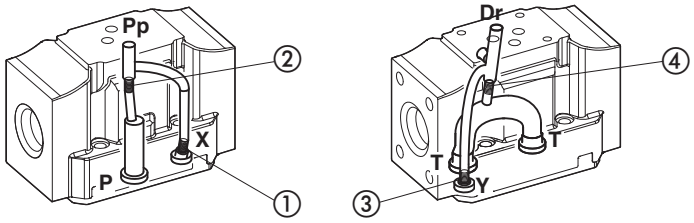
19.4 Pressure/Force transducer connectors - only for **SP, SF, SL**

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

20 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

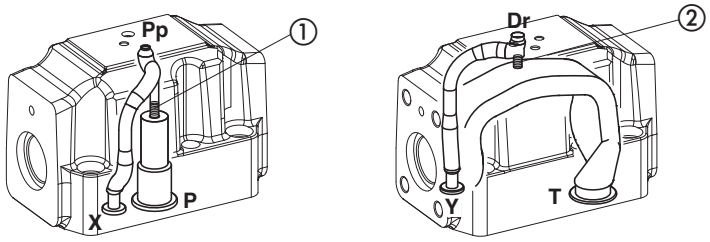
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain.

DPZO-1 **Pilot channels** **Drain channels**



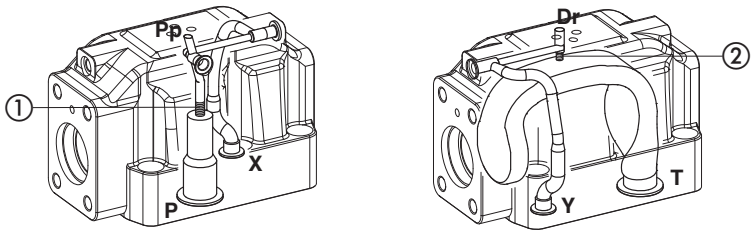
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels** **Drain channels**



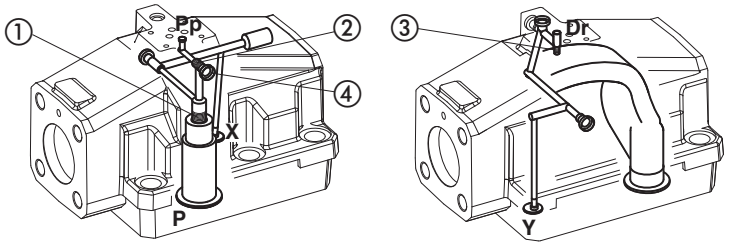
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels** **Drain channels**



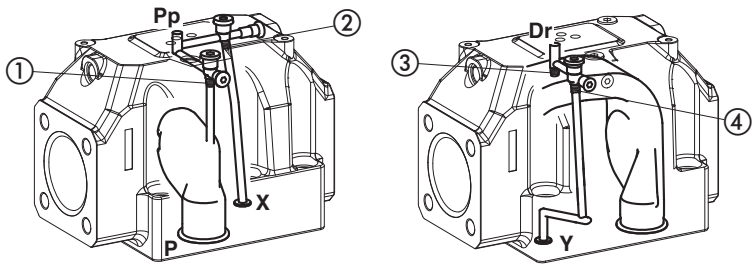
Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels** **Drain channels**



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-8 **Pilot channels** **Drain channels**



Internal piloting: Without plug ①;
External piloting: Add NPTF 1/8 in pos ①;
plug NPTF 1/8 in pos ②;
Internal drain: Without plug NPTF 1/8 in pos ③;
Add plug NPTF 1/8 in pos ④;
External drain: Add plug NPTF 1/8 in pos ③.

21 FASTENING BOLTS AND SEALS

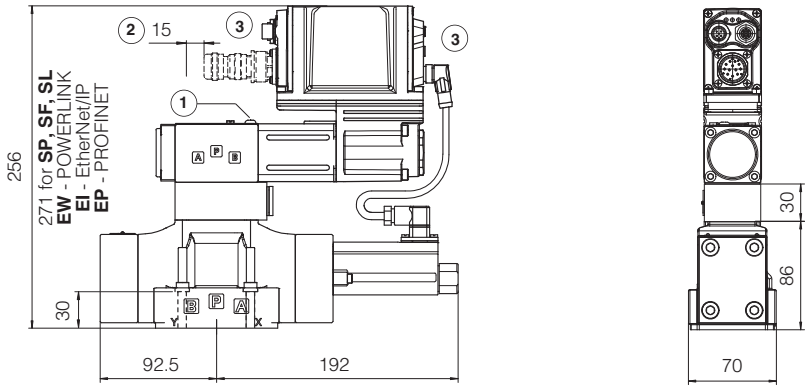
Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156; Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

22 INSTALLATION DIMENSIONS [mm]

DPZO-LEB-*-1
DPZO-LES-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

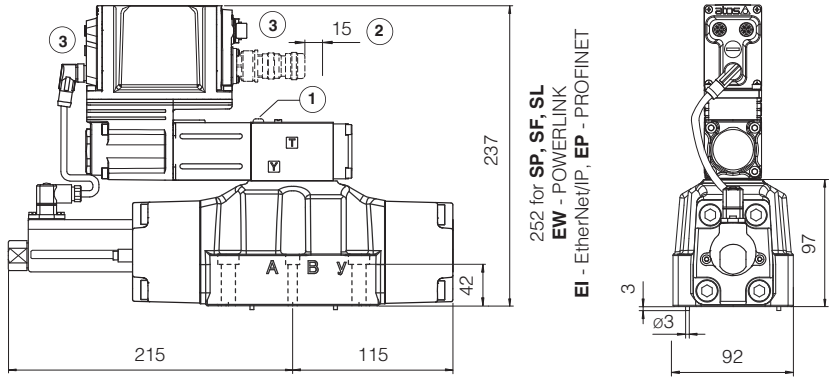
Mass [kg]	
DPZO-*-1	9,5



DPZO-LEB-*-2
DPZO-LES-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-*-2	14



(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

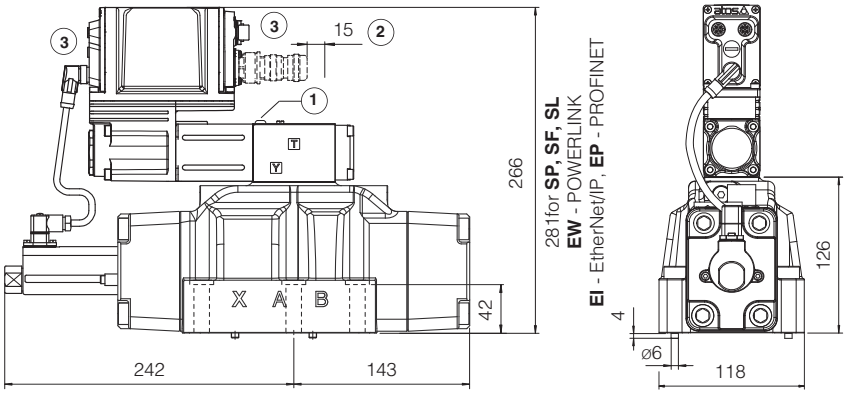
DPZO-LEB-*-4
DPZO-LES-*-4

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

DPZO-LEB-*-4M
DPZO-LES-*-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm

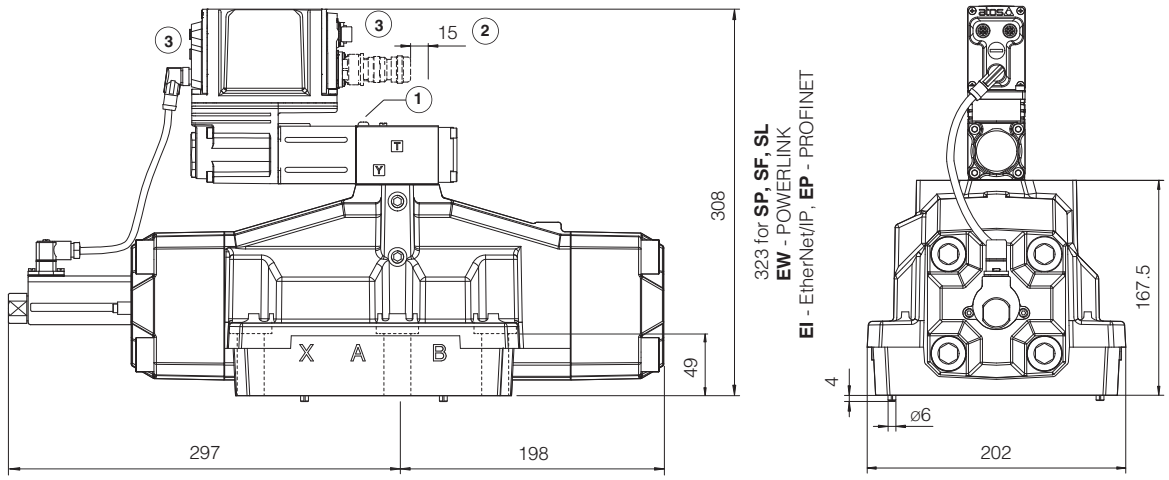
Mass [kg]	
DPZO-*-4	19



DPZO-LEB-*-6
DPZO-LES-*-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-6	43



(1) = Air bleeding 3

(2) = Space to remove the connectors

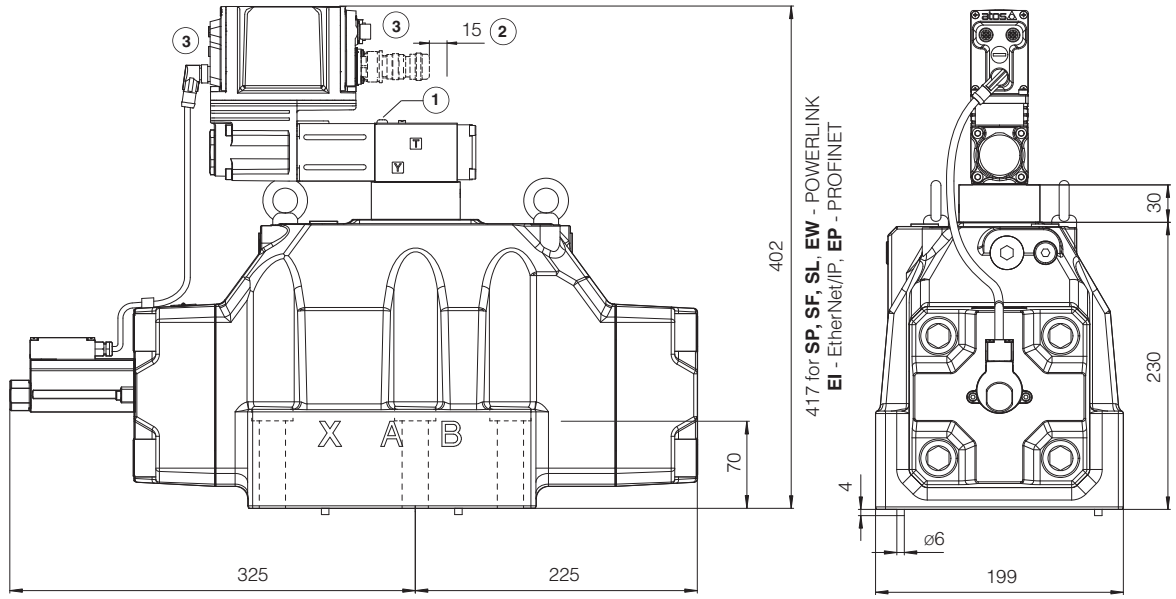
(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

DPZO-LEB-*-8
DPZO-LES-*-8

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-8	80



(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

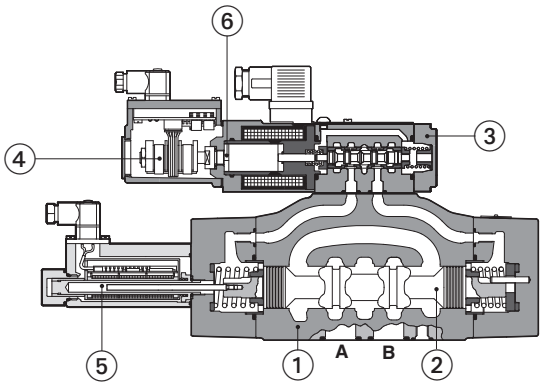
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS900	Operating and maintenance information for proportional valves
FY100	Safety proportional valves - option /U
FY200	Safety proportional valves - option /K
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB320	Quickstart for LEB valves commissioning
QF320	Quickstart for LES valves commissioning
Y010	Basics for safety components

Proportional directional valves **high performance**

piloted, with two LVDT transducers and positive spool overlap



DPZO-L-271

① Valve body
② Main stage Spool
③ Pilot valve
④ Pilot valve LVDT transducer
⑤ Main stage LVDT transducer
⑥ Pilot valve solenoid

DPZO-L

Proportional directional valves, piloted, with two LVDT position transducers and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

The valves operate in association with digital off-board divers, see section [3].

The two LVDT transducers (pilot and main stage) grant very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs

Spools regulation characteristics:
L = linear
S = progressive for fine low flow control
D and DL = differential, for control of actuators with area ratio 1:2
D9 and L9 = for regenerative circuit
Q5 and V9 = for alternate P/Q control

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1600 l/min**
Max pressure: **350 bar**

[1] MODEL CODE OF STANDARD SPOOLS

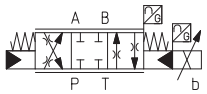
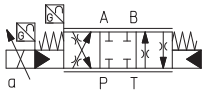
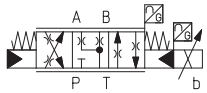
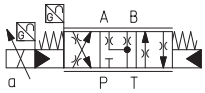
DPZO	-	L	-	2	71	-	L	5	/	*	*	/	*

DPZO: Proportional directional valve, piloted

L = two LVDT transducers

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32

Configuration:

	Standard	Option **/B**
71 =		
73 =		

Spool type, regulating characteristics **(1)**:

L =  linear

S =  progressive

DL =  differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

D =  differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Hydraulic options (2):
B = solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Seals material, see section [7]:
- = NBR
PE = FKM
BT = HNBR

Series number

Spool size:

	3 (L,S,D)	**5** (L,DL,S,D)	**5** (L,S,D)
DPZO-1 =	-	100	-
DPZO-2 =	160	250	-
DPZO-4 =	-	480	-
DPZO-4M =	-	550	-
DPZO-6 =	-	-	640

Nominal flow (l/min) at Δp 10bar P-T

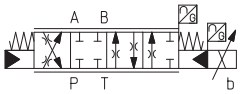
(1) Spools for regenerative circuit or alternated P/Q control, see section [2]
(2) All combination possible

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT OR ALTERNATED P/Q CONTROL - for valve model code and options, see sect. 1

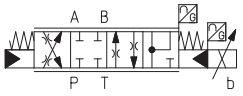
DPZO	-	L	-	2	71 - L9	/	*	*	/	*

Configuration and spool for regenerative circuit:

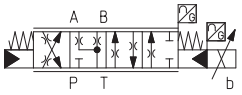
71-D9



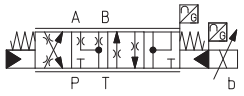
71-L9



73-D9

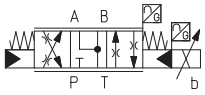


73-L9

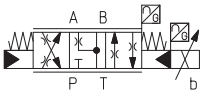


Configuration and spool for alternated P/Q control:

73-Q5



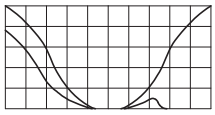
73-V9



Spool size:	**D9**	**L9**	**V9**	**Q5**
DPZO-1 =	100	-	100	100
DPZO-2 =	250	250	250	250
DPZO-4 =	480	-	480	480
DPZO-4M =	550	-	550	550
DPZO-6 =	-	-	640	-

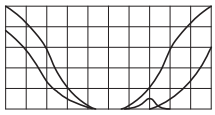
Nominal flow (l/min) at Δp 10bar P-T

D9



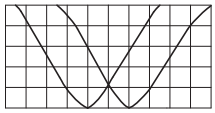
For regenerative circuit (additional external check valve required)
see 8.1 - diagram 26

L9



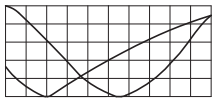
For regenerative circuit internal to the valve
see 8.1 - diagram 27

Q5



For alternated P/Q control
see 8.1 - diagram 28

V9



For alternated P/Q control of injection cycle in plastic machinery
see 8.1 - diagram 29

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LID	E-BM-LEB	E-BM-LES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-L-1	DPZO-L-2		DPZO-L-4	DPZO-L-4M	DPZO-L-6
Pressure limits [bar]		ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;					
Spool type	standard	**L5, DL5, S5, D5**	**L3, S3, D3**	**L5, DL5, S5, D5**			**L5, S5, D5**
	regenerative or P/Q	**D9, V9, Q5**		**D9, L9, V9, Q5**	**D9, V9, Q5**		**V9**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	100	160	250	480	550	640
	Δp= 30 bar	160	270	430	830	950	1100
Max permissible flow [l/min]		180	400	550	1000	1100	1600
Piloting pressure [bar]		min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)					
Piloting volume [cm³]		1,4	3,7		9,0	11,3	21,6
Piloting flow **(2)** [l/min]		1,7	3,7		6,8	8	14,4
Leakage **(3)** Pilot [cm³/min]		100 / 300	100 / 300		200 / 500	200 / 600	900 / 2800
	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	0,3 / 1,0	1,0 / 3,0
Response time **(4)** [ms]		≤ 50	≤ 60		≤ 80	≤ 85	≤ 90
Hysteresis		≤ 0,1 [% of max regulation]					
Repeatability		± 0,1 [% of max regulation]					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 8.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal see detailed diagrams in section 8.3

6 ELECTRICAL CHARACTERISTICS

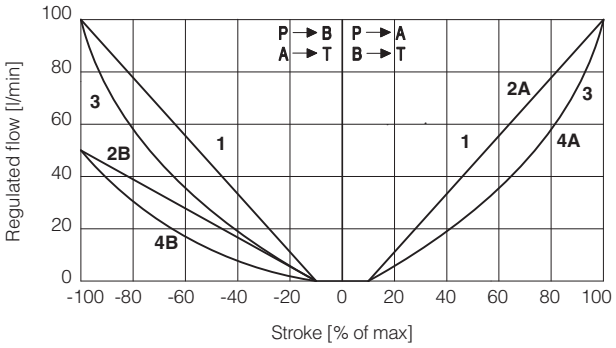
Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

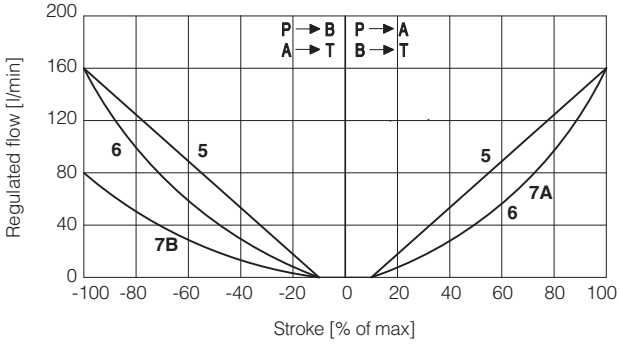
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

8 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

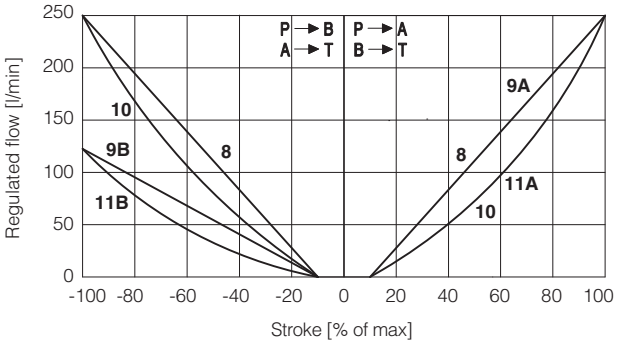
8.1 Regulation diagrams (values measure at Δp 10 bar P-T)



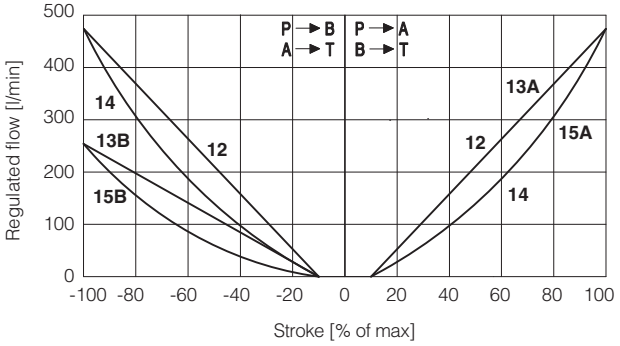
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T)
4A = D5 (P → A, A → T)
4B = D5 (P → B, B → T)



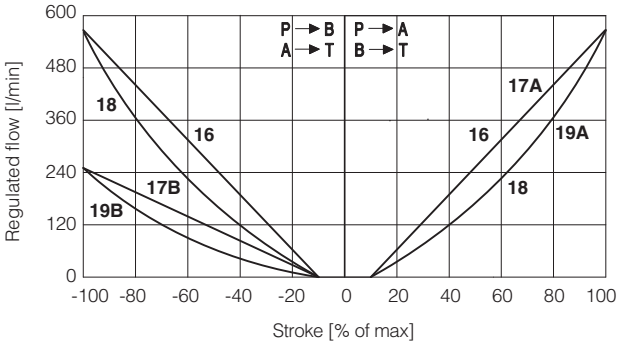
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



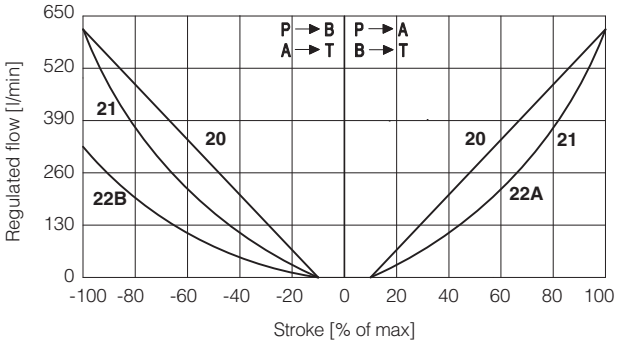
DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T)
11A = D5 (P → A, A → T)
11B = D5 (P → B, B → T)



DPZO-4:
12 = L5 **13A** = DL5 (P → A, A → T)
14 = S5 **13B** = DL5 (P → B, B → T)
15A = D5 (P → A, A → T)
15B = D5 (P → B, B → T)



DPZO-4M:
16 = L5 **17A** = DL5 (P → A, A → T)
18 = S5 **17B** = DL5 (P → B, B → T)
19A = D5 (P → A, A → T)
19B = D5 (P → B, B → T)



DPZO-6:
20 = L5 **22A** = D5 (P → A, A → T)
21 = S5 **22B** = D5 (P → B, B → T)

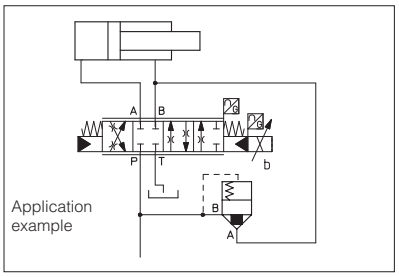
Note:
Hydraulic configuration vs. reference signal (standard and option /B)

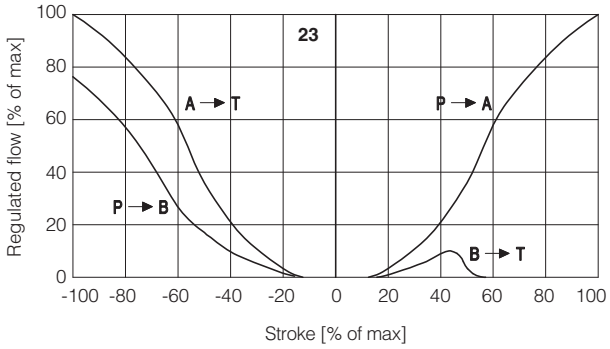
Reference signal $\left.\begin{matrix}0 \div +10\ V\\ 12 \div 20\ mA\end{matrix}\right\}$ P → A / B → T

Reference signal $\left.\begin{matrix}0 \div -10\ V\\ 12 \div 4\ mA\end{matrix}\right\}$ P → B / A → T

23 = differential - regenerative spool **D9**
(not available for valve size 32 and 35)

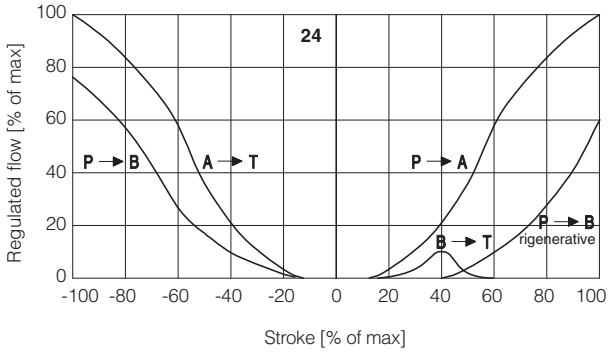
D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.





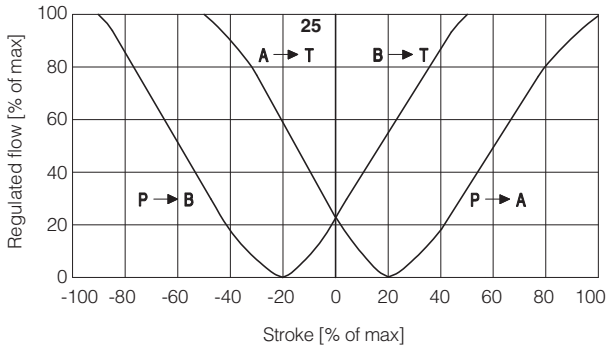
24 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



25 = linear spool **Q5**
(not available for valve size 32 and 35)

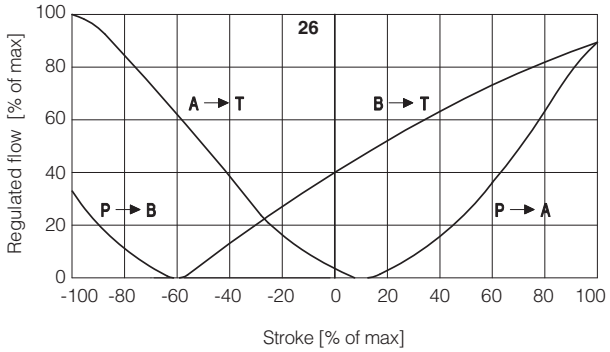
Q5 spool type is specific for alternate P/Q controls in combination with /S* option of digital integral drivers, (see tech. table **FS500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



26 = differential - progressive spool **V9**

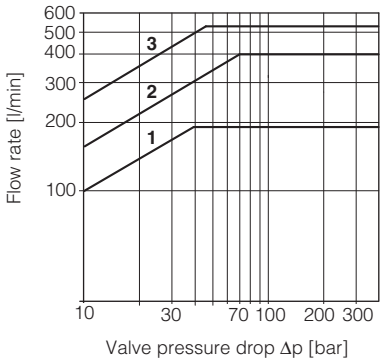
V9 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**).
This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

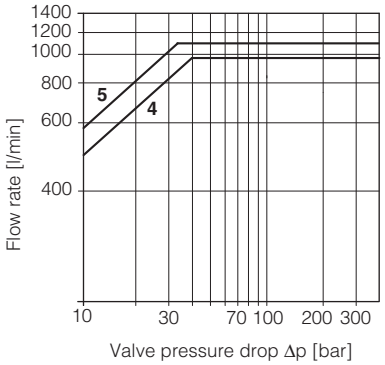
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank

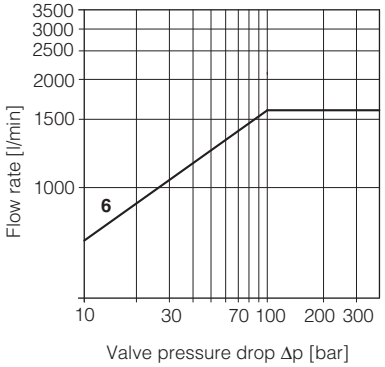


8.2 Operating diagrams

Flow /Δp diagram
stated at 100% of spool stroke







DPZO-1:
1 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9, V9, Q5

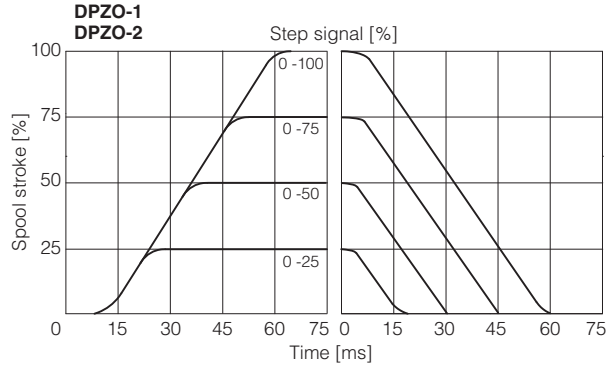
DPZO-4:
4 = spools L5, S5, D5, DL5, D9, V9, Q5

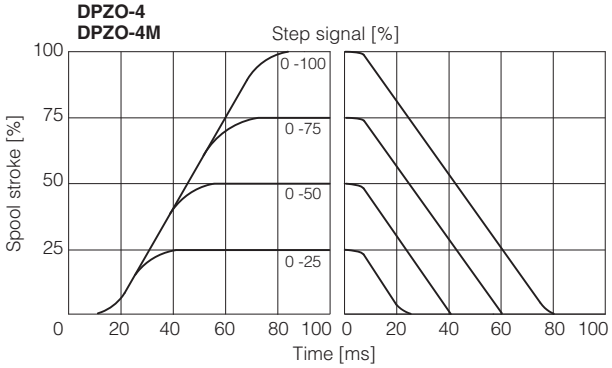
DPZO-4M:
5 = spools L5, S5, D5,DL5, D9, V9, Q5

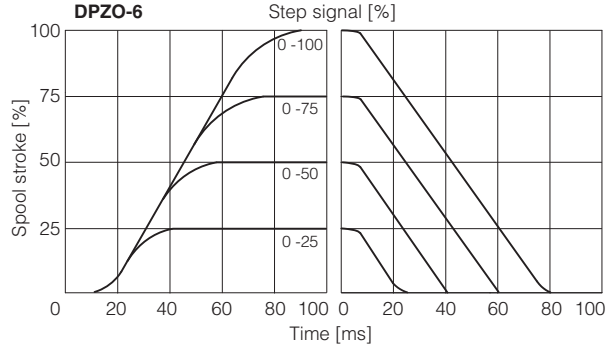
DPZO-6:
6 = L5, S5, D5, V9

8.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.







9 HYDRAULIC OPTIONS

B = Solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 8.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.

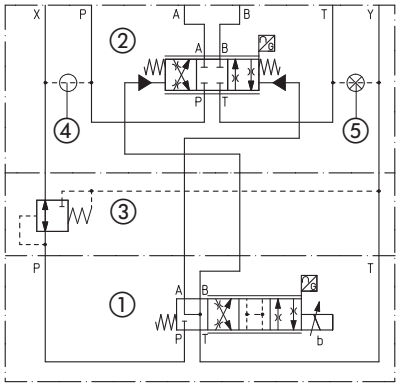
G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = **28 bar**

DPZO-1, DPZO-4(M) and DPZO-6 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

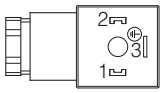
Functional Scheme - example of configuration 71



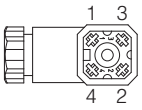
① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

10 ELECTRICAL CONNECTION

10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

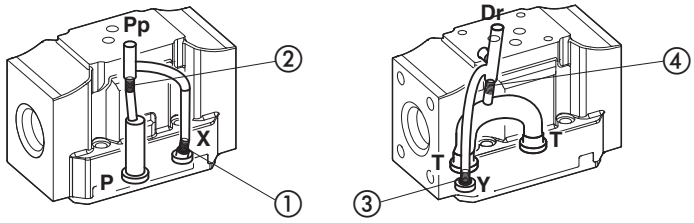
11 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

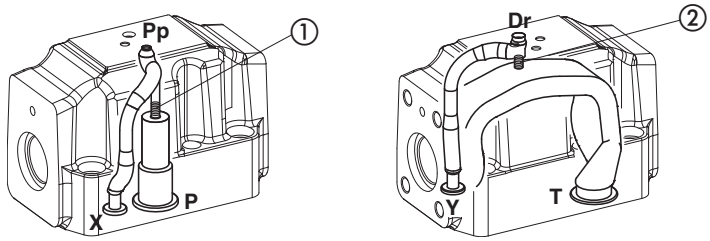
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain.

DPZO-1 **Pilot channels** **Drain channels**



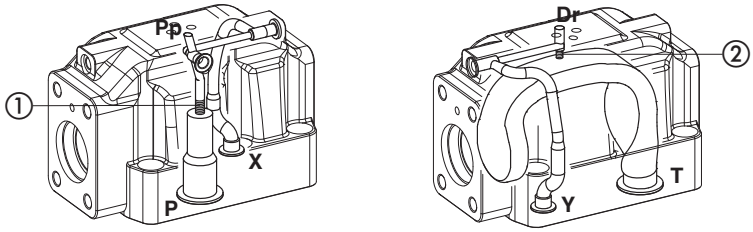
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels** **Drain channels**



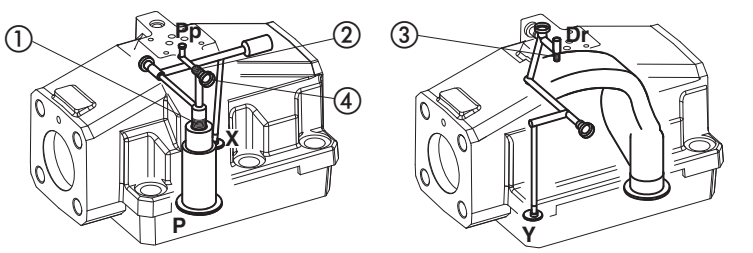
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels** **Drain channels**



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels** **Drain channels**

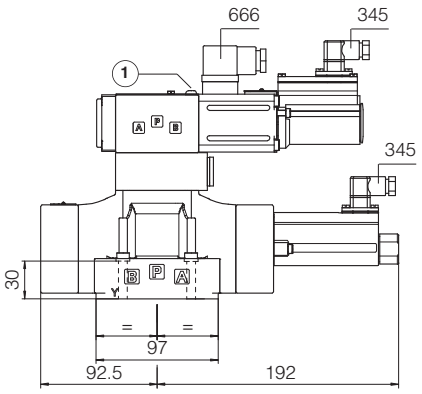


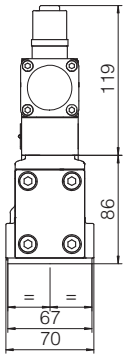
Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-L-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-L-1	9



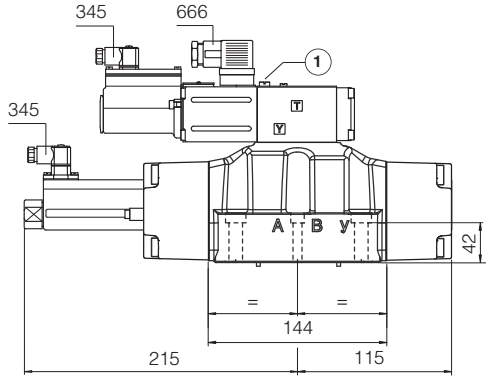


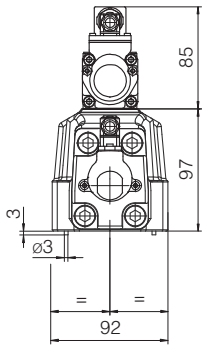
1 = Air bleeding 3

DPZO-L-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-L-2	13,5





1 = Air bleeding 3

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

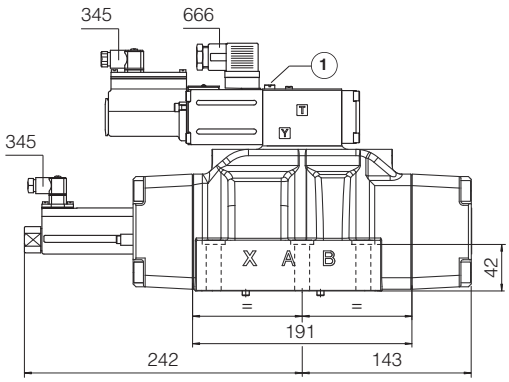
DPZO-L-4

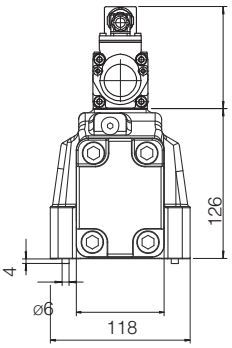
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

Mass [kg]	
DPZO-L-4	17,5

DPZO-L-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm



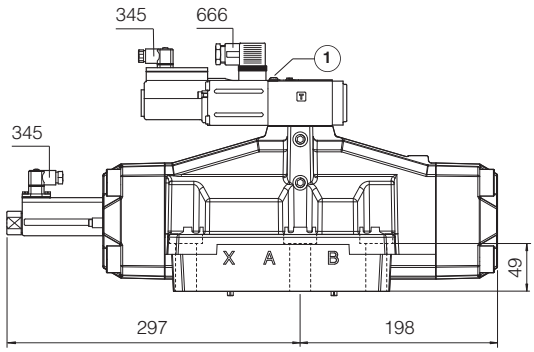


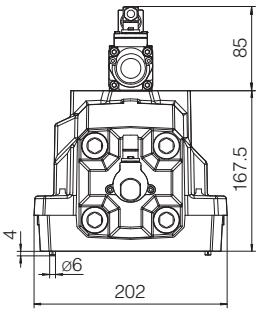
(1) = Air bleeding 3

DPZO-L-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-L-6	42,5





(1) = Air bleeding 3

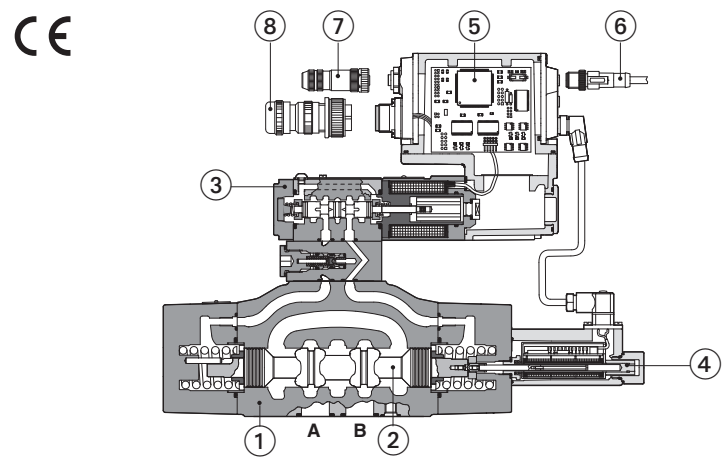
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
GS230	E-BM-LEB digital driver	**K800**	Electric and electronic connectors
GS235	E-BM-LID digital driver	**P005**	Mounting surfaces for electrohydraulic valves
GS240	E-BM-LES digital driver		

Digital proportional directional valves

piloted, with on-board driver, LVDT transducer and positive spool overlap



DPZO-TES-SN-BP-251

① Valve body
② Main stage Spool
③ Pilot valve
④ Main stage LVDT transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector

DPZO-TEB, DPZO-TES

Digital proportional directional valves, piloted, specifically designed for directional and speed controls.

They are equipped with one LVDT position transducer (main stage) and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

TEB basic execution with analog reference signals and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1600 l/min**
Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

DPZO	-	TES	-	SN	-	NP	-	2	71	-	L	5	/	*	*	/	*

DPZO: Proportional directional valve, piloted

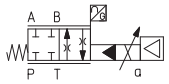
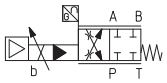
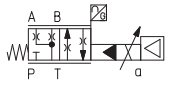
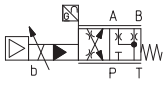
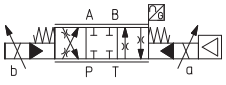
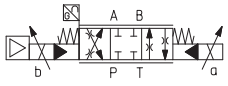
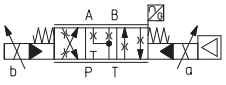
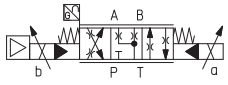
TES: **TEB** = basic on-board digital driver **(1)**; **TES** = full on-board digital driver

SN: **Alternated P/Q controls**: **SN** = none

NP: **Fieldbus interfaces,** USB port always present: **NP** = Not present; **BC** = CANopen; **BP** = PROFIBUS DP; **EH** = EtherCAT; **EW** = POWERLINK; **EI** = EtherNet/IP; **EP** = PROFINET RT/IRT

2: **Valve size** ISO 4401: **1** = 10 **2** = 16 **4** = 25 **6** = 32

71: **Configuration**:

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

L: **Seals material,** see sect. 10: **-** = NBR; **PE** = FKM; **BT** = HNBR

Series number

Hydraulic options (2):
B = solenoid with on-board digital driver and LVDT transducer at side of port A of the main stage (side B of pilot valve)
D = internal drain
E = external pilot pressure

Electronics options (2):
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

Safety options TÜV certified - only **TES (2)**:
U = safe double power supply
K = safe on/off signals
See section 6

SAFETY CERTIFIED

Spool size:	**3** (L,S,D)	**5** (L,DL,S,D)	**5** (L,S,D)
DPZO-1 =	-	100	-
DPZO-2 =	160	250	-
DPZO-4 =	-	480	-
DPZO-6 =	-	-	640

Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics **(4)**:


L linear


DL differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q


S progressive


D differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

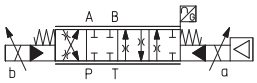
(1) Only in version **SN-NP**
(2) For possible combined options, see section 14
(3) Double power supply only for **TES**
(4) Spools for regenerative circuit , see section 2

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1

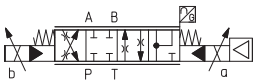
DPZO	-	TES	-	SN	-	NP	-	2	71 - L9	/	*	*	/	*

Configuration and spool:

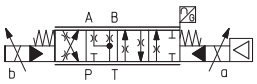
71-D9



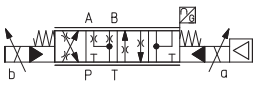
71-L9



73-D9



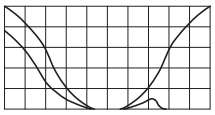
73-L9



Spool size:		**D9**	**L9**
DPZO-1	=	100	-
DPZO-2	=	250	250
DPZO-4	=	480	-

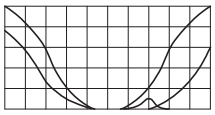
Nominal flow (l/min) at Δp 10bar P-T

D9



For regenerative circuit (additional external check valve required)
see 11.1 - diagram 19

L9



For regenerative circuit internal to the valve
see 11.1 - diagram 20

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

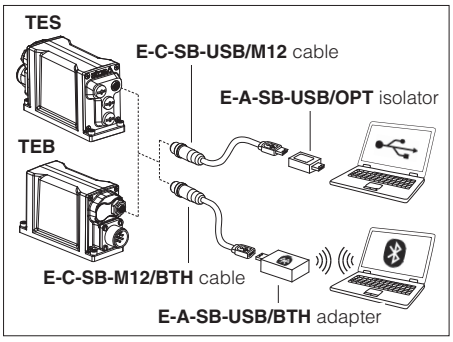
4 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

USB or Bluetooth connection



WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for **TES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 SAFETY OPTIONS - only for **TES**

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** , designed to accomplish a safety function, intended to reduce the risk in process control systems.
They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-*-1	DPZO-*-2		DPZO-*-4	DPZO-*-6
Pressure limits [bar]		ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type	standard	**L5, DL5, S5, D5**	**L3, S3, D3**	**L5, DL5, S5, D5**		**L5, S5, D5**
	regenerative	**D9**		**D9, L9**	**D9**	
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	100	160	250	480	640
	Δp= 30 bar	160	270	430	830	1100
	Max permissible flow	180	400	550	1000	1600
Piloting pressure [bar]		min. = 25; max = 350				
Piloting volume [cm³]		1,4	3,7		9,0	21,6
Piloting flow **(2)** [l/min]		1,7	3,7		6,8	14,4
Leakage **(3)**	Pilot [cm³]	100 / 300	100 / 300		200 / 500	900 / 2800
	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time **(4)** [ms]		≤ 60	≤ 75		≤ 90	≤ 120
Hysteresis		≤ 1 [% of max regulation]				
Repeatability		± 0,5 [% of max regulation]				
Thermal drift		zero point displacement < 1% at ΔT = 40°C				

(1) For different Δp, the max flow is in accordance to the diagrams in section 11.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal see detailed diagrams in section 11.3

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

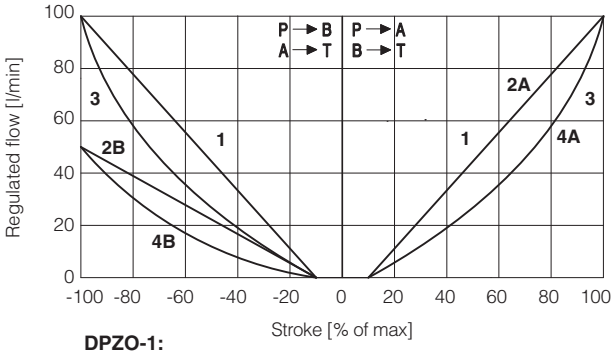
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

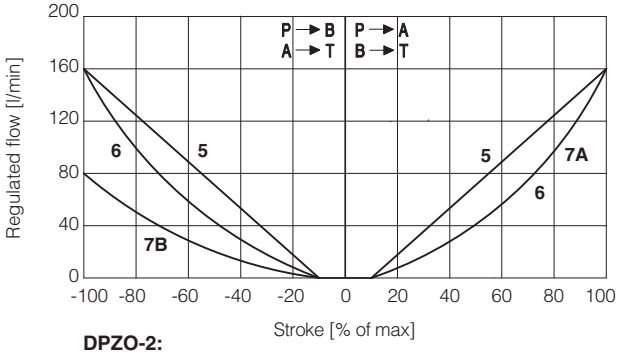
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog	
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5			
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**	
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922	
Flame resistant with water	NBR, HNBR	HFC		

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

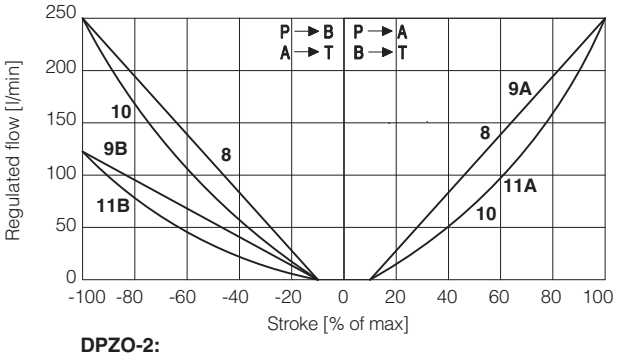
11.1 Regulation diagrams (values measure at p 10 bar P-T)



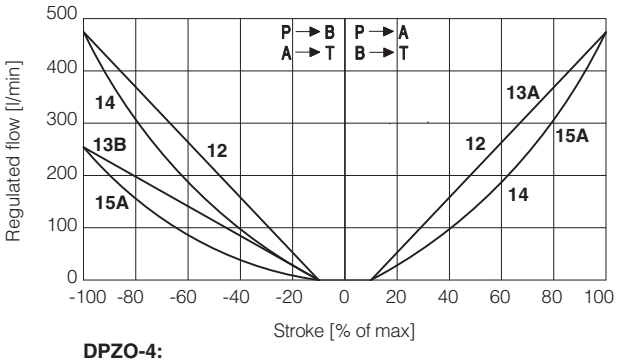
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T) **4A** = D5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T) **4B** = D5 (P → B, B → T)



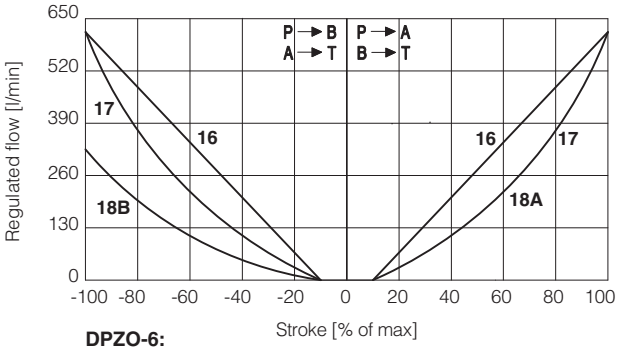
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T) **11A** = D5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T) **11B** = D5 (P → B, B → T)



DPZO-4:
12=L5 **13A**=DL5 (P → A, A → T) **15A**=D5 (P → A, A → T)
14=S5 **13B**=DL5 (P → B, B → T) **15B**=D5 (P → B, B → T)



DPZO-6:
16 = L5 **18A** = D5 (P → A, A → T)
17 = S5 **18B** = D5 (P → B, B → T)

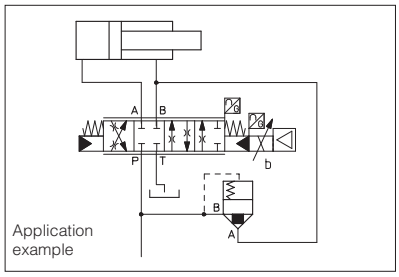
Note:
Hydraulic configuration vs. reference signal (standard and option /B)

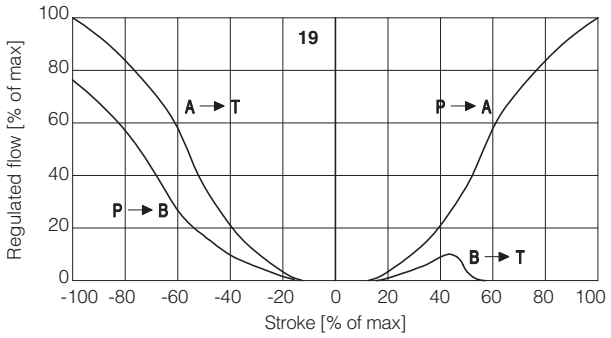
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

19 = differential - regenerative spool **D9**
(not available for valve size 32)

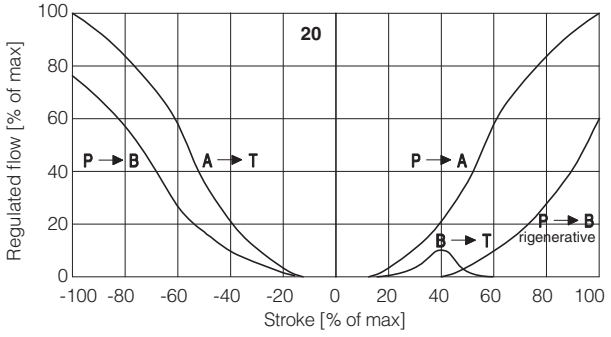
D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.





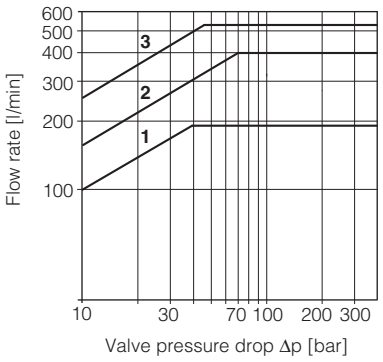
20 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.

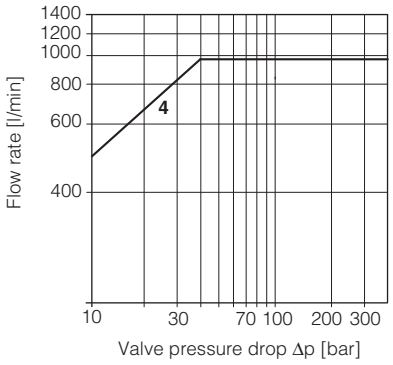


11.2 Operating diagrams

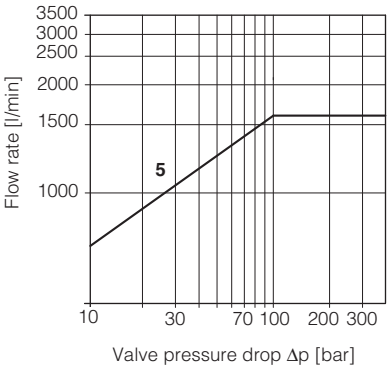
Flow /Δp diagram stated at 100% of spool stroke



DPZO-1:
1 = spools L5, S5, D5, DL5, D9
DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9



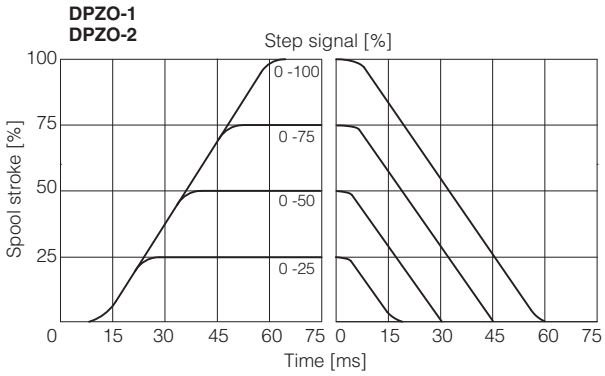
DPZO-4:
4 = spools L5, S5, D5, DL5, D9

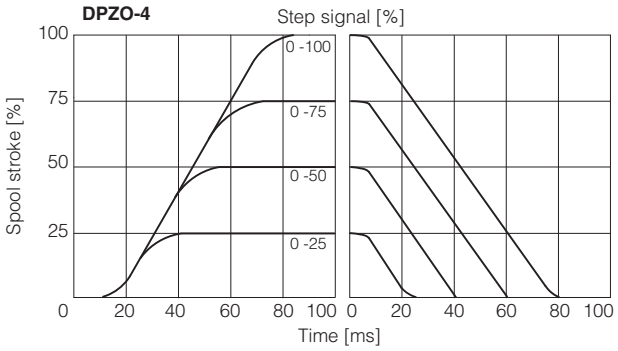


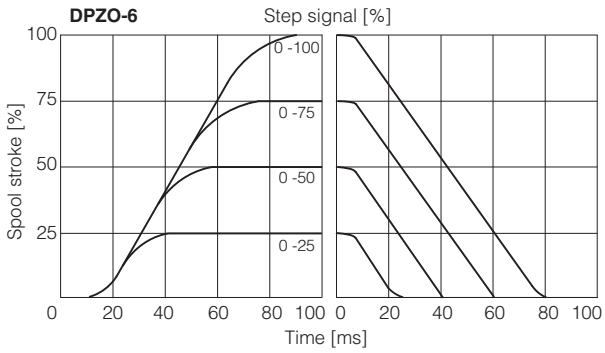
DPZO-6:
6 = L5, S5, D5

11.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.
For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

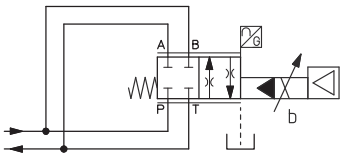






11.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar



DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min] Δp = 15 bar	320	860	1600	2200

12 HYDRAULIC OPTIONS

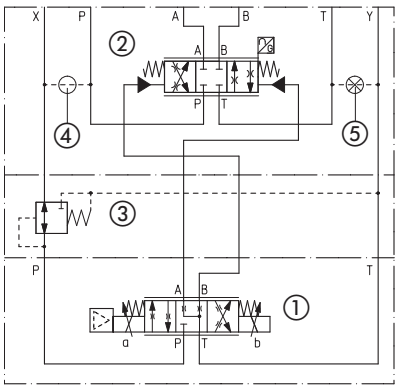
B = Solenoid, on-board digital driver and LVDT transducer at side of port A of the main stage (side B of pilot valve). For hydraulic configuration vs reference signal, see 12.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 19
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 19
The valve's standard configuration provides internal pilot and external drain.

① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

Functional Scheme - example of configuration 71



13 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 15.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 15.8)
Power supply for driver's logics and communication - only for **TES** (see 15.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

14 POSSIBLE COMBINED OPTIONS

Hydraulic options:
all combination possible

Electronics options - Standard versions:	**Electronics options** - Safety certified versions:
TEB-SN, **TES-SN**	**TES-SN**
/FI, /IQ, /IZ	/IU, /IK

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **TES** with **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Flow monitor output signal (Q_MONITOR) - not for **/F**

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

15.5 Enable input signal (ENABLE) - not for standard and **/F**

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.6 Repeat enable output signal (R_ENABLE) - only for **TEB** with **/Z** option

Repeat enable is used as output repeater signal of enable input signal (see 15.5).

15.7 Fault output signal (FAULT) - not for standard and **/Q**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16 ELECTRONIC CONNECTIONS AND LEDS

16.1 Main connector signals - 7 pin (A1) Standard, **/Q** and **/F** options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND / V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

16.2 Main connector signals - 12 pin (A2) **/Z** option

PIN	TEB /Z	TES /Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0 / VL0		Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND / VL0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**		Analog ground	Gnd - analog signal
		NC	Do not connect	
8	**R_ENABLE**		Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
9	**NC**		Do not connect	
		VL+	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**NC**		Do not connect	
		VL0	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT** referred to: V0 / VL0		Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

16.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

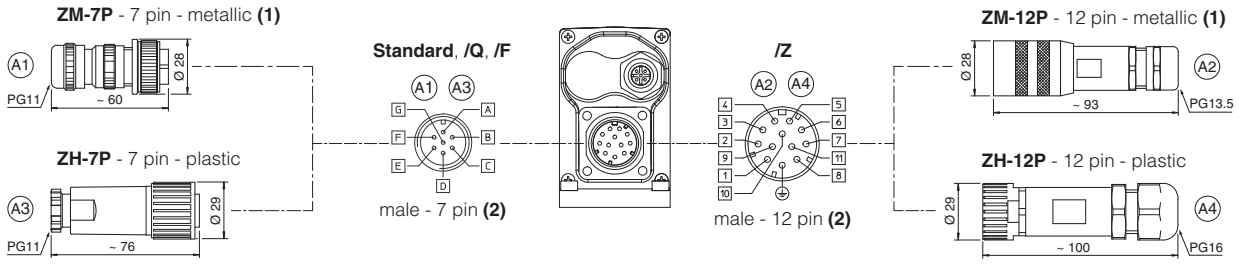
(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

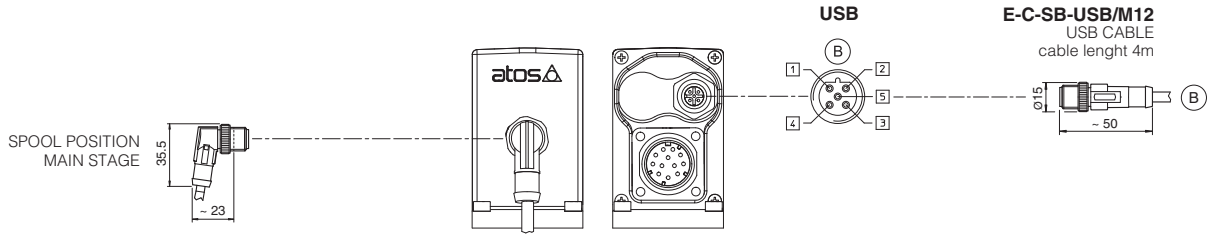
(2) Pin 2 can be fed with external +5V supply of CAN interface

16.4 TEB connections layout

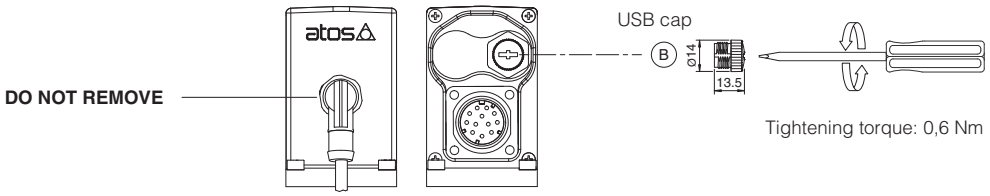
MAIN CONNECTORS



TRANSDUCER AND USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves

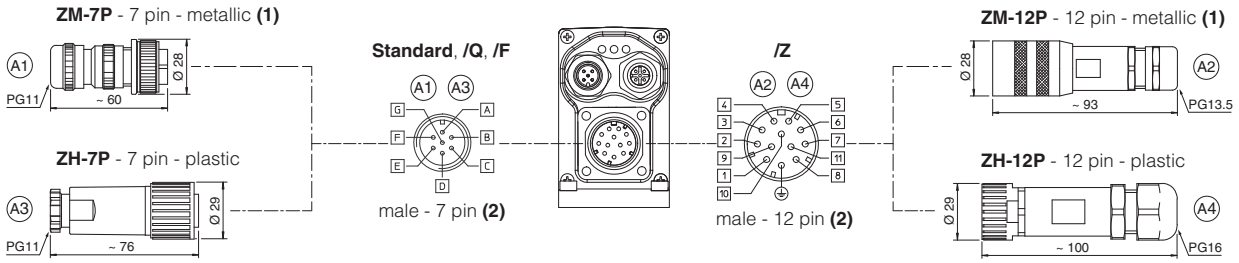


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

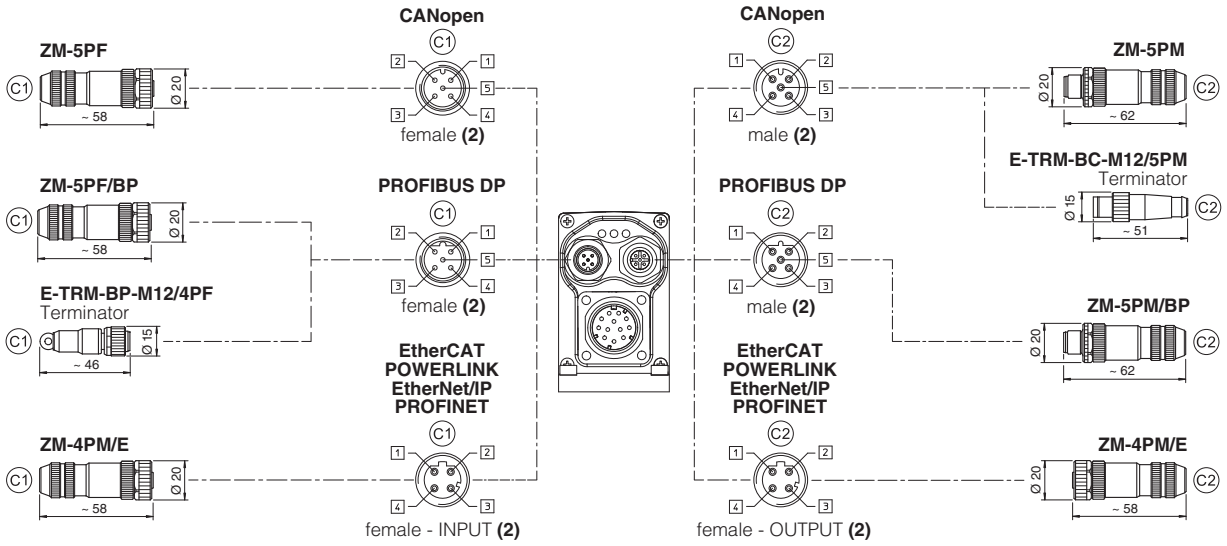
(2) Pin layout always referred to driver's view

16.5 TES connections layout

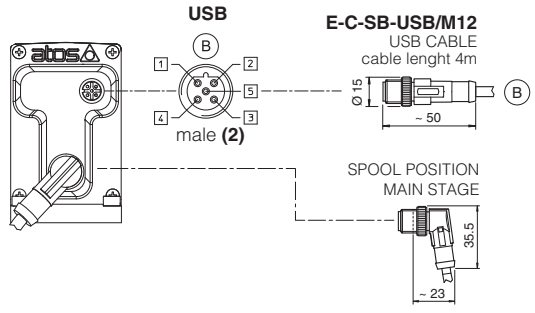
MAIN CONNECTORS



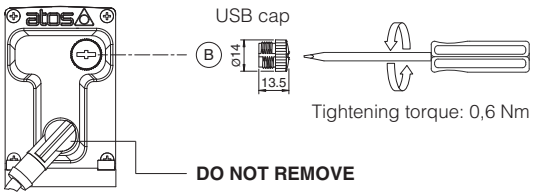
FIELDBUS CONNECTORS



TRANSDUCER AND USB CONNECTORS



PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

16.6 Diagnostic LEDs - only for **TES**

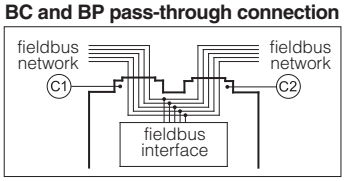
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

17 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

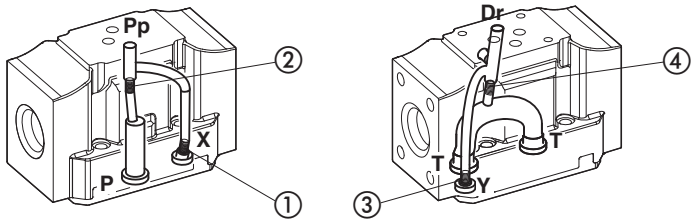
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

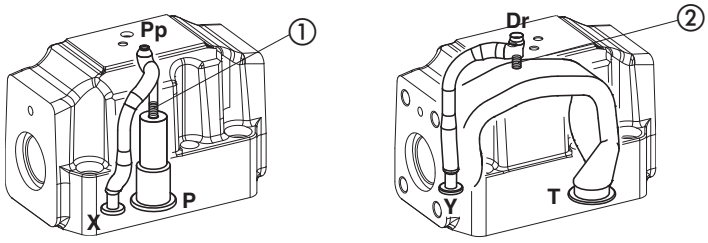
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZO-1 **Pilot channels** **Drain channels**



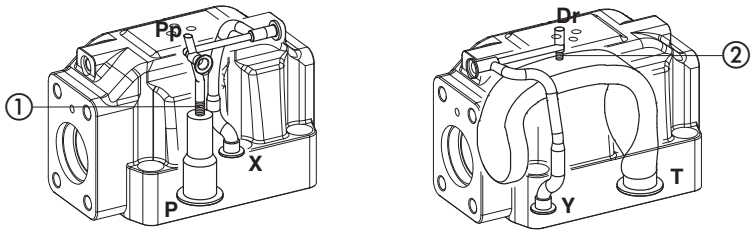
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels** **Drain channels**



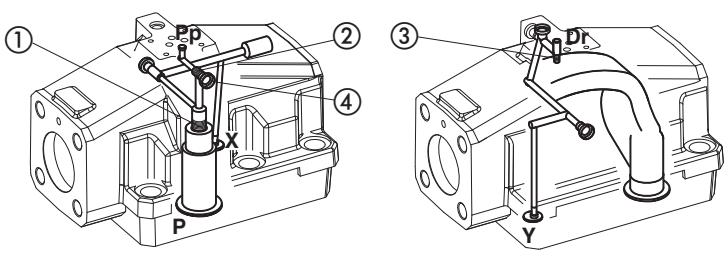
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels** **Drain channels**



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels** **Drain channels**

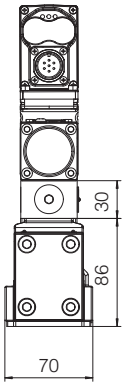


Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

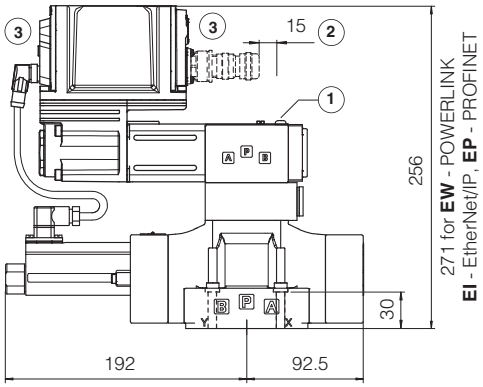
20 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

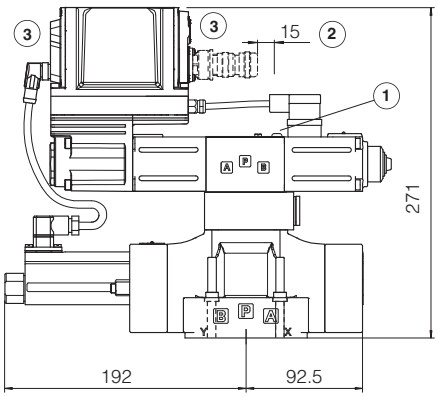
21 INSTALLATION DIMENSIONS [mm]



DPZO-TEB-*-15*
DPZO-TES-*-15*



DPZO-TEB-*-17*
DPZO-TES-*-17*



ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)

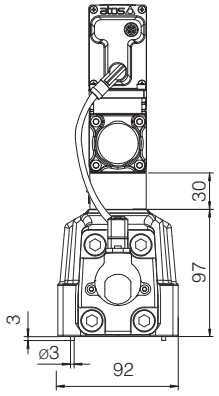
Mass [kg]	
DPZO-*-15	9
DPZO-*-17	9,8

(1) = Air bleeding 3

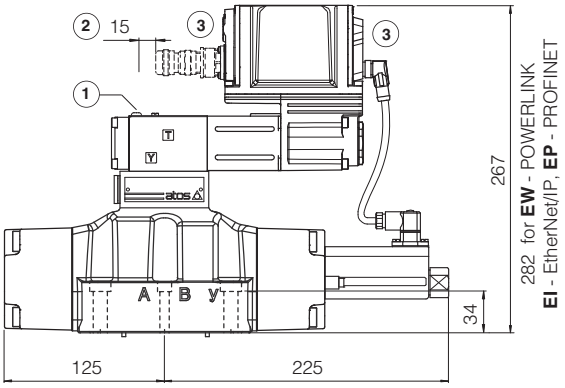
(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 16.4 and 16.5

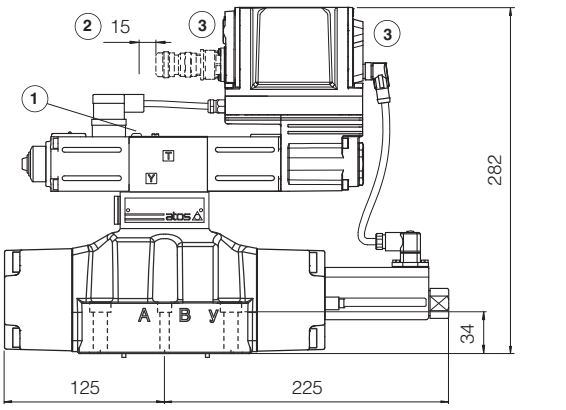
Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage



DPZO-TEB-*-25*
DPZO-TES-*-25*

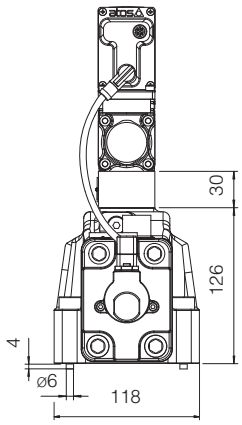


DPZO-TEB-*-27*
DPZO-TES-*-27*

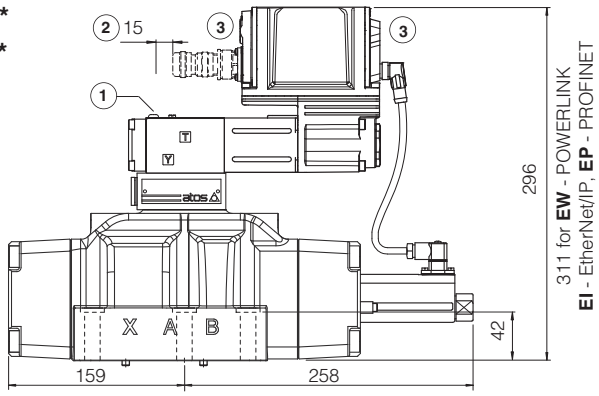


ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
(see table P005)

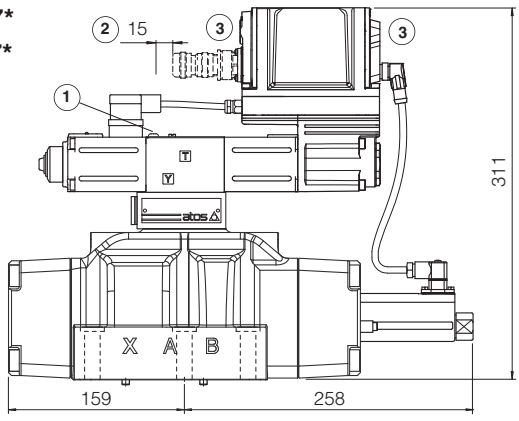
Mass [kg]	
DPZO-*-25	14
DPZO-*-27	14,8



DPZO-TEB-*-45*
DPZO-TES-*-45*



DPZO-TEB-*-47*
DPZO-TES-*-47*



ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
(see table P005)

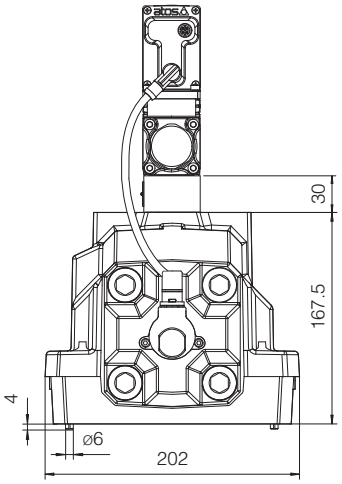
Mass [kg]	
DPZO-*-45	18,5
DPZO-*-47	19,3

(1) = Air bleeding 3

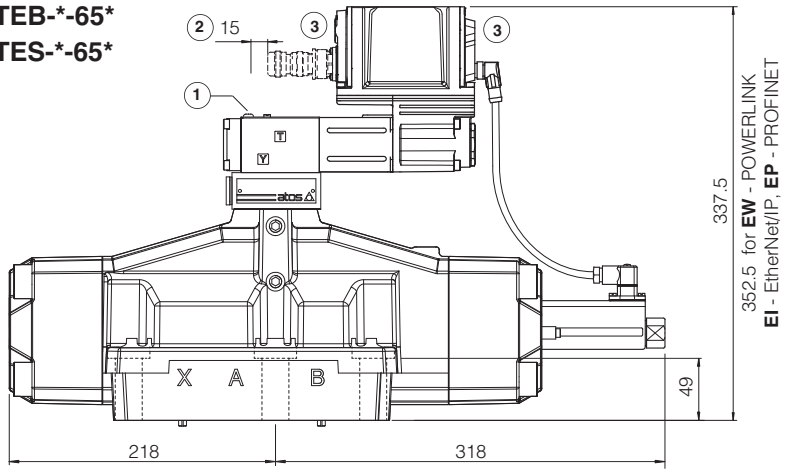
(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 16.4 and 16.5

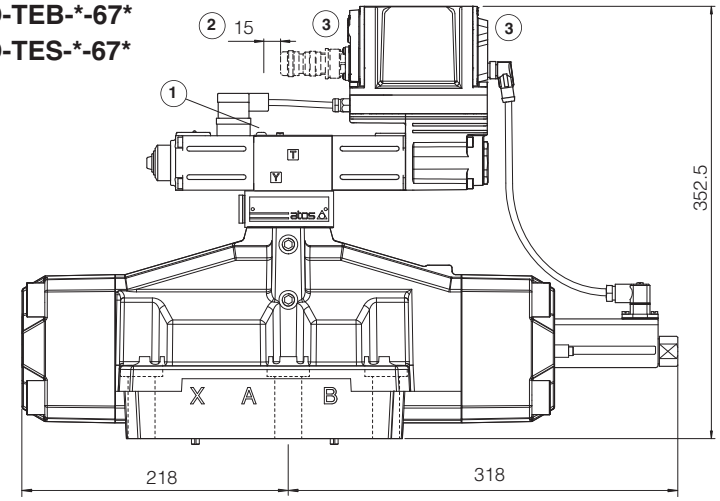
Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage



DPZO-TEB-*-65*
DPZO-TES-*-65*



DPZO-TEB-*-67*
DPZO-TES-*-67*



ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
(see table P005)

Mass [kg]	
DPZO-*-65	42,5
DPZO-*-67	43,3

(1) = Air bleeding  3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 16.4 and 16.5

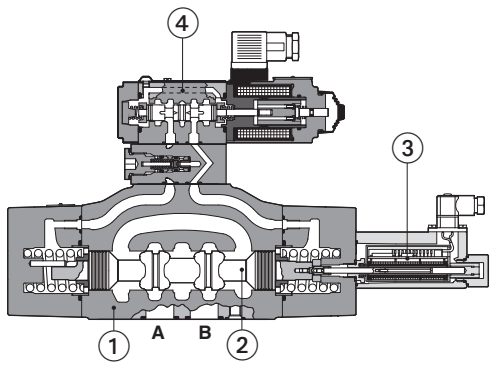
Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS900	Operating and maintenance information for proportional valves
FY100	Safety proportional valves - option /U
FY200	Safety proportional valves - option /K
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB320	Quickstart for LEB valves commissioning
QF320	Quickstart for LES valves commissioning
Y010	Basics for safety components

Proportional directional valves

piloted, with LVDT transducer and positive spool overlap



DPZO-T-251

① Valve body
② Main stage Spool
③ Main stage LVDT transducer
④ Pilot valve

DPZO-T

Proportional directional valves, piloted, with LVDT position transducer (main stage) and positive spool overlap for directional controls and not compensated flow regulations.

The valves operate in association with digital off-board divers, see section 3.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:
L = linear
S = progressive for fine low flow control
D and DL = differential-progressive, for control of actuators with area ratio 1:2
D9 and L9 = for regenerative circuit

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1600 l/min**
Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

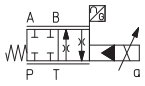
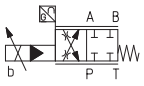
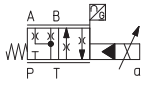
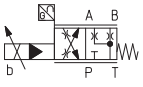
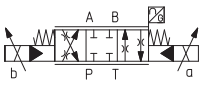
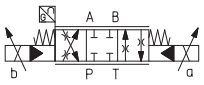
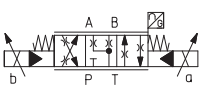
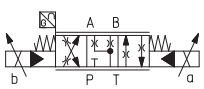
DPZO	-	T	-	2	71	-	L	5	/	*	*	/	*

DPZO: Proportional directional valve, piloted

T = with LVDT transducer

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration:

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid and LVDT transducer at side of port A of the main stage (side B of pilot valve)
D = internal drain
E = external pilot pressure

Spool size		**3** (L,S,D)	**5** (L,DL,S,D)	**5** (L,S,D)
DPZO-1	=	-	100	-
DPZO-2	=	160	250	-
DPZO-4	=	-	480	-
DPZO-6	=	-	-	640

Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics **(2)**:


L linear


DL differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q


S progressive


D differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

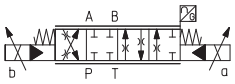
(1) All combination possible
(2) Spools for regenerative circuit, see section 2

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1

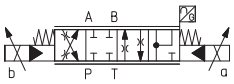
DPZO	-	T	-	2	71 - L9	/	*	*	/	*

Configuration and spool:

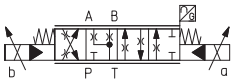
71-D9



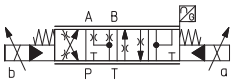
71-L9



73-D9



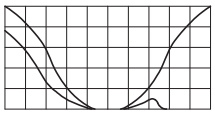
73-L9



Spool size:		**D9**	**L9**
DPZO-1	=	100	-
DPZO-2	=	250	250
DPZO-4	=	480	-

Nominal flow (l/min) at Δp 10bar P-T

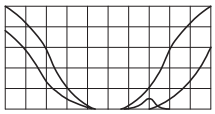
D9



For regenerative circuit (additional external check valve required)

see 11.1 - diagram 19

L9



For regenerative circuit internal to the valve

see 11.1 - diagram 20

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model			**DPZO-T-1**	**DPZO-T-2**		**DPZO-T-4**	**DPZO-T-6**
Pressure limits		[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type		standard	**L5, DL5, S5, D5**	**L3, S3, D3**	**L5, DL5, S5, D5**		**L5, S5, D5**
		regenerative	**D9**		**D9, L9**	**D9**	
Nominal flow Δp P-T **(1)**		[l/min]					
		Δp= 10 bar	100	160	250	480	640
		Δp= 30 bar	160	270	430	830	1100
		Max permissible flow	180	400	550	1000	1600
Piloting pressure		[bar]	min. = 25; max = 350				
Piloting volume		[cm³]	1,4	3,7		9,0	21,6
Piloting flow **(2)**		[l/min]	1,7	3,7		6,8	14,4
Leakage **(3)**		Pilot [cm³]	100 / 300	100 / 300		200 / 500	900 / 2800
		Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time **(4)**		[ms]	≤ 60	≤ 75		≤ 90	≤ 120
Hysteresis			≤ 1 [% of max regulation]				
Repeatability			± 0,5 [% of max regulation]				
Thermal drift			zero point displacement < 1% at ΔT = 40°C				

(1) For different Δp, the max flow is in accordance to the diagrams in section 8.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal see detailed diagrams in section 8.3

6 ELECTRICAL CHARACTERISTICS

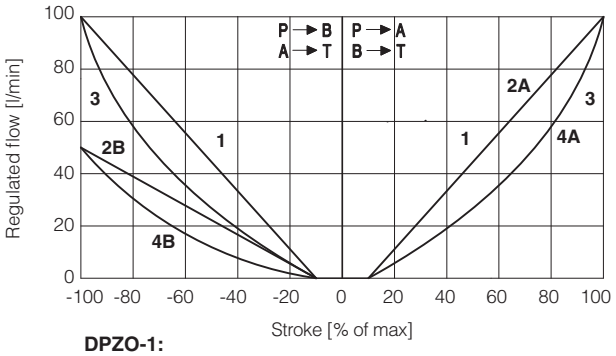
Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

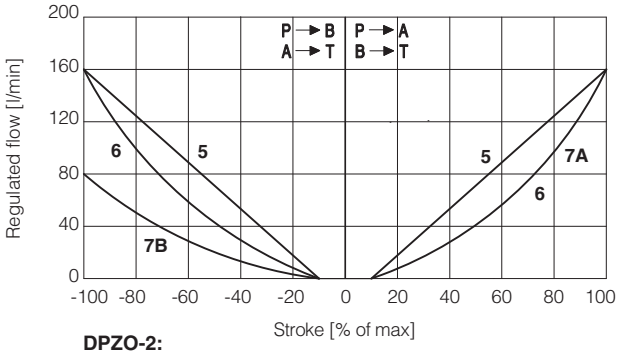
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

8 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

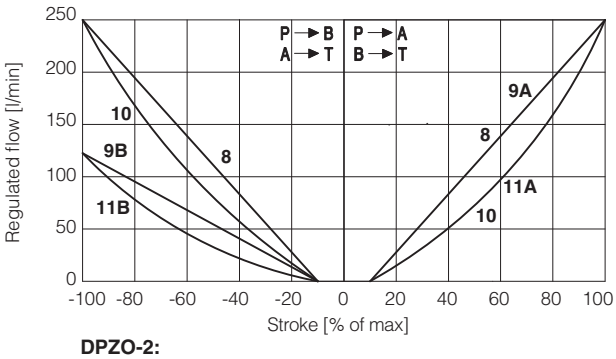
8.1 Regulation diagrams (values measure at p 10 bar P-T)



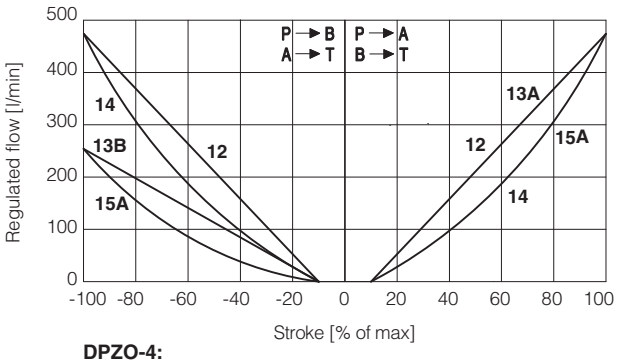
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T) **4A** = D5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T) **4B** = D5 (P → B, B → T)



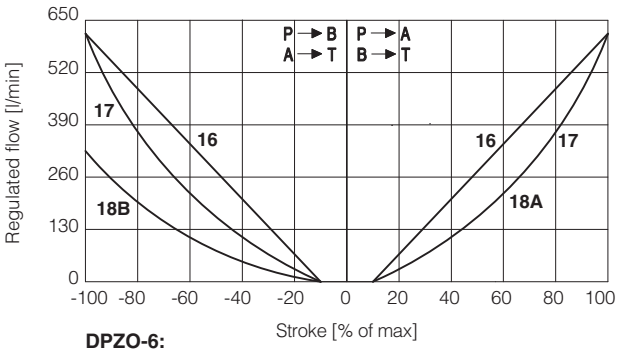
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T) **11A** = D5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T) **11B** = D5 (P → B, B → T)



DPZO-4:
12=L5 **13A**=DL5 (P → A, A → T) **15A**=D5 (P → A, A → T)
14=S5 **13B**=DL5 (P → B, B → T) **15B**=D5 (P → B, B → T)



DPZO-6:
16 = L5 **18A** = D5 (P → A, A → T)
17 = S5 **18B** = D5 (P → B, B → T)

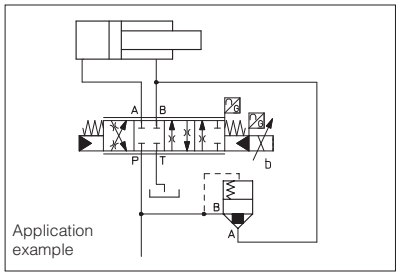
Note:
Hydraulic configuration vs. reference signal (standard and option /B)

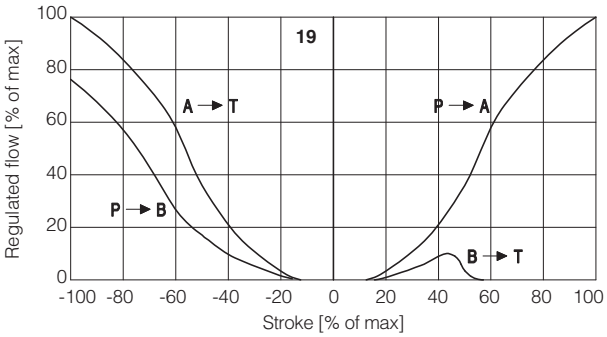
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

19 = differential - regenerative spool **D9**
(not available for valve size 32)

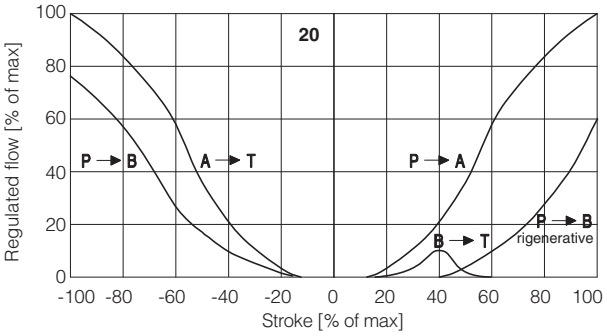
D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.





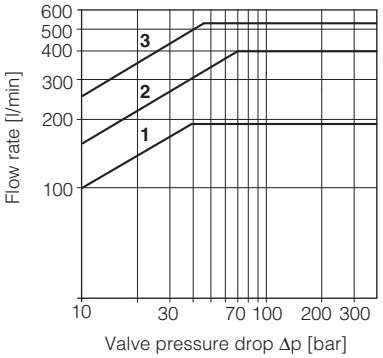
20 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



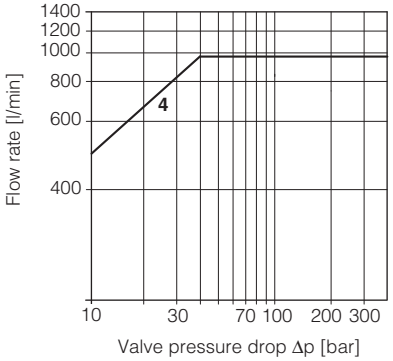
8.2 Operating diagrams

Flow /Δp diagram stated at 100% of spool stroke

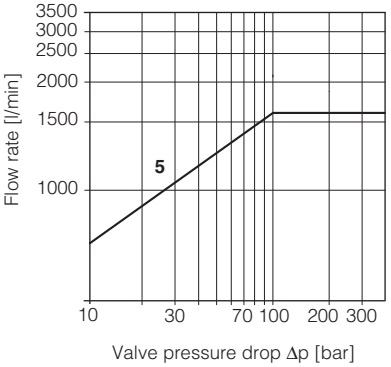


DPZO-1:
1 = spools L5, S5, D5, DL5, D9

DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9



DPZO-4:
4 = spools L5, S5, D5, DL5, D9

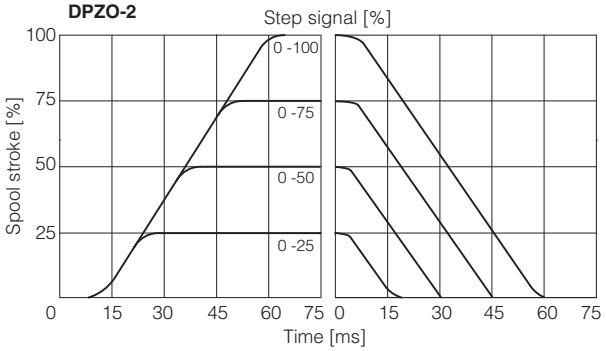


DPZO-6:
6 = L5, S5, D5

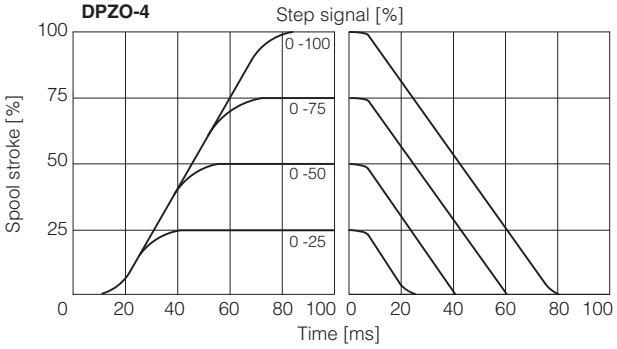
8.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.
For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

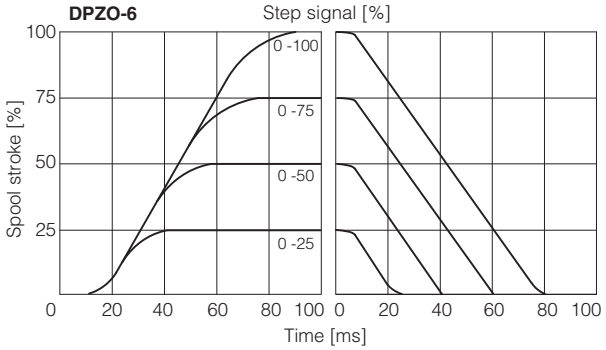
DPZO-1
DPZO-2



DPZO-4

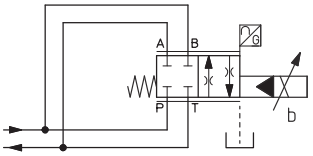


DPZO-6



8.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar



DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min] Δp = 15 bar	320	860	1600	2200

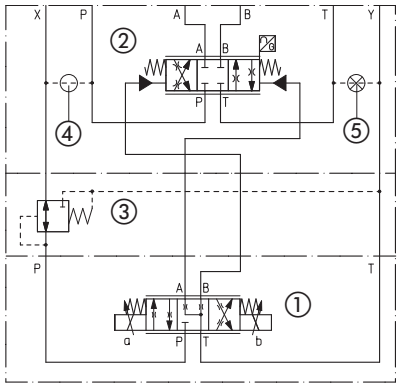
9 HYDRAULIC OPTIONS

B = Solenoid and LVDT transducer at side of port A of the main stage (side B of pilot valve). For hydraulic configuration vs reference signal, see 8.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 11
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 11
The valve's standard configuration provides internal pilot and external drain.

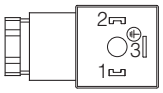
Functional Scheme - example of configuration 71



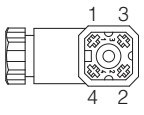
① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

10 ELECTRICAL CONNECTION

10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

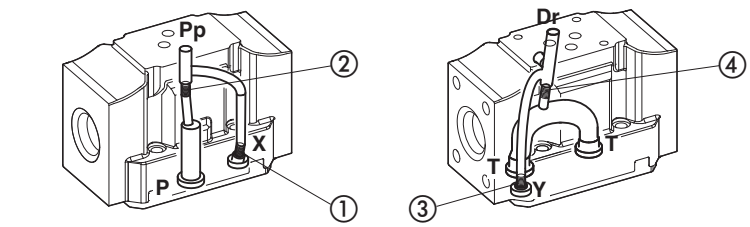
10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

11 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

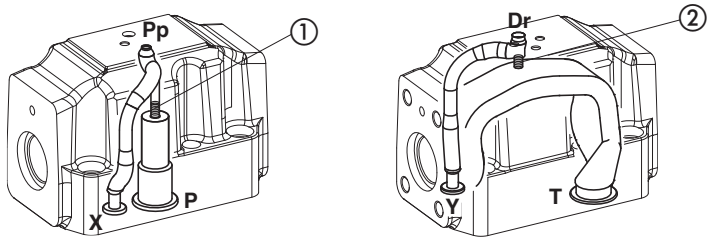
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZO-1 **Pilot channels** **Drain channels**



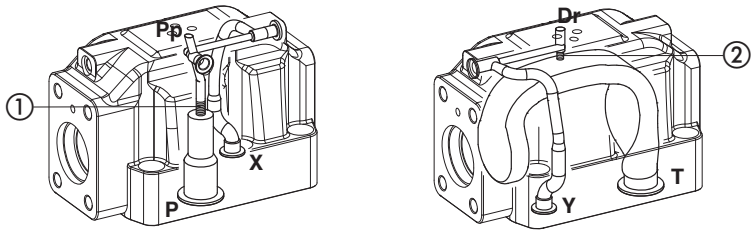
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels** **Drain channels**



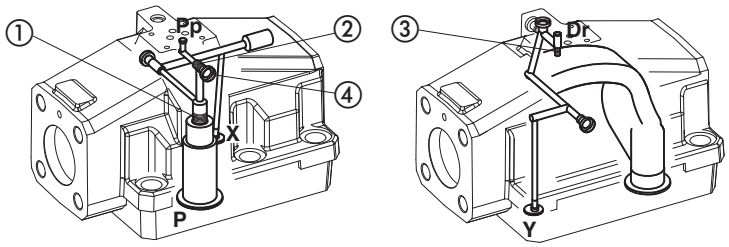
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels** **Drain channels**



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels** **Drain channels**



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

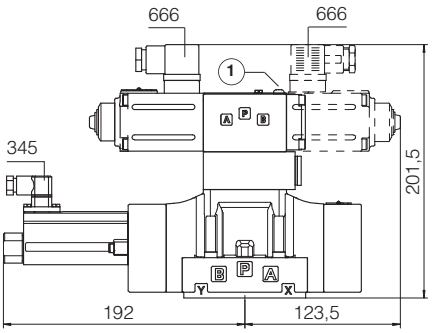
12 FASTENING BOLTS AND SEALS

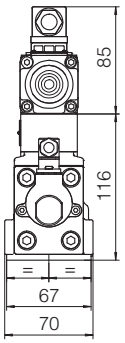
Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

DPZO-T-1 (dotted line = double solenoid version)

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-T-15	8,5
DPZO-T-17	9,4



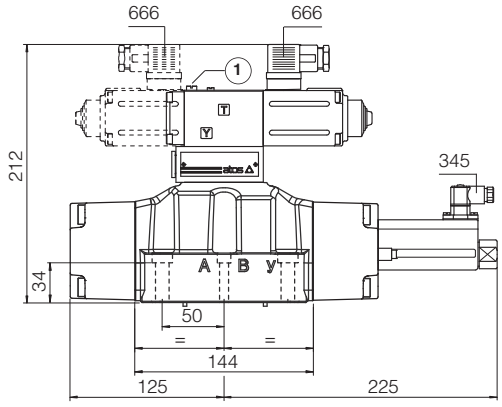


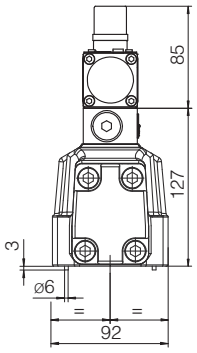
(1) = Air bleeding 3

DPZO-T-2 (dotted line = double solenoid version)

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-T-25	13,5
DPZO-T-27	14,4





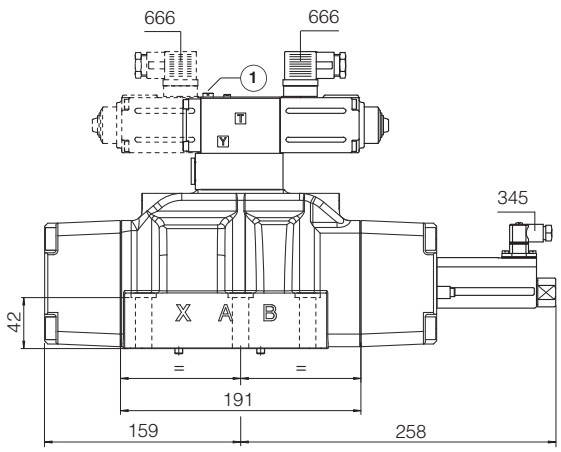
(1) = Air bleeding 3

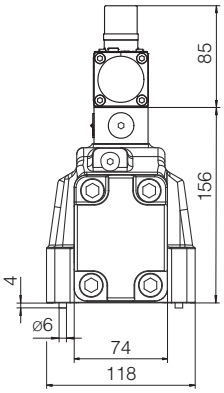
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage

DPZO-T-4 (dotted line = double solenoid version)

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)

Mass [kg]	
DPZO-T-45	17,6
DPZO-T-47	18,5



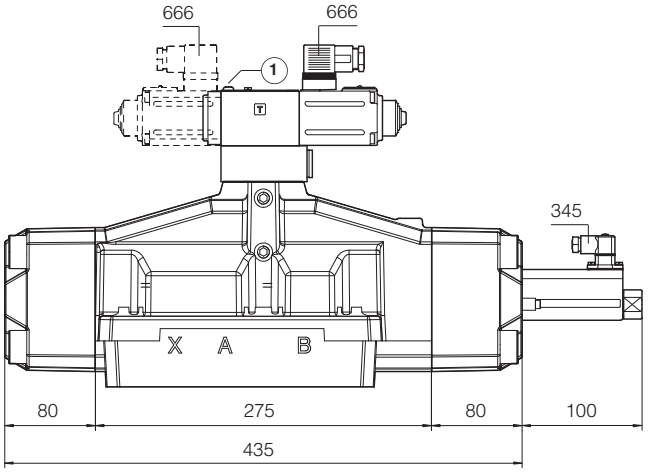


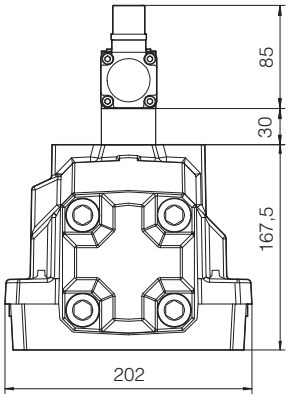
1 = Air bleeding 3

DPZO-T-6 (dotted line = double solenoid version)

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-T-65	42,3
DPZO-T-67	43,1





1 = Air bleeding 3

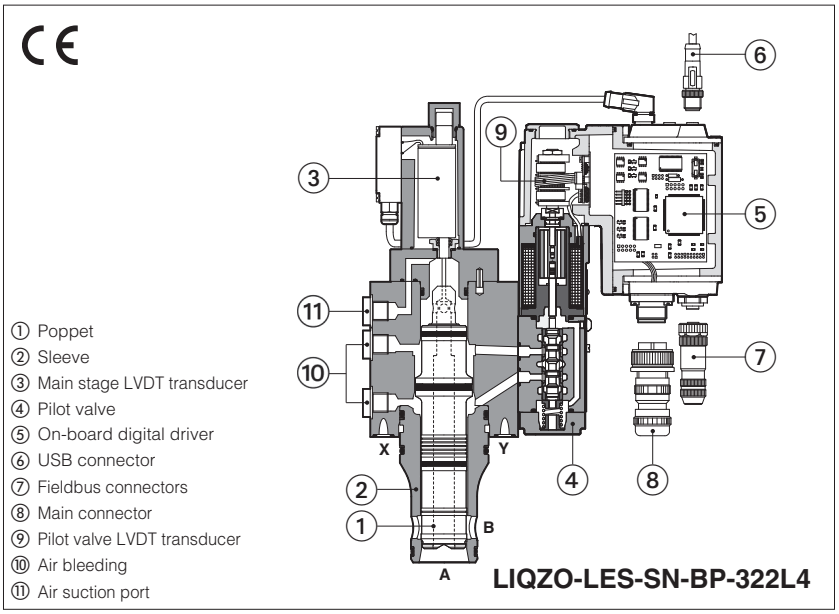
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
GS230	E-BM-TEB digital driver
GS235	E-BM-TID digital driver
GS240	E-BM-TES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Digital proportional 2-way cartridges high performance

piloted, with on-board driver and two LVDT transducers



LIQZO-LEB, LIQZP-LEB
LIQZO-LES, LIQZP-LES

Digital high performance 2-way proportional cartridges specifically designed for high speed closed loop controls. They are equipped with two LVDT position transducers for best dynamics in not compensated flow regulations. The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

LEB basic execution with analog reference signal and USB port for software functional parameters setting.

LES full execution which includes also optional fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

LIQZO: Size: **16** ÷ **40** - ISO 7368
Max flow: **600** ÷ **2500 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50** ÷ **100** - ISO 7368
Max flow: **4000** ÷ **16000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	LES	-	SN	-	NP	-	25	2	L4	/	*	*	/	*

LIQZO
Proportional 2-way cartridge, piloted
LIQZO = size 16 to 40, Pmax 350 bar
LIQZP = size 50 to 100, Pmax 420 bar

LES
LEB = basic on-board digital driver **(1)**
LES = full on-board digital driver

SN
Alternated P/Q controls:
SN = none

NP
Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

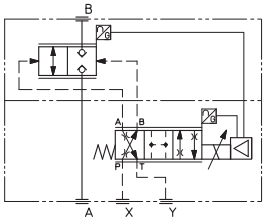
25
Valve size ISO 7368, see section 6 :

LIQZO =	**16**	**25**	**32**	**40**
l/min	250	500	800	1200
LIQZP =	**50**	**63**	**80**	**100**
l/min	2000	3000	4500	7200

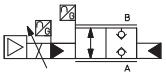
Nominal flow (l/min) at Δp 5 bar

2
Configuration:
2 = 2 way

functional symbol



simplified symbol



L4
Poppet type, regulating characteristics:
L4 = linear

*****
Electronics options (2):
F = fault signal
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

*****
Series number

*****
Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Only in version **SN-NP**
(2) Possible combined options: /FI, /IQ, /IZ
(3) Double power supply only for **LES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage.
In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z).
A safety fuse 2,5 A installed on 24VDC power supply of each valve is always recommended, see also power supply note at sections 13 .

WARNING

The loss of the pilot pressure causes the undefined position of the main poppet.
The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet.
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

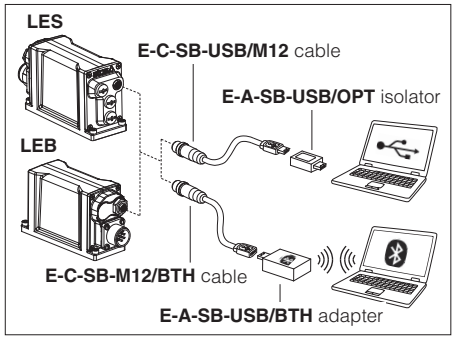
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for **LES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size		16	25	32	40	50	63	80	100
Nominal flow Δp A-B	[l/min]								
	Δp = 5 bar	250	500	800	1200	2000	3000	4500	7200
	Δp = 10 bar	350	700	1100	1700	2800	4250	6350	10200
	Max permissible flow	600	1200	1800	2500	4000	6000	10000	16000
Max pressure [bar]	**LIQZO**	Ports A, B = **350** X = 350 Y ≤ 10							
	LIQZP	Ports A, B = **420** X = 350 Y ≤ 10							
Nominal flow of pilot valve at Δp = 70 bar [l/min]		4	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar [l/min]		0,2	0,2	0,3	0,7	0,7	1	1	1
Piloting pressure [bar]		min: 40% of system pressure max 350 recommended 140 ÷ 160							
Piloting volume [cm³]		1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow **(1)** [l/min]		4	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal **(2)** [ms]		24	25	28	30	30	35	40	50
Hysteresis [% of the max regulation]		≤ 0,1							
Repeatability [% of the max regulation]		± 0,1							
Thermal drift		zero point displacement < 1% at ΔT = 40°C							

(1) With step reference input 0÷100%
(2) With pilot pressure = 140 bar, see datailed diagrams in section 9.2

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 16			

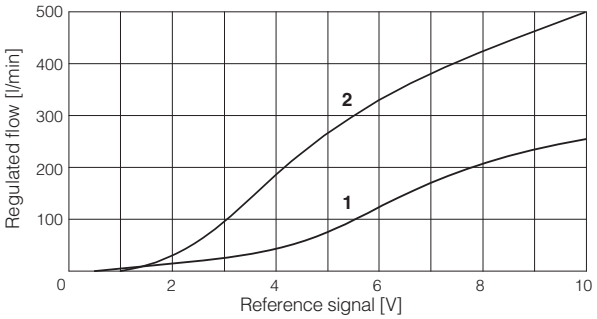
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

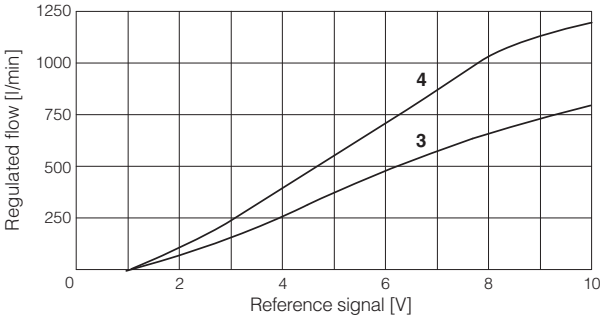
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

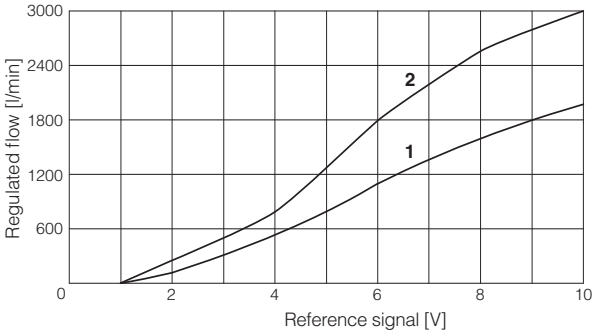
9.1 Regulation diagrams (values measured at Δp 5 bar)



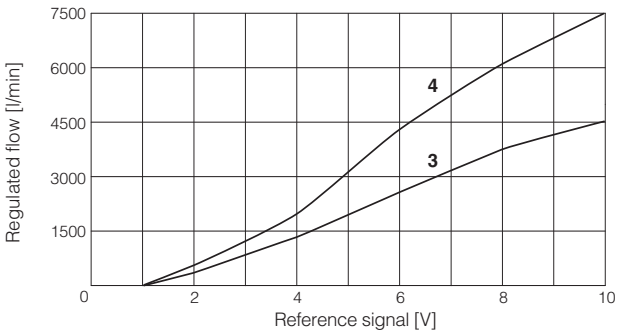
1 = LIQZO-L*-162L4
2 = LIQZO-L*-252L4



3 = LIQZO-L*-322L4
4 = LIQZO-L*-402L4



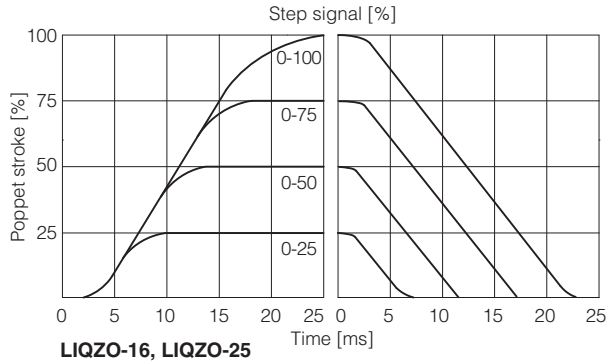
1 = LIQZP-L*-502L4
2 = LIQZP-L*-632L4



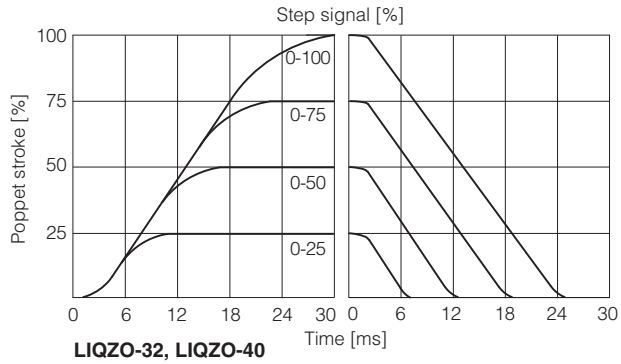
3 = LIQZP-L*-802L4
4 = LIQZP-L*-1002L4

9.2 Response time

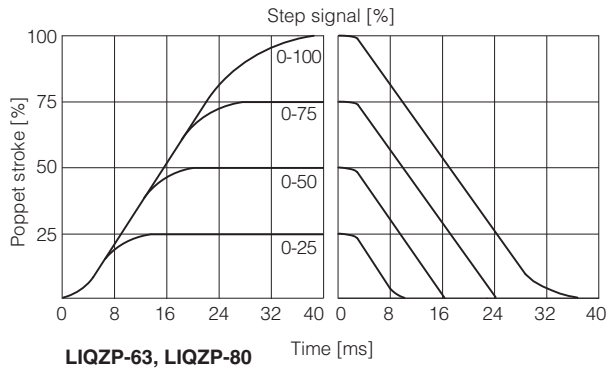
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



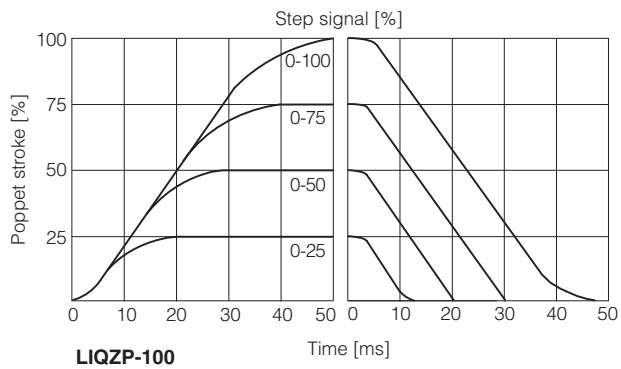
LIQZO-16, LIQZO-25



LIQZO-32, LIQZO-40
LIQZP-50

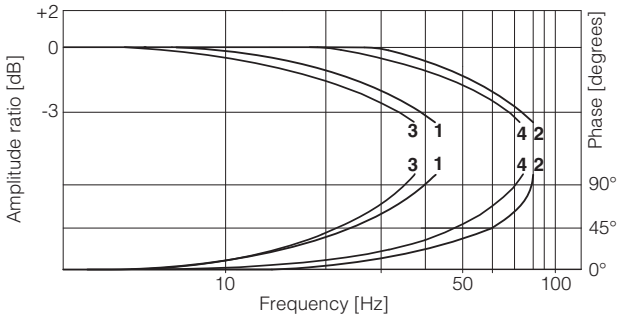


LIQZP-63, LIQZP-80

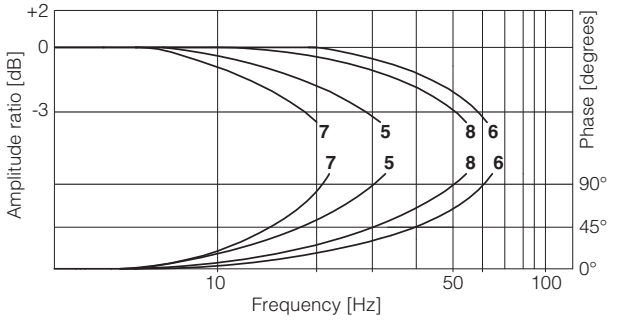


LIQZP-100

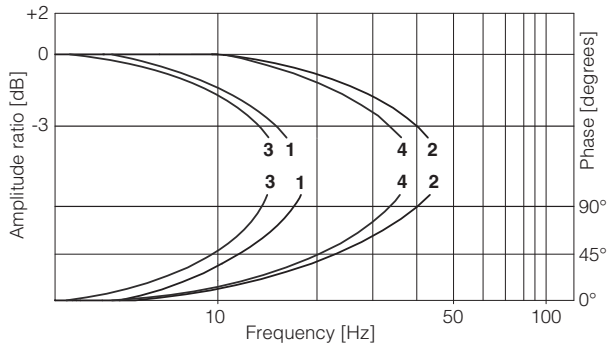
9.3 Bode diagrams - stated at nominal hydraulic conditions



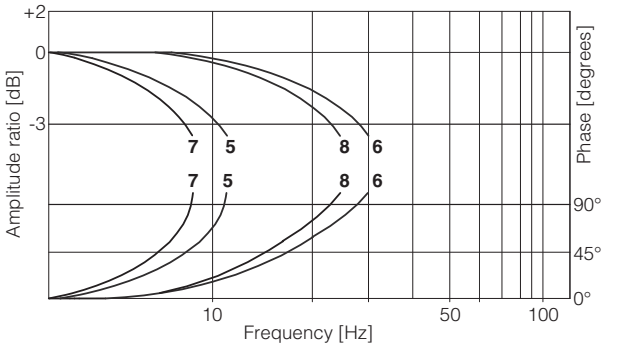
1 = LIQZO-L*-162L4: 10% ↔ 90%
2 = LIQZO-L*-162L4: 50% ± 5%
3 = LIQZO-L*-252L4: 10% ↔ 90%
4 = LIQZO-L*-252L4: 50% ± 5%



5 = LIQZO-L*-322L4: 10% ↔ 90%
6 = LIQZO-L*-322L4: 50% ± 5%
7 = LIQZO-L*-402L4: 10% ↔ 90%
8 = LIQZO-L*-402L4: 50% ± 5%



1 = LIQZP-L*-502L4: 10% ↔ 90%
2 = LIQZP-L*-502L4: 50% ± 5%
3 = LIQZP-L*-632L4: 10% ↔ 90%
4 = LIQZP-L*-632L4: 50% ± 5%



5 = LIQZP-L*-802L4: 10% ↔ 90%
6 = LIQZP-L*-802L4: 50% ± 5%
7 = LIQZP-L*-1002L4: 10% ↔ 90%
8 = LIQZP-L*-1002L4: 50% ± 5%

10 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 13.7 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 13.5 for signal specifications.

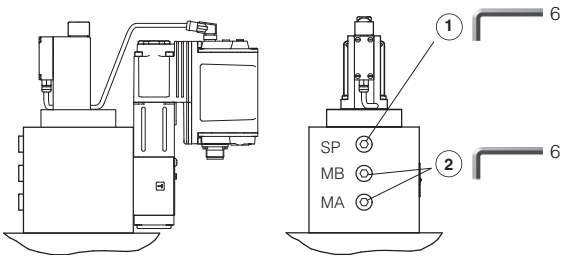
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **LEB** (see 13.6)
Power supply for driver's logics and communication - only for **LES** (see 13.2)

11 POSSIBLE COMBINED OPTIONS

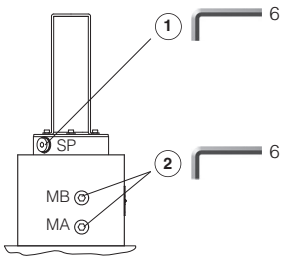
/FI, /IQ, /IZ

12 AIR BLEEDING

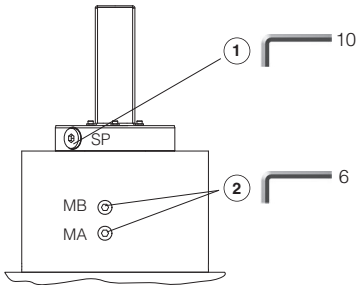
Size 16 to 40



Size 50



Sizes 63 to 100



(1) **Air suction port:**

N° 1 plug G1/4" for sizes 16 to 50
N° 1 plug G1/2" for sizes 63 to 100

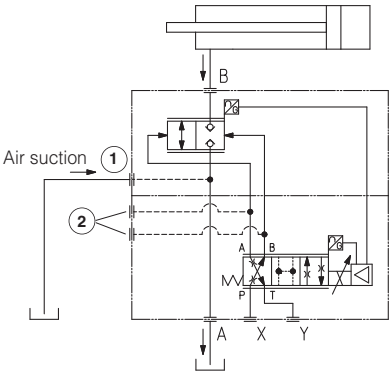
To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

(2) **Air bleeding:**

N° 2 plugs G1/4"

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.



13 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

13.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 13.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

13.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

13.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

13.4 Flow monitor output signal (Q_MONITOR) - not for **/F**

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

13.5 Enable input signal (ENABLE) - not for standard and **/F**

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

13.6 Repeat enable output signal (R_ENABLE) - only for **LEB** with **/Z** option

Repeat enable is used as output repeater signal of enable input signal (see 13.5).

13.7 Fault output signal (FAULT) - not for standard and **/Q**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.).

14 ELECTRONIC CONNECTIONS

14.1 Main connector signals - 7 pin (A1) **Standard**, **/Q** and **/F** options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND | V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

14.2 Main connector signals - 12 pin (A2) **/Z** option

PIN	LEB-SN /Z	LES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0 | VL0		Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for Q_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND | VL0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
7	**AGND**		Analog ground	Output - analog signal
		NC	Do not connect	Gnd - analog signal
8	**R_ENABLE**		Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
9	**NC**		Do not connect	
		VL+	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**NC**		Do not connect	
		VL0	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT** referred to: V0 | VL0		Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

14.3 Communications connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

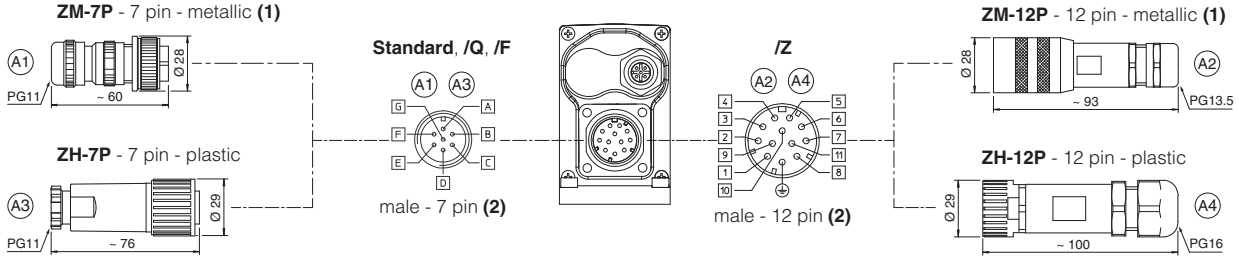
(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

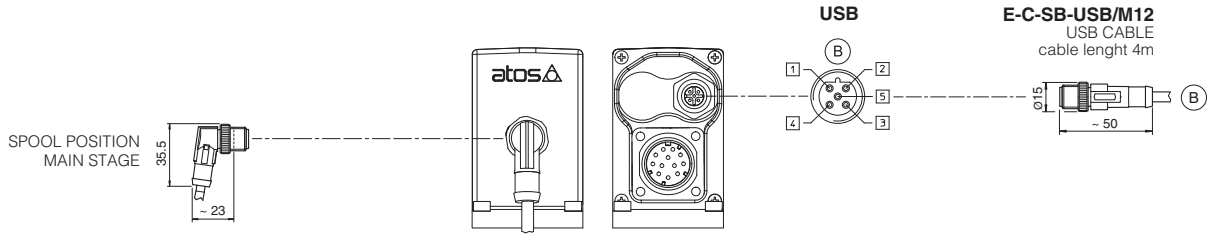
(2) Pin 2 can be fed with external +5V supply of CAN interface

14.4 LEB connections layout

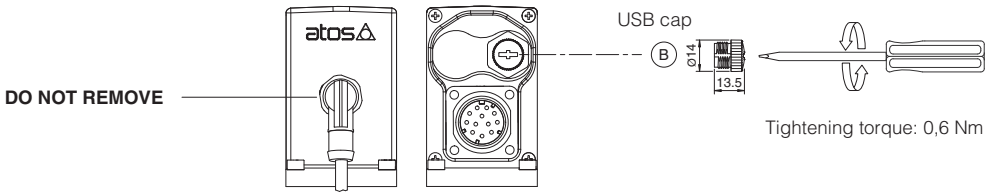
MAIN CONNECTORS



TRANSDUCER AND USB CONNECTOR



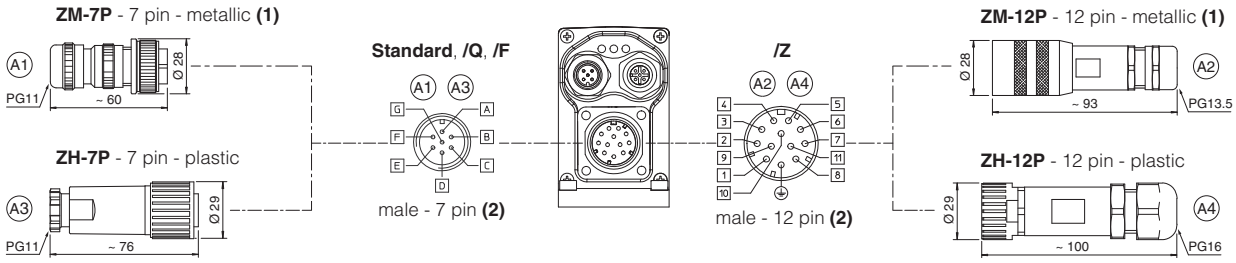
PLASTIC PROTECTION CAP - supplied with the valves



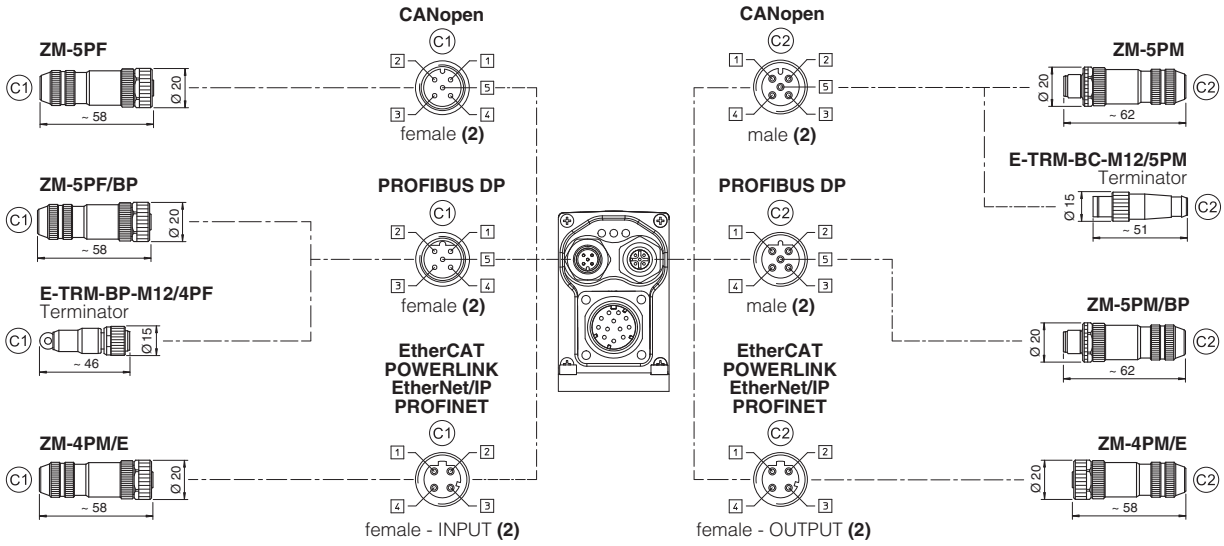
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

14.5 LES connections layout

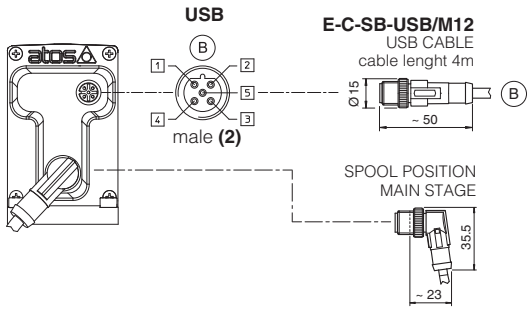
MAIN CONNECTORS



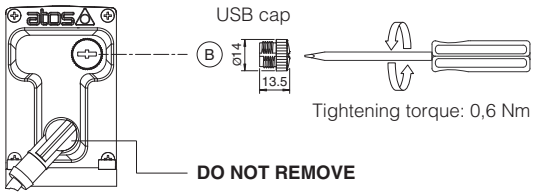
FIELDBUS CONNECTORS



TRANSDUCER AND USB CONNECTORS



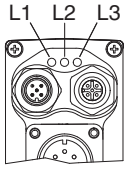
PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

14.6 Diagnostic LEDs - only for **LES**

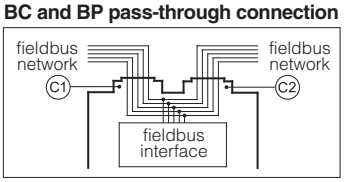
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

15 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



16 CONNECTORS CHARACTERISTICS - to be ordered separately

16.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

16.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

16.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

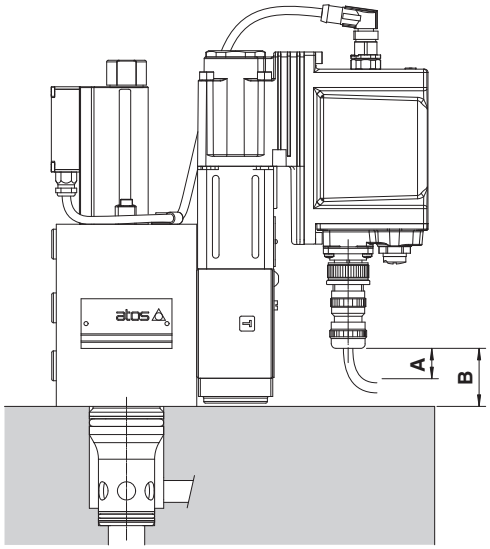
17 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	16	4 socket head screws M8x90 class 12.9 Tightening torque = 35 Nm	5,6
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,2
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	10,9
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	16,7
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	23,9
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,0
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	71,6
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	122,5

(1) Fastening bolts supplied with the valve

18 MAIN CONNECTORS INSTALLATION DIMENSIONS

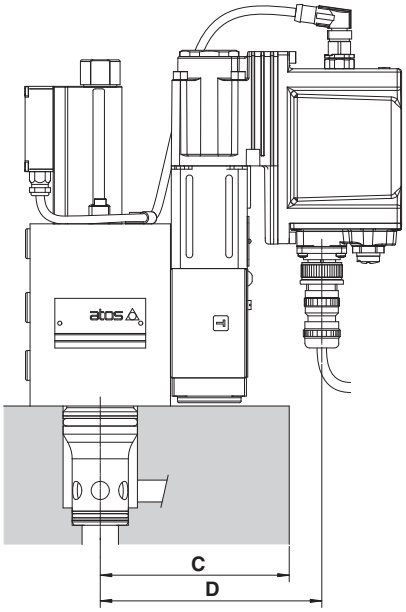
Installation 1 - possible interference between manifold and main connector



A = 15 mm space to remove the 7 or 12 pin main connectors

B = Clearance between main connector to valve's mounting surface. See the below table to verify eventual interferences, depending to the valve size and connector type

Installation 2 - no interference



C = Max manifold dimension to avoid interference with the main connector, see below table

Reference dimension	Main connector code	Valve size							
		16	**25**	**32**	**40**	**50**	**63**	**80**	**100**
B	ZM-7P	32	32	32	32	45	68	68	80
	ZH-7P	**(1)**	**(1)**	**(1)**	**(1)**	29	52	52	64
	ZM-12P	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	35	35	47
	ZH-12P	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(2)**	40
C (max)	-	104	114	121	134	141	172	202	229
D	-	124	134	141	154	161	192	222	249

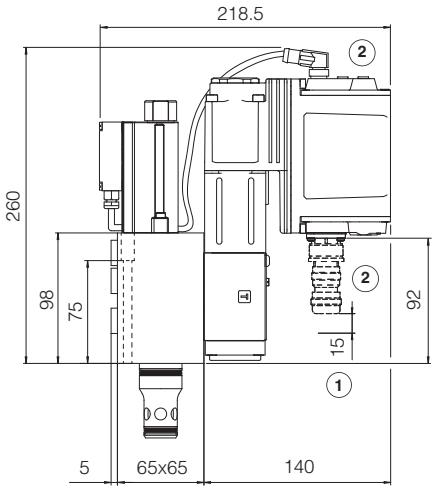
Above dimenions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered

(1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as rapresented in above "Installation 2"

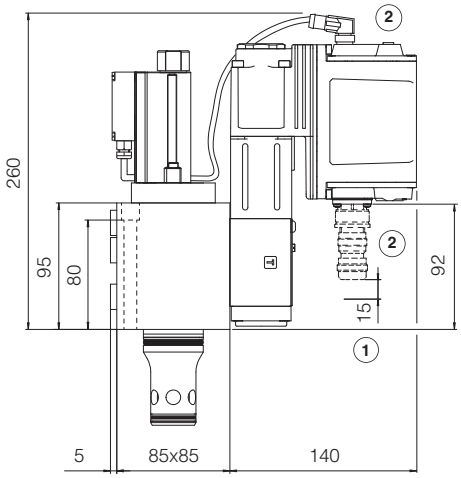
(2) The connector installation may be critic, depending to the cable size and bending radius

19 INSTALLATION DIMENSIONS [mm]

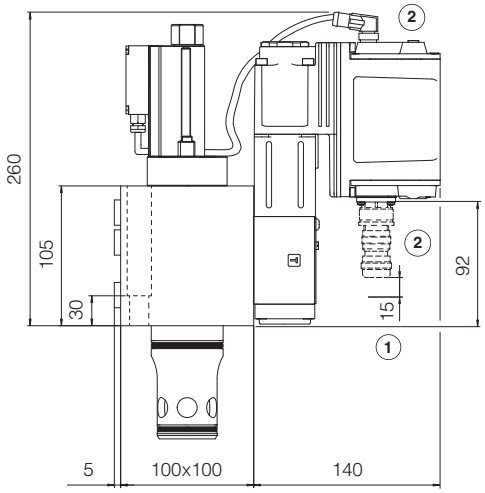
LIQZO-LEB-162
LIQZO-LES-162



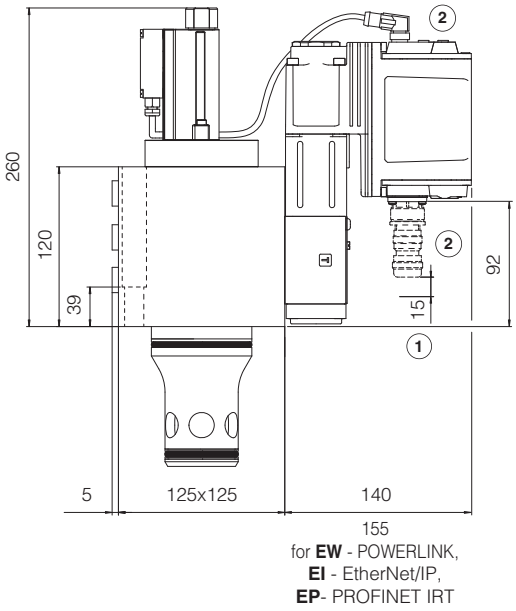
LIQZO-LEB-252
LIQZO-LES-252



LIQZO-LEB-322
LIQZO-LES-322



LIQZO-LEB-402
LIQZO-LES-402

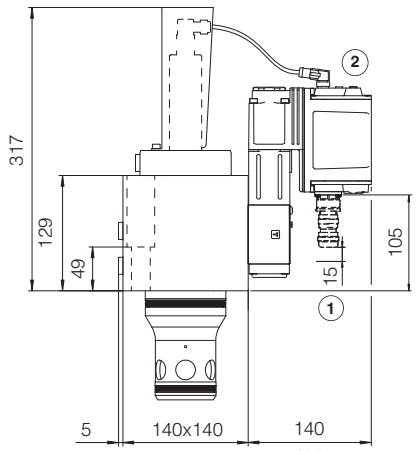


(1) = Space to remove the connectors

(2) = The dimensions of all connectors must be considered, see section 14.4 and 14.5
For main connectors installation, see also section [18].

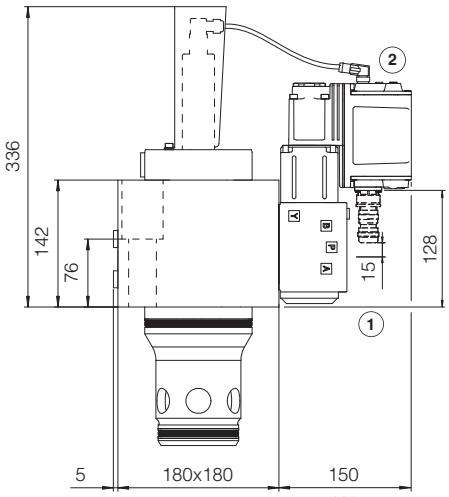
Note: for mounting surface and cavity dimensions, see table P006

LIQZP-LEB-502
LIQZP-LES-502



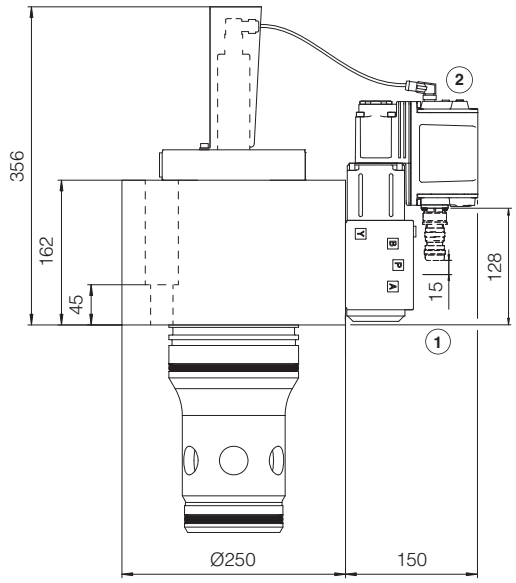
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

LIQZP-LEB-632
LIQZP-LES-632



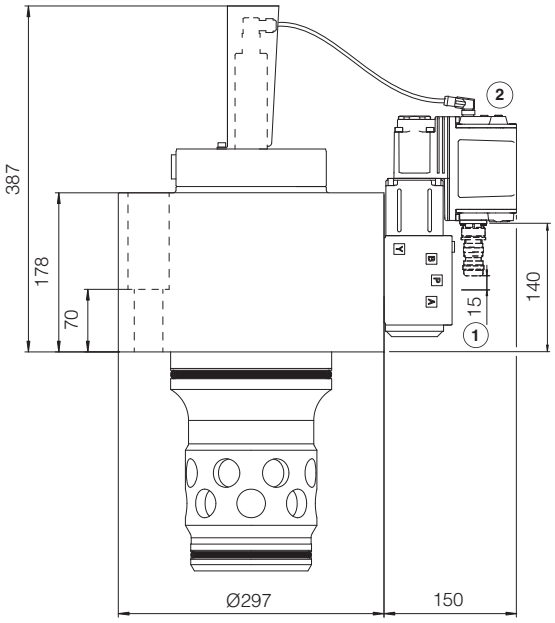
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

LIQZP-LEB-802
LIQZP-LES-802



for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

LIQZP-LEB-1002
LIQZP-LES-1002



for **EW** - POWERLINK,
EI - EtherNet/IP,
EP- PROFINET IRT

(1) = Space to remove the connectors

(2) = The dimensions of all connectors must be considered, see section 14.4 and 14.5
For main connectors installation, see also section [18].

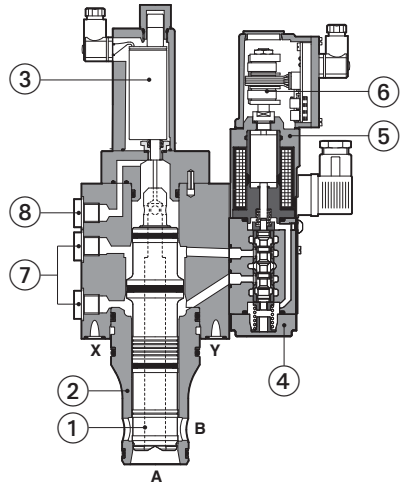
Note: for mounting surface and cavity dimensions, see table P006

[20] RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P006**	Mounting surfaces and cavities for cartridge valves
GS500	Programming tools	**QB340**	Quickstart for LEB valves commissioning
GS510	Fieldbus	**QF340**	Quickstart for LES valves commissioning

Proportional 2-way cartridges high performance

piloted, with two LVDT transducers, ISO 7368 sizes from 16 to 100



① Poppet
② Sleeve
③ Main stage LVDT transducer
④ Pilot valve
⑤ Proportional solenoid
⑥ Pilot valve LVDT transducer
⑦ Air bleeding
⑧ Air suction port

LIQZO-L-322L4

LIQZO-L, LIQZP-L

High performance 2-way proportional cartridge valves specifically designed for high speed closed loop controls.

The valves operate in association with digital off-board divers, see section 2.

They are equipped with two LVDT position transducers for best dynamics in not compensated flow regulations.

The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

Spool regulation characteristics: L = linear

LIQZO: Size: **16** ÷ **40** - ISO 7368
Max flow: **600** ÷ **2500 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50** ÷ **100** - ISO 7368
Max flow: **4000** ÷ **16000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	L	-	32	2	L4	/	*	/	*

LIQZO
Proportional cartridge, piloted
LIQZO = size 16 to 40, Pmax 350 bar
LIQZP = size 50 to 100, Pmax 420 bar

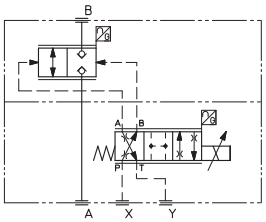
L = two LVDT transducers

Valve size ISO 7368, see section 4 :

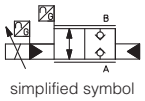
LIQZO =	**16**	**25**	**32**	**40**
l/min	250	500	800	1200
LIQZP =	**50**	**63**	**80**	**100**
l/min	2000	3000	4500	7200

Nominal flow (l/min) at Δp 5 bar

Configuration: **2** = 2 way



functional symbol



simplified symbol

Series number

Seals material,
see section 6 :
- = NBR
PE = FKM
BT = HNBR

Spool type, regulating characteristics:

L4 = linear

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LID	E-BM-LEB	E-BM-LES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage.
In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver.

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size		**16**	**25**	**32**	**40**	**50**	**63**	**80**	**100**
Nominal flow Δp A-B	[l/min]								
Δp = 5 bar		250	500	800	1200	2000	3000	4500	7200
Δp = 10 bar		350	700	1100	1700	2800	4250	6350	10200
Max permissible flow		600	1200	1800	2500	4000	6000	10000	16000
Max pressure [bar]	**LIQZO**	Ports A, B = **350** X = 350 Y ≤ 10							
	LIQZP	Ports A, B = **420** X = 350 Y ≤ 10							
Nominal flow of pilot valve at Δp = 70 bar	[l/min]	4	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar	[l/min]	0,2	0,2	0,3	0,7	0,7	1	1	1
Piloting pressure	[bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160							
Piloting volume	[cm^3]	1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow **(1)**	[l/min]	4	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal **(2)**	[ms]	24	25	28	30	30	35	40	50
Hysteresis	[% of the max regulation]	≤ 0,1							
Repeatability	[% of the max regulation]	± 0,1							
Thermal drift		zero point displacement < 1% at ΔT = 40°C							

(1) With step reference input 0÷100%
(2) With pilot pressure = 140 bar, see datailed diagrams in section 7.2

WARNING

The loss of the pilot pressure causes the undefined position of the main spool.
The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A).
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

5 ELECTRICAL CHARACTERISTICS

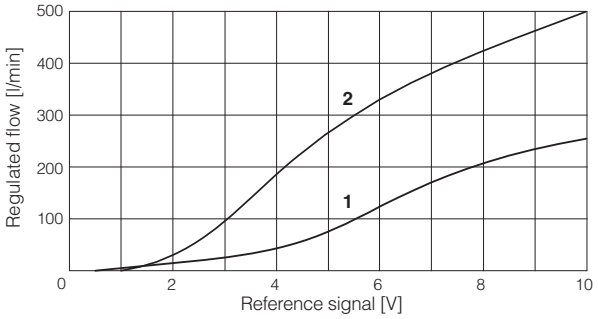
Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

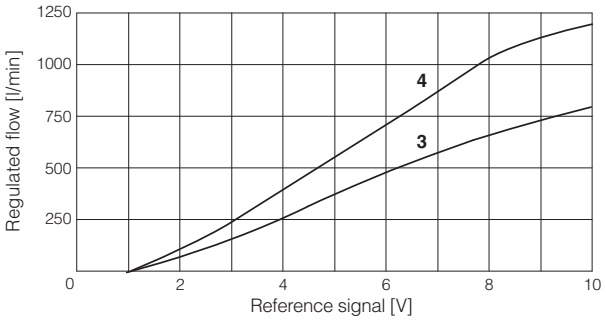
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

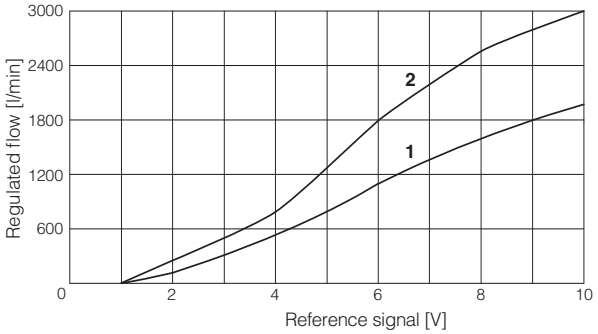
7.1 Regulation diagrams (values measured at Δp 5 bar)



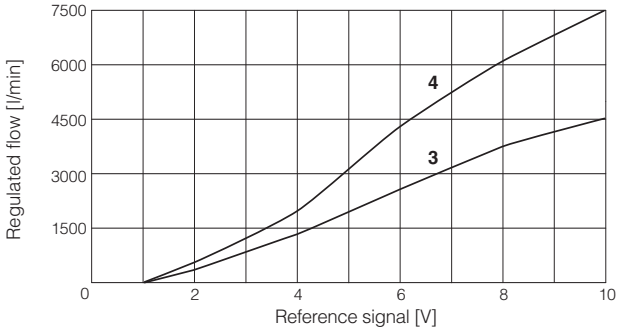
1 = LIQZO-L-162L4
2 = LIQZO-L-252L4



3 = LIQZO-L-322L4
4 = LIQZO-L-402L4



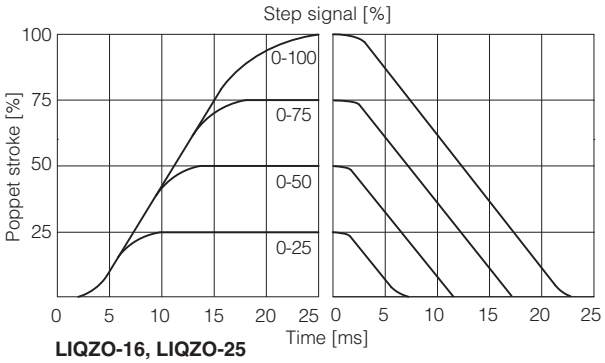
1 = LIQZP-L-502L4
2 = LIQZP-L-632L4



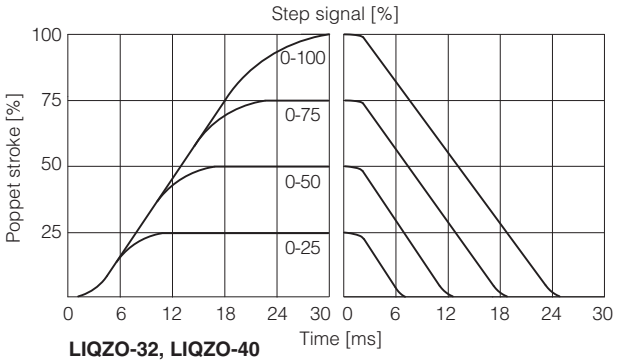
3 = LIQZP-L-802L4
4 = LIQZP-L-1002L4

7.2 Response time

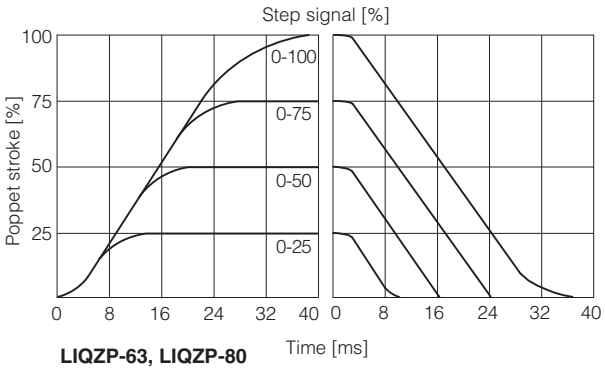
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



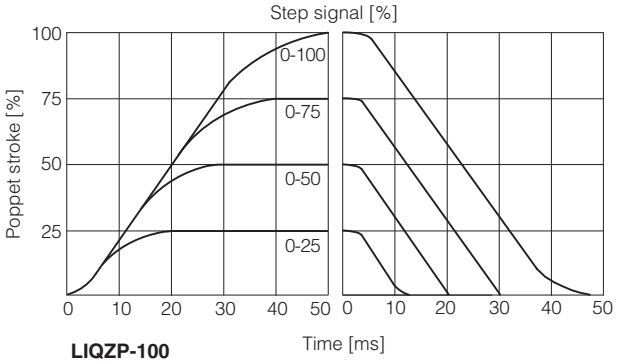
LIQZO-16, LIQZO-25



LIQZO-32, LIQZO-40
LIQZP-50

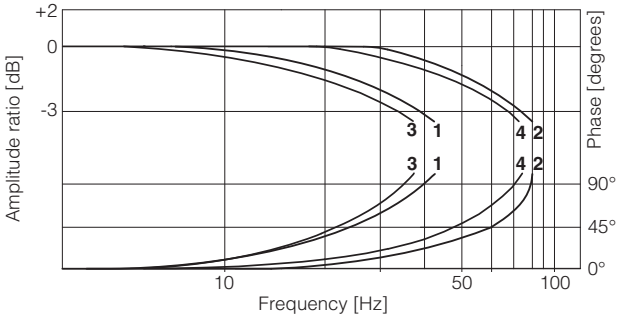


LIQZP-63, LIQZP-80

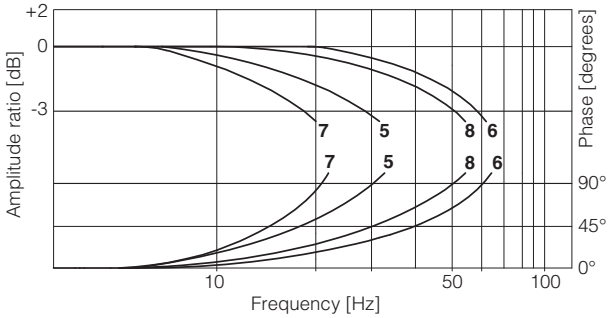


LIQZP-100

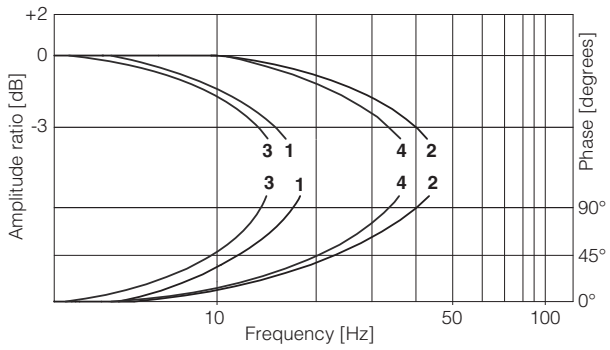
7.3 Bode diagrams - stated at nominal hydraulic conditions



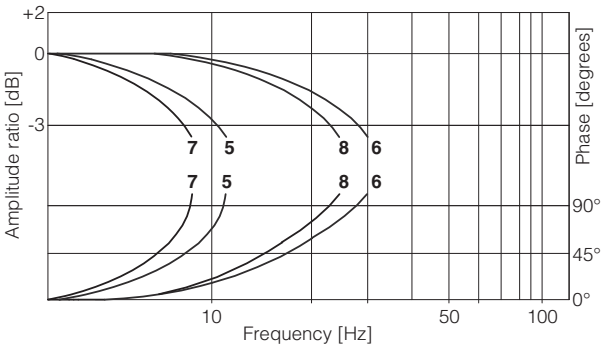
1 = LIQZO-L-162L4: 10% ↔ 90%
2 = LIQZO-L-162L4: 50% ± 5%
3 = LIQZO-L-252L4: 10% ↔ 90%
4 = LIQZO-L-252L4: 50% ± 5%



5 = LIQZO-L-322L4: 10% ↔ 90%
6 = LIQZO-L-322L4: 50% ± 5%
7 = LIQZO-L-402L4: 10% ↔ 90%
8 = LIQZO-L-402L4: 50% ± 5%



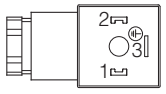
1 = LIQZP-L-502L4: 10% ↔ 90%
2 = LIQZP-L-502L4: 50% ± 5%
3 = LIQZP-L-632L4: 10% ↔ 90%
4 = LIQZP-L-632L4: 50% ± 5%



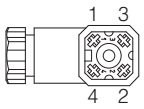
5 = LIQZP-L-802L4: 10% ↔ 90%
6 = LIQZP-L-802L4: 50% ± 5%
7 = LIQZP-L-1002L4: 10% ↔ 90%
8 = LIQZP-L-1002L4: 50% ± 5%

8 ELECTRICAL CONNECTION - connectors supplied with the valve

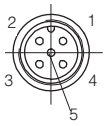
8.1 Solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

8.2 LVDT transducer connector - for LIQZO

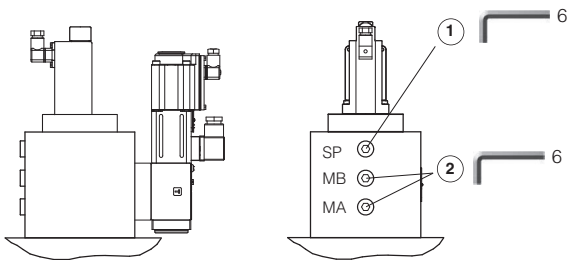
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

8.3 LVDT transducer connector - for LIQZP

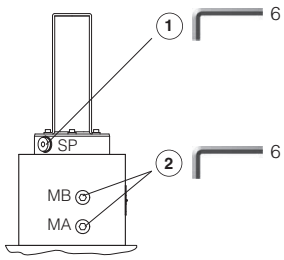
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**PROG**	Do not connect	
2	**VT+**	Power supply +15VDC	
3	**AGND**	Ground	
4	**TR**	Output signal	
5	**VT-**	Power supply -15VDC	

9 AIR BLEEDING

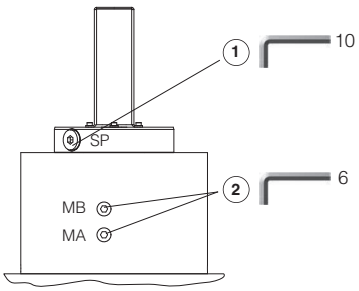
Size 16 to 40



Size 50



Sizes 63 to 100



(1) Air suction port:

N° 1 plug G1/4" for sizes 16 to 50
N° 1 plug G1/2" for sizes 63 to 100

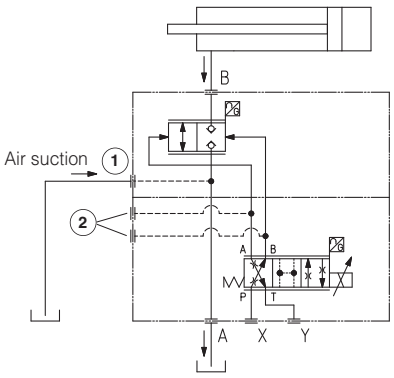
To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

(2) Air bleeding:

N° 2 plugs G1/4"

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.



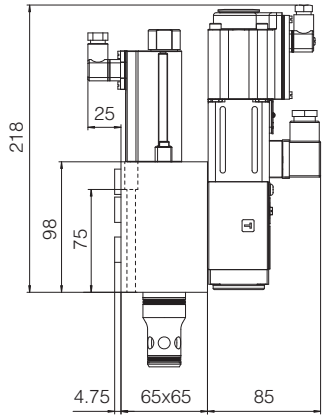
10 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	16	4 socket head screws M8x90 class 12.9 Tightening torque = 35 Nm	5,6
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,2
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	10,9
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	16,7
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	23,9
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,0
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	71,6
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	122,5

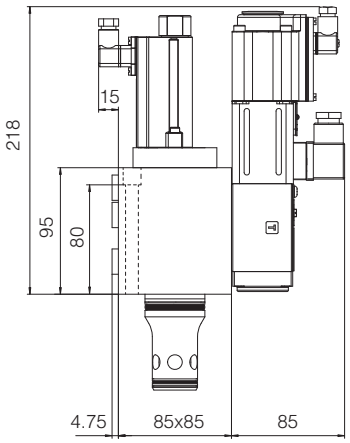
(1) Fastening bolts supplied with the valve

11 INSTALLATION DIMENSIONS [mm]

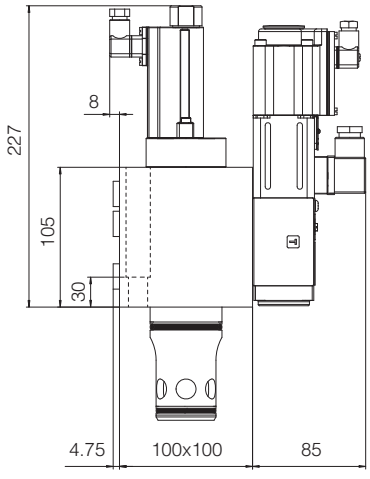
LIQZO-L-162



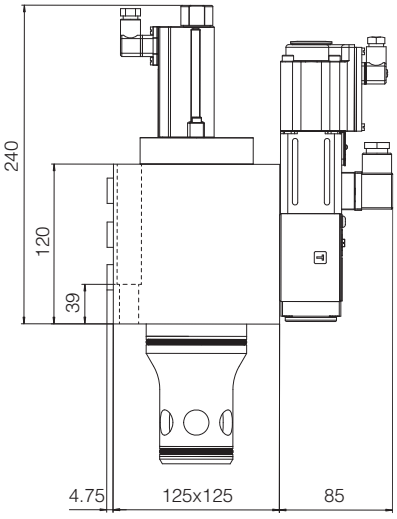
LIQZO-L-252



LIQZO-L-322

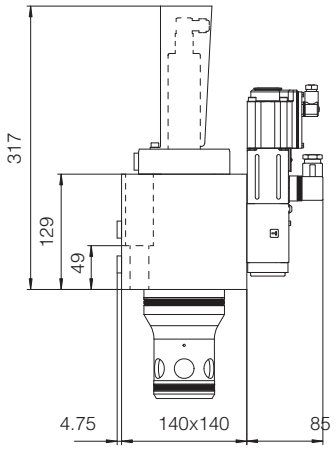


LIQZO-L-402

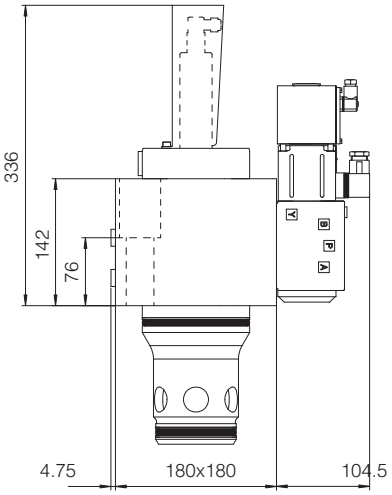


Note: for mounting surface and cavity dimensions, see table P006

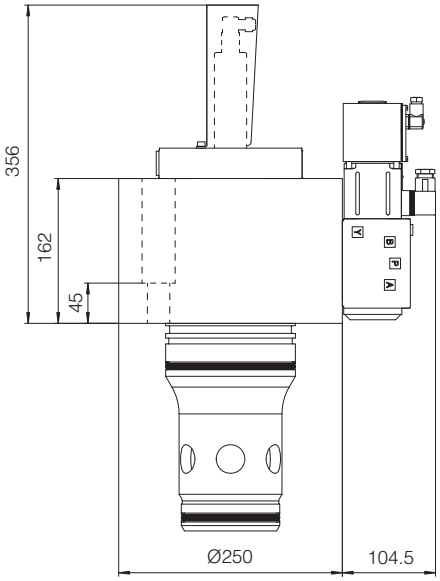
LIQZP-L-502



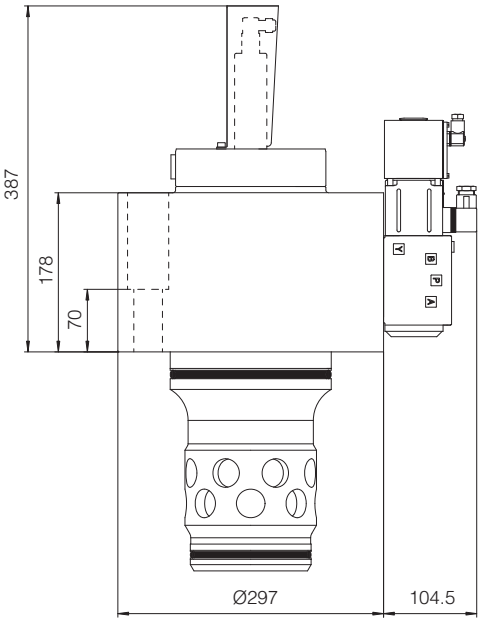
LIQZP-L-632



LIQZP-L-802



LIQZP-L-1002



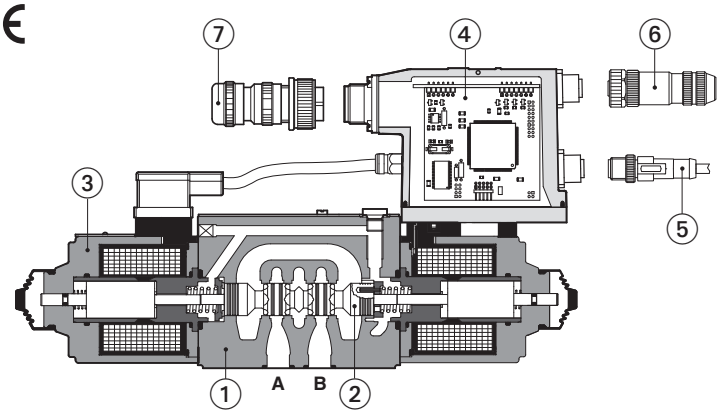
Note: for mounting surface and cavity dimensions, see table P006

12 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
GS230	E-BM-LEB digital driver	**K800**	Electric and electronic connectors
GS235	E-BM-LID digital driver	**P006**	Mounting surfaces and cavities for cartridge valves
GS240	E-BM-LES digital driver		

Digital proportional directional valves

direct, without transducer, with positive spool overlap



DKZOR-AES-BC-171

① Valve body
② Spool
③ Proportional solenoid
④ On-board digital driver
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector

DHZO-A, DHZO-AEB, DHZO-AES
DKZOR-A, DKZOR-AEB, DKZOR-AES

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **70 l/min**	Max flow: **160 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 **MODEL CODE for STANDARD SPOOLS**

DHZO	-	AES	-	BP	-	0	71	-	L	5	/	*	/	*	*	/	*

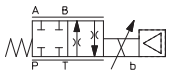
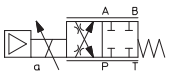
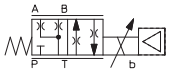
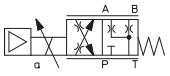
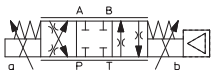
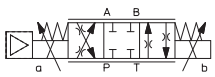
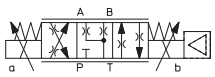
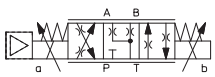
DHZO = size 06
DKZOR = size 10

A = for off-board driver, see section 2
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Valve size ISO 4401:
0 = 06 **1** = 10

Configuration (4):

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

Spool type, regulating characteristics:

L = linear 

S = progressive 

D = differential-progressive 
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

Series number

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers

Hydraulic options (5):
B = solenoid and on-board digital driver at side of port A
Y = external drain

Hand lever options, only for **A**:
MO = horizontal hand lever
MV = vertical hand lever
BMO = horizontal hand lever installed at side of port A
BMV = vertical hand lever installed at side of port A

Electronic options, only for **AEB** and **AES (5)**:
C = current feedback for pressure transducer 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC) - only for **W**
I = current reference input 4 ÷ 20 mA (omit for std voltage ±10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector
W = power limitation function - 12 pin connector

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZO =	1	4,5	8	18	28
DKZOR =	-	-	-	45	60

Nominal flow (l/min) at Δp 10bar P-T

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Hydraulic symbols are represented with on-board digital driver
(5) For possible combined options, see section 13

2 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Data sheet	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

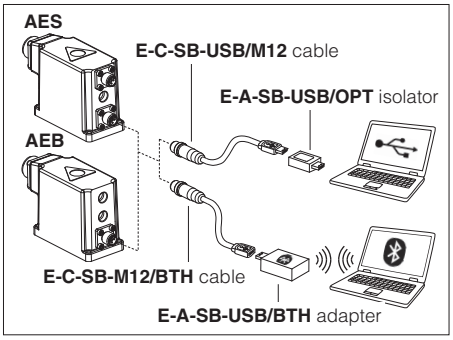
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DHZO**					**DKZOR**	
Pressure limits [bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with internal drain /Y) **Y** = 10					ports **P**, **A**, **B** = 315; **T** = 210 (250 with internal drain /Y) **Y** = 10	
Spool type	**L14**	**L1**	**S2**	**L3, S3, D3**	**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**
Nominal flow Δp P-T [l/min] **(1)**							
Δp= 10 bar	1	4,5	8	18	28	45	60
Δp= 30 bar	1,7	8	14	30	50	80	105
Δp= 70 bar	2,6	12	21	45	70	120	160
Max permissible flow **(2)**	4	18	30	50	70	120	160
Leakage [cm³/min]	<30 (at p = 100 bar); <135 (at p = 350 bar)					<80 (at p = 100 bar); <600 (at p = 315 bar)	
Response time **(3)** [ms]	≤ 30					≤ 40	
Hysteresis	≤ 5 [% of max regulation]						
Repeatibility	± 1 [% of max regulation]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2
(1) For different Δp, the max flow is in accordance to the diagrams in section 10.2
(2) See detailed diagrams in section 10.3
(3) 0-100% step signal, see detailed diagrams in section 10.4

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	**DHZO**			**DKZOR**		
	A = 30 W	**AEB**, **AES** = 50 W		**A** = 35 W	**AEB**, **AES** = 50 W	
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω					
Monitor output	Output range: voltage ±5 VDC @ max 5 mA					
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ					
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)					
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Tropicalization	Tropical coating on electronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408		PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898		optical insulated RS485	Fast Ethernet, insulated 100 Base TX	
Recommended wiring cable	LiYCY shielded cables, see section 17					

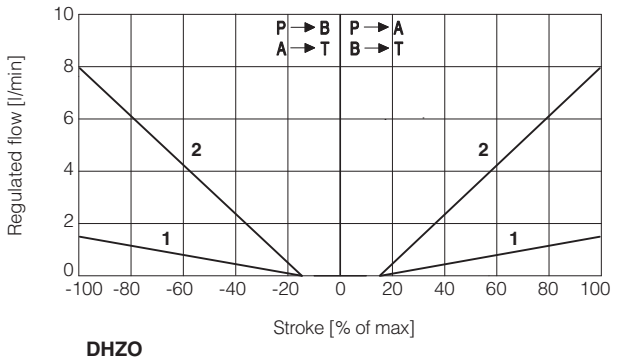
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

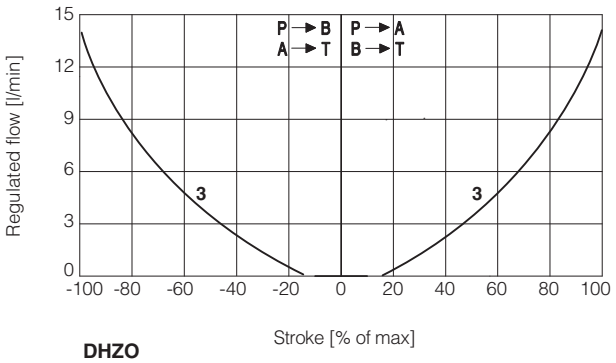
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7			see also filter section at www.atos.com or KTF catalog
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5			
Hydraulic fluid	**Suitable seals type**		**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR		HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM		HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR		HFC	

10 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

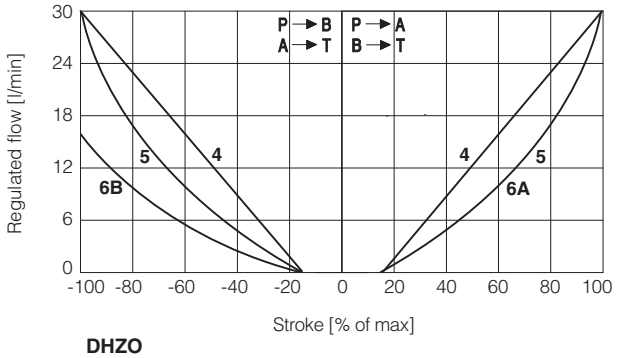
10.1 Regulation diagrams - values measure at Δp 30 bar P-T



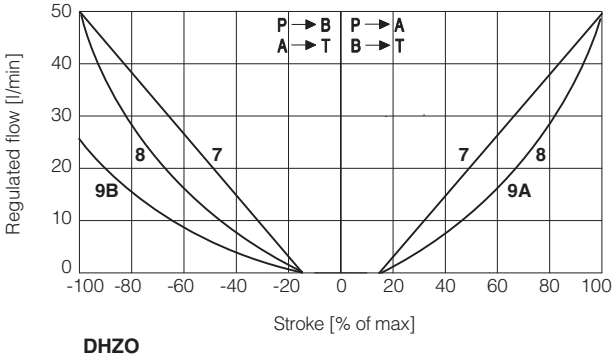
DHZO
1 = L14 **2** = L1



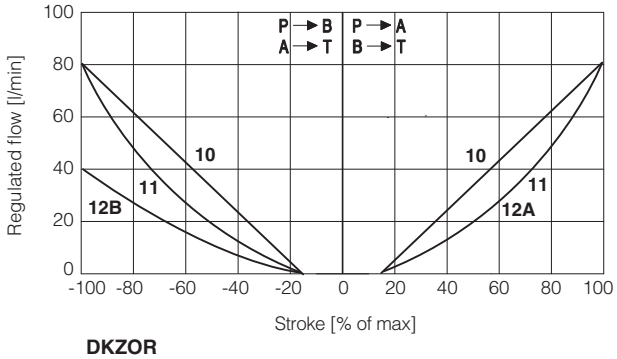
DHZO
3 = S2



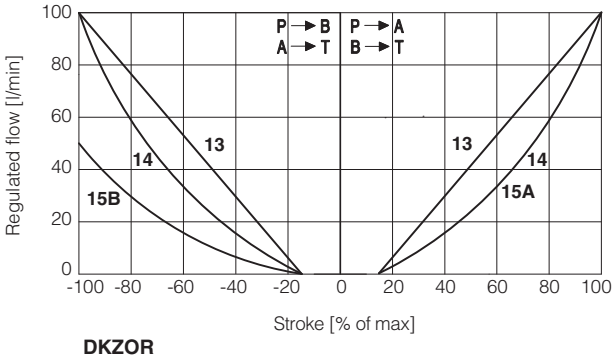
DHZO
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZO
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZOR
10 = L3 **11** = S3 **12A** = D3 (P → A, A → T)
12B = D3 (P → B, B → T)



DKZOR
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\begin{matrix} 0 \div +10\ V \\ 12 \div 20\ mA \end{matrix}$ } P → A / B → T

Reference signal $\begin{matrix} 0 \div -10\ V \\ 12 \div 4\ mA \end{matrix}$ } P → B / A → T

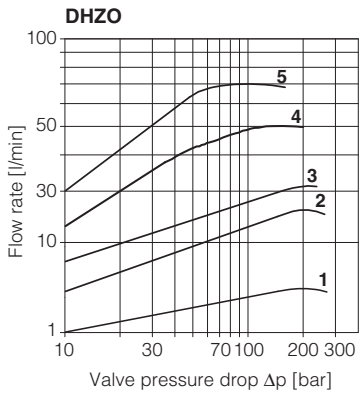
10.2 Flow /Δp diagrams - stated at 100% of valve stroke

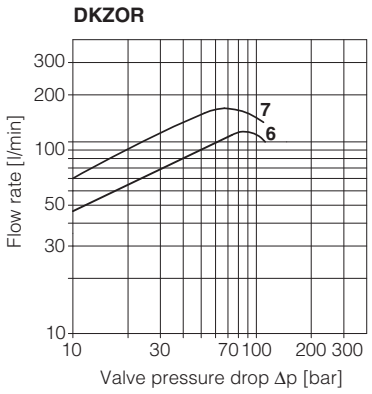
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5

DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5





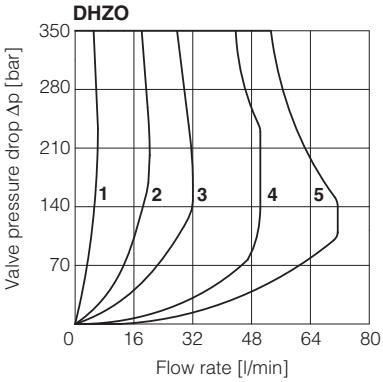
10.3 Operating limits

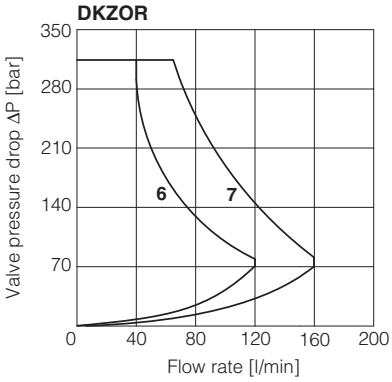
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5

DKZOR

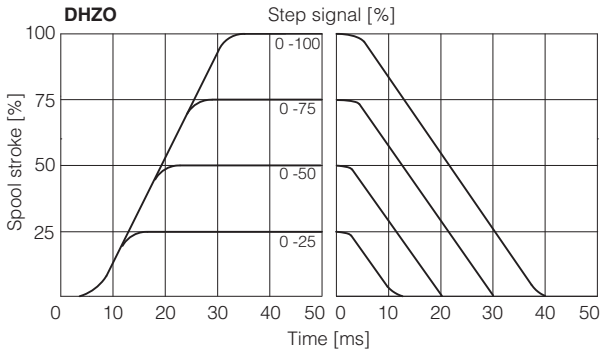
6 = spool S3, L3, D3
7 = spool S5, L5, D5

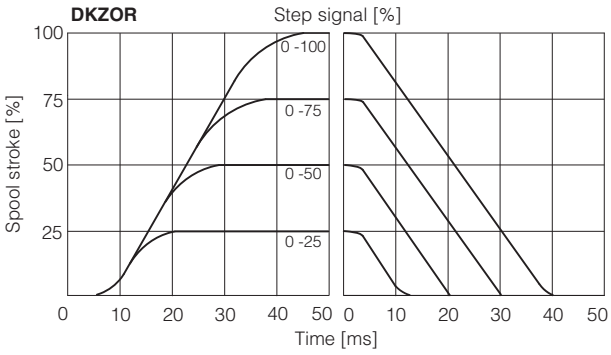




10.4 Response time

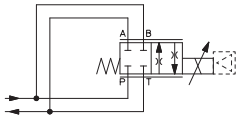
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.





10.5 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



Max flow Δp= 15 bar [l/min]	SPOOL TYPE				
	L14	**L1**	**S2**	**L3 S3**	**L5 S5**
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	200

11 HYDRAULIC OPTIONS

B = DHZO-05 and DKZOR-15 = solenoid and on-board digital driver at side of port A.
DHZO-07 and DKZOR-17 = on-board digital driver at side of port A.

Y = External drain advisable when the valve is used in double flow path, see section 10.5.
This option is mandatory if the pressure in port T exceeds 210 bar.

Hand lever option - only for **DHZO-A** with spool type S3, S5, D3, D5, L3, L5.

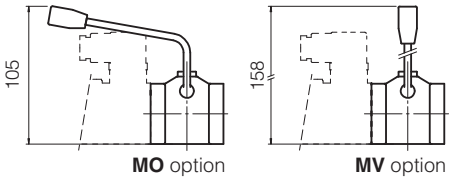
It allows to operate the valve in absence of electrical power supply.
For detailed description of DHZO-A with hand lever option see tech. table **E138**.

MO = Horizontal hand lever

BMO = Horizontal hand lever installed at side of port A

MV = Vertical hand lever

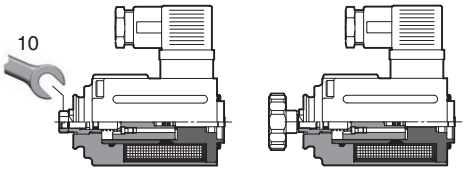
BMV = Vertical hand lever installed at side of port A



The following supplementary options allow to operate **DHZO-A** and **DKZOR-A** in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see tech. table **TK150**

N = Manual micrometric adjustment

NV = As option /N plus handwheel and graduated scale



12 ELECTRONICS OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver.
Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.5 for signal specifications.

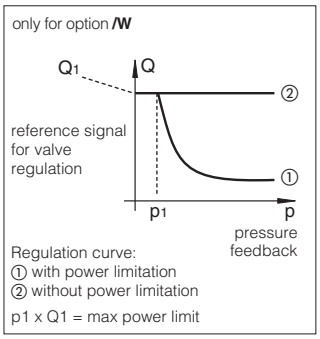
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 15.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 15.2

C = Only in combination with option **/W**
This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator, see tech table **D150**.
It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} \; ; \; \text{Flow Reference [INPUT+]} \right)$$

Hydraulic Power Limitation



13 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible
Electronics options: /IQ, /IZ, /IW, /CW, /CWI

14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** and **/W** options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC.

15.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.6 Fault output signal (FAULT) - only for **/Z** and **/W** options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

15.7 Remote pressure transducer input signal (TR+) - only for **/W** option

Analog pressure transducers can be directly connected to the driver (see 16.4).
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

16 ELECTRONIC CONNECTIONS

16.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND | V0		Monitor output signal: ±5 VDC maximum range Default is ± 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

16.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**		Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is ± 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**		Do not connect	
8	**NC**		Do not connect	
		MONITOR2	2nd monitor output signal: ±5 VDC maximum range, referred to VL0. Default is 0 ÷ 5 VDC	Output - analog signal
9	**VL+**		Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**		Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

16.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

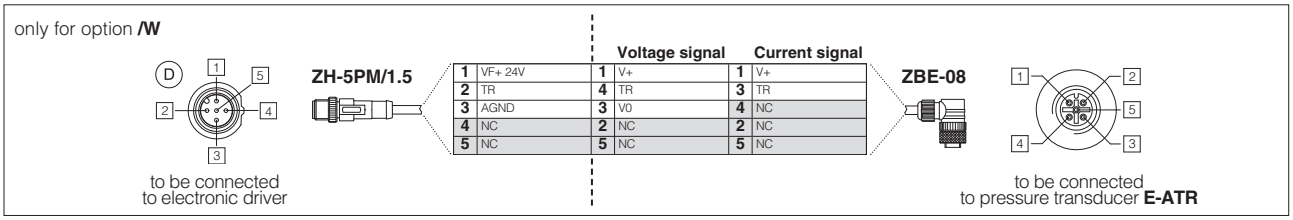
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

16.4 Remote pressure transducer connector - M12 - 5 pin - only for **/W** option - for **AEB** and **AES** (D)

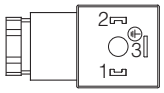
PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Connect	Connect
2	**TR**	Signal transducer maximum range ±10 VDC / ±20 mA, software selectable Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Connect	Connect
3	**AGND**	Common GND for transducer power and signals	Connect	/
4	**NC**	Not Connect	/	/
5	**NC**	Not Connect	/	/

Remote pressure transducer connection - example



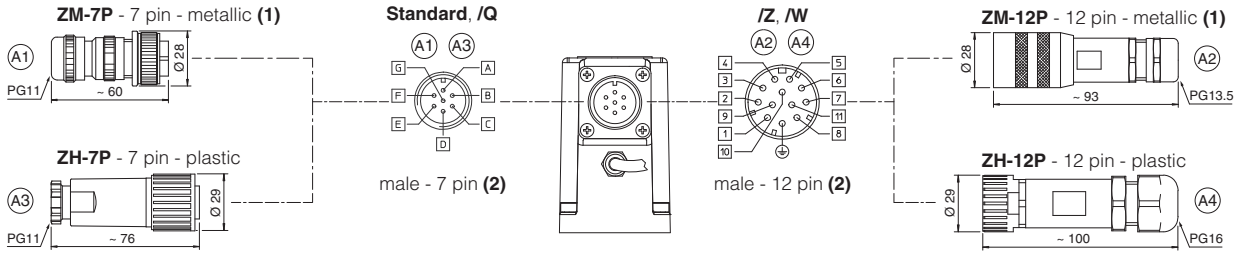
Note: connectors front view

16.5 Solenoid connection - only for **A**

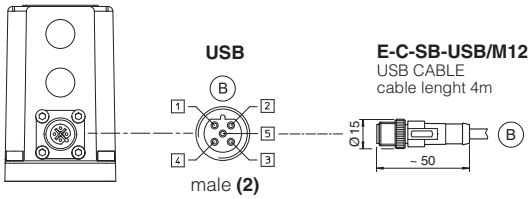
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

16.6 AEB connections layout

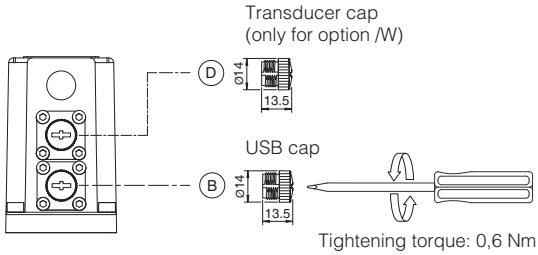
MAIN CONNECTORS



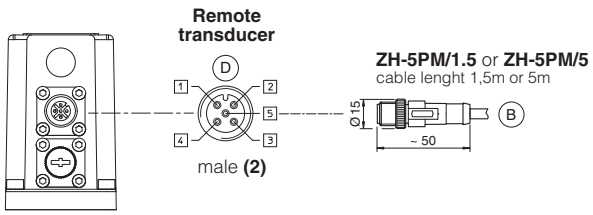
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



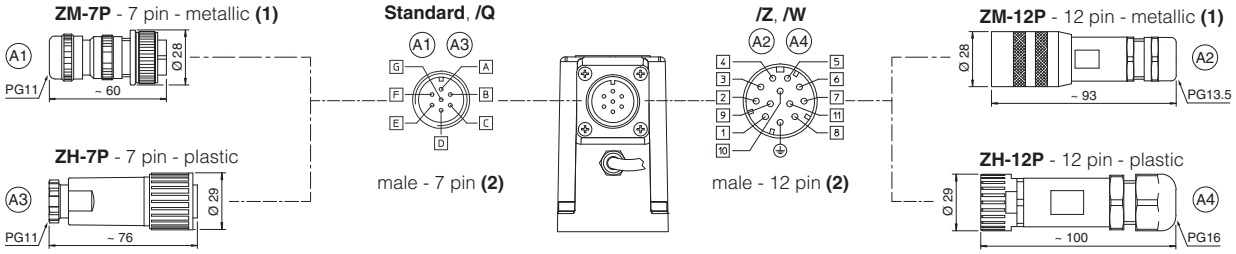
TRANSDUCER CONNECTOR - only for option **/W**



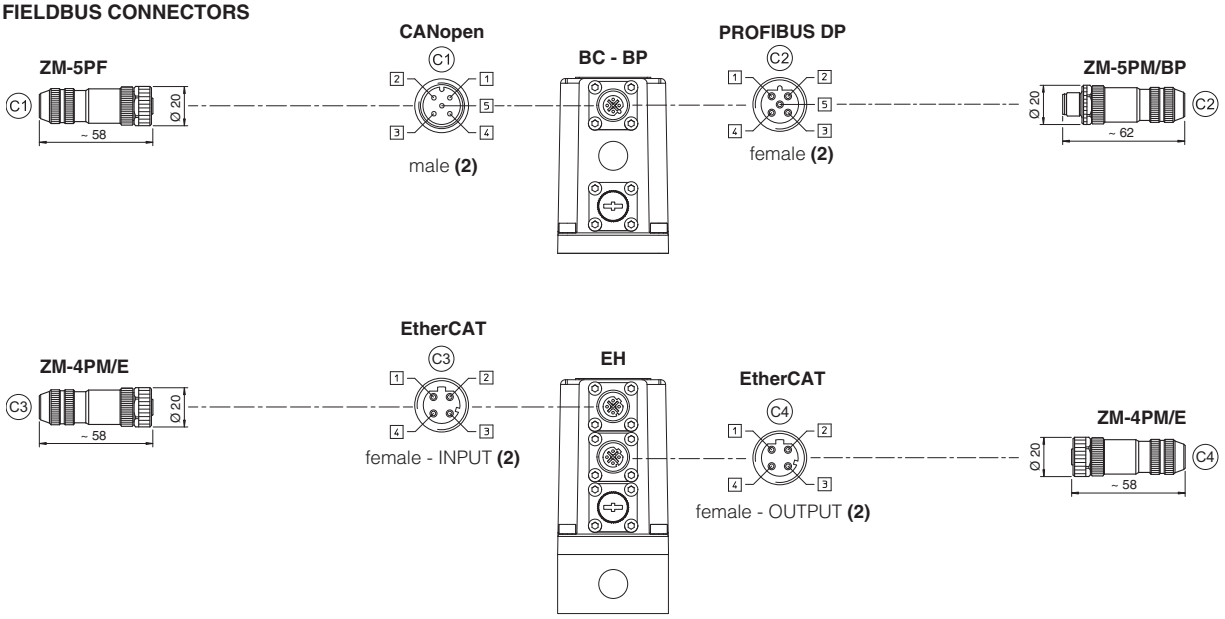
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

16.7 AES connections layout

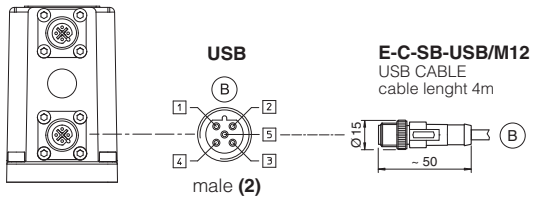
MAIN CONNECTORS



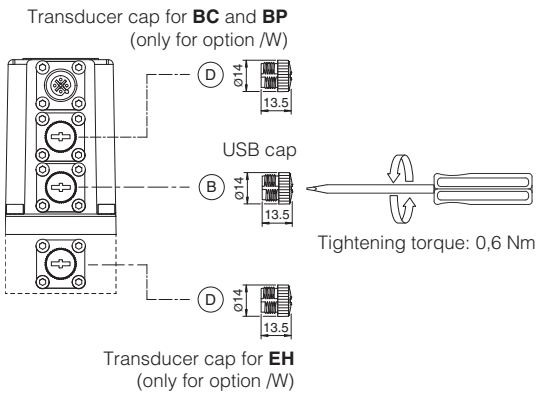
FIELDBUS CONNECTORS



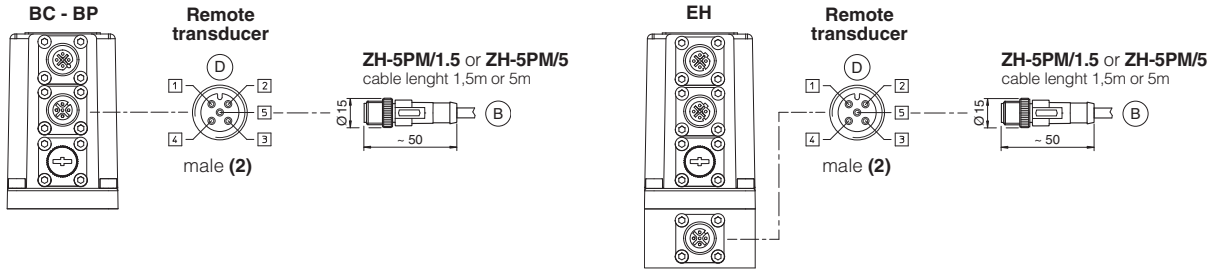
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option **/W**



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17 CONNECTORS CHARACTERISTICS - to be ordered separately

17.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

17.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

17.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

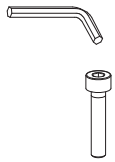
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

17.4 Pressure transducer connectors - only for **/W** option

CONNECTOR TYPE	TRANSDUCER	
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm²	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

18 FASTENING BOLTS AND SEALS

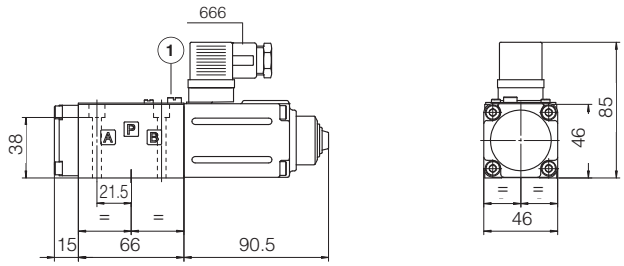
	DHZO	DKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø 5 mm (only for /Y option)

19 INSTALLATION DIMENSIONS FOR DHZO [mm]

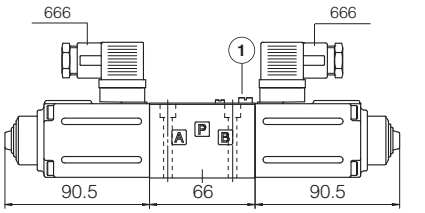
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y version, surface 4401-03-03-0-05 without X port)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DHZO-*-05	1,9	2,3	2,4
DHZO-*-07	2,6	3,1	3,2

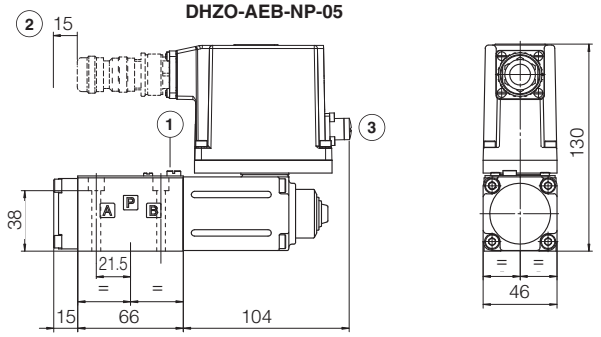
DHZO-A-05



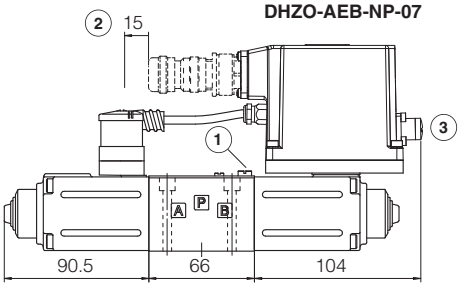
DHZO-A-07



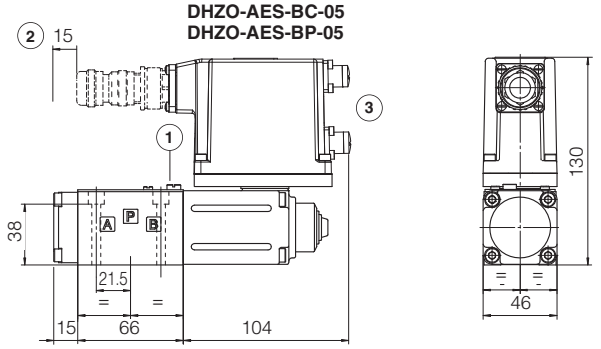
DHZO-AEB-NP-05



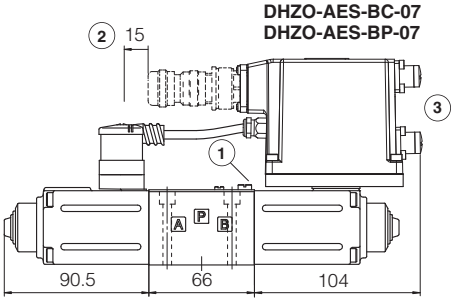
DHZO-AEB-NP-07



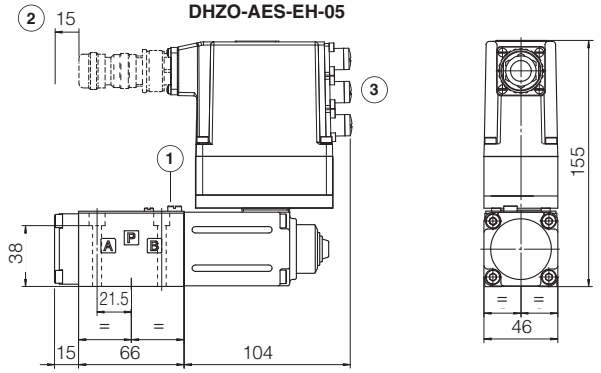
DHZO-AES-BC-05
DHZO-AES-BP-05



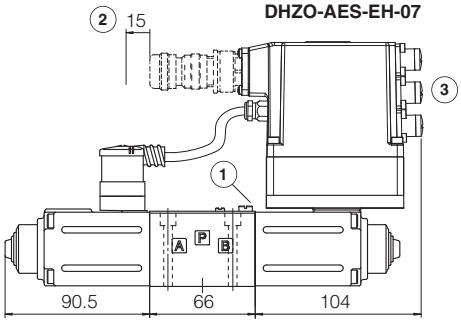
DHZO-AES-BC-07
DHZO-AES-BP-07



DHZO-AES-EH-05



DHZO-AES-EH-07



(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 16.6 and 16.7

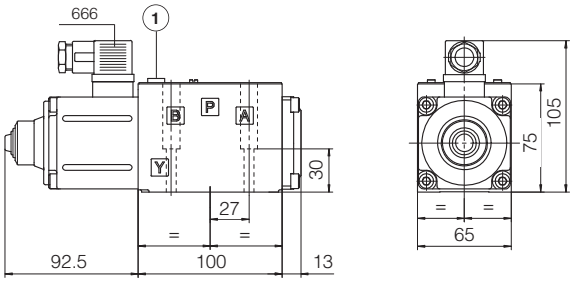
Note: for option /B the solenoid and the on-board digital driver are at side of port A

20 INSTALLATION DIMENSIONS FOR DKZOR [mm]

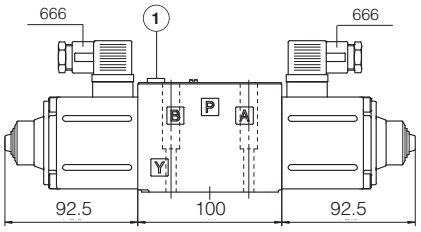
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y version, surface 4401-05-05-0-05 without X port)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DKZOR-*-15	3,8	4,3	4,4
DKZOR-*-17	4,5	5,0	5,1

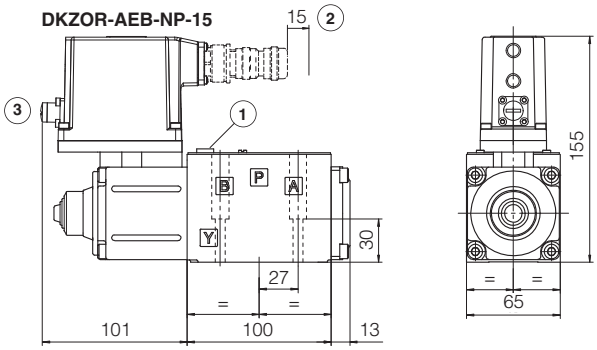
DKZOR-A-15



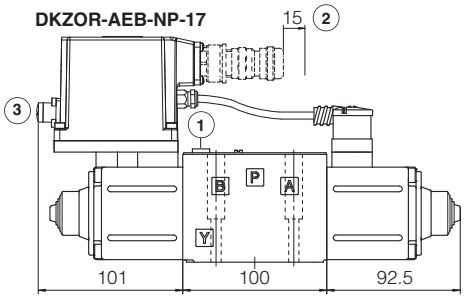
DKZOR-A-17



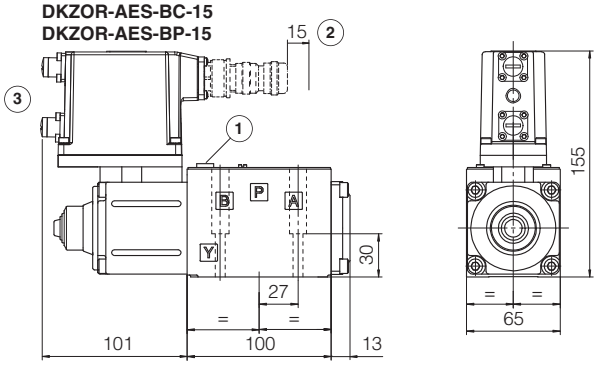
DKZOR-AEB-NP-15



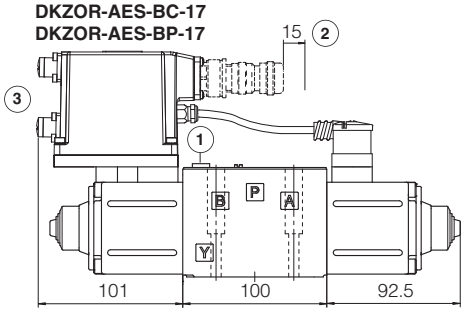
DKZOR-AEB-NP-17



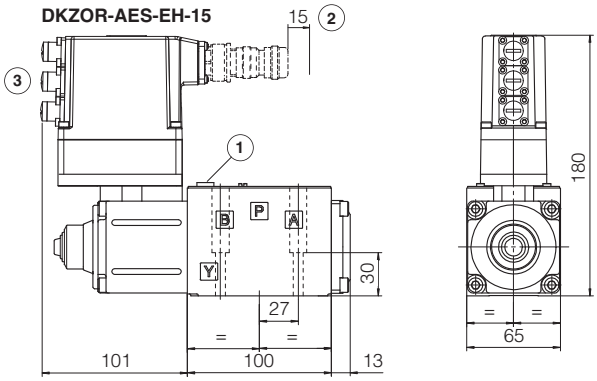
DKZOR-AES-BC-15
DKZOR-AES-BP-15



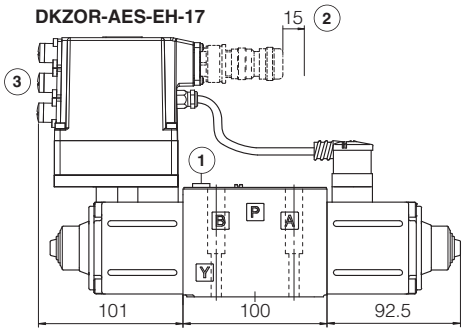
DKZOR-AES-BC-17
DKZOR-AES-BP-17



DKZOR-AES-EH-15



DKZOR-AES-EH-17



(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 16.6 and 16.7

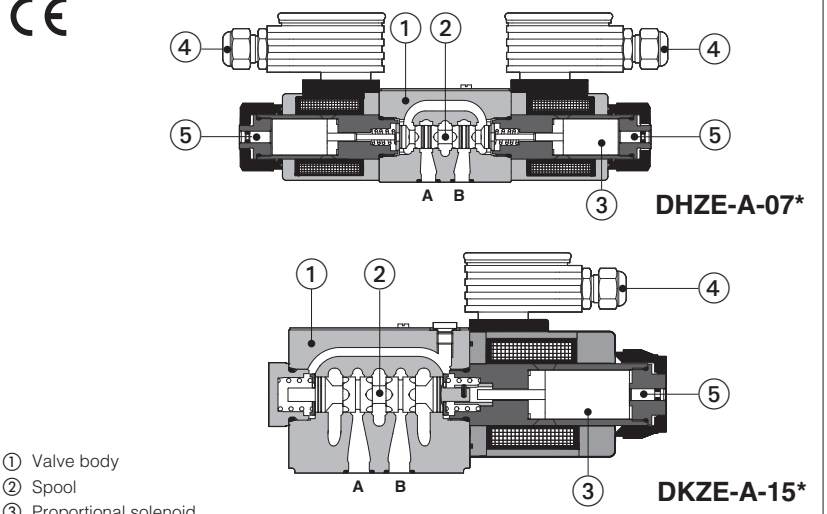
Note: for option /B the solenoid and the on-board digital driver are at side of port A

21 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS900	Operating and maintenance information for proportional valves	**K800**	Electric and electronic connectors
G010	E-MI-AC analog driver	**P005**	Mounting surfaces for electrohydraulic valves
G020	E-MI-AS-IR digital driver	**QB100**	Quickstart for AEB valves commissioning
G030	E-BM-AS digital driver	**QF100**	Quickstart for AES valves commissioning
GS050	E-BM-AES digital driver		
GS500	Programming tools		

Proportional directional valves

direct, without transducer



① Valve body
② Spool
③ Proportional solenoid
④ E-MI-AS-IR digital driver (to be ordered separately)
⑤ Manual override

DHZE-A, **DKZE-A**

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

Spool regulation characteristics:
L =linear
S = progressive
D = differential-progressive

Valve body characteristics:
3 chambers type for DHZE
5 chambers type for DKZE

The solenoids are certified according to North American standard **cURus**.

DHZE:	**DKZE**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **70 l/min**	Max flow: **160 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

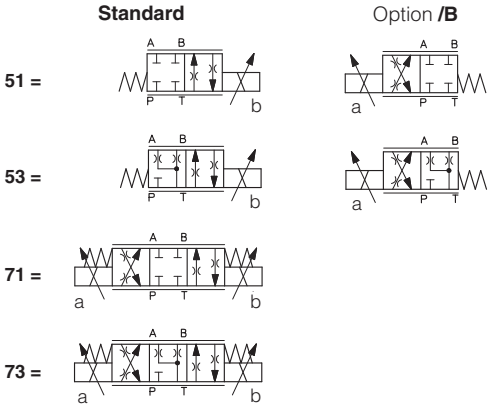
DHZE	-	A	-	0	71	-	S	5	/	*	-	*	/	*	*	/	*

DHZE = size 06
DKZE = size 10

A = for off-board driver, see section 2

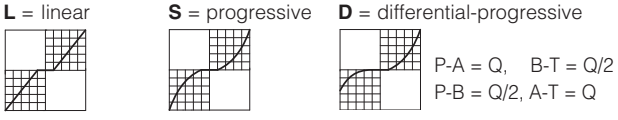
Valve size ISO 4401:
0 = 06 **1** = 10

Configuration:



Spool type, regulating characteristics:

L = linear
S = progressive
D = differential-progressive



(1) Only for **DHZE** with spool type S3, S5, D3, D5, L3, L5

Series number

Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR

Coil voltage, see section 10 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers

Coil with special connectors, see section 12 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

Hydraulic options:
B = solenoid at side of port A (only for valve configuration 5)

Hand lever options (1):
MO = horizontal hand lever
MV = vertical hand lever
BMO = horizontal hand lever installed at side of port A
BMV = vertical hand lever installed at side of port A

Spool size:	**14** (L)	**1** (L)	**3** (L,S,D)	**5** (L,S,D)
DHZE =	1	4,5	17	28
DKZE =	-	-	45	60

Nominal flow (l/min) at Δp 10 bar P-T

2 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS

Valve model	**DHZE**				**DKZE**	
Pressure limits [bar]	ports **P, A, B** = 350; **T** = 210				ports **P, A, B** = 315; **T** = 210	
Spool type and size	**L14**	**L1**	**S3, L3, D3**	**S5, L5, D5**	**S3, L3, D3**	**S5, L5, D5**
Nominal flow **(1)** [l/min]						
at Δp = 10 bar (P-T)	1	4,5	18	28	45	60
at Δp = 30 bar (P-T)	1,7	8	30	50	80	105
at Δp = 70 bar (P-T)	3	12	45	70	120	160
Response time **(2)** [ms]	≤ 30				≤ 40	
Hysteresis [%]	5 [% of max regulation]					
Repeatability [%]	± 1 [% of max regulation]					

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2;
the flow regulated by the directional proportional valves is not pressure compensated, thus it is affected by the load variations;
to keep costant the regulated flow under different load conditions, modular pressure compensators are available - see tech. table D150

(1) For different Δp, the max flow is in accordance to the diagrams in sections 8.2 and 9.2
(2) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

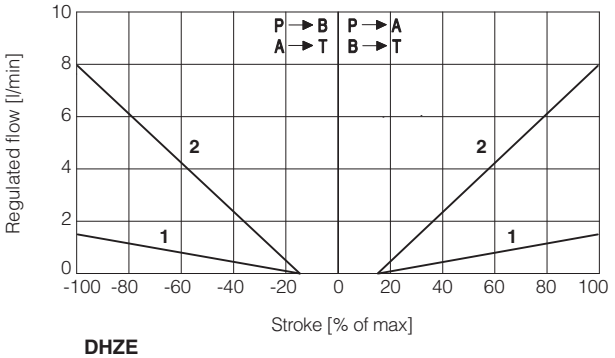
Max power consumption	**DHZE**			**DKZE**		
	30 W			35 W		
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	IP65 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Certification	**cURus** North American Standard					

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

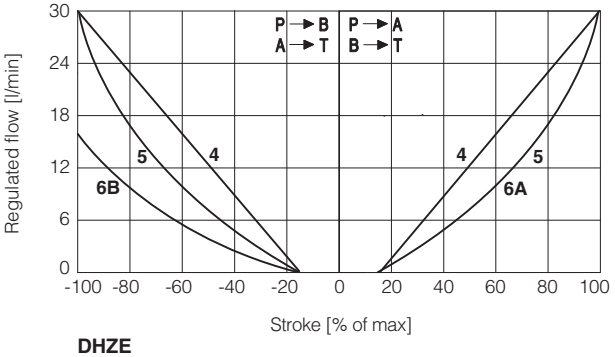
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

8 DIAGRAMS FOR DHZE (based on mineral oil ISO VG 46 at 50 °C)

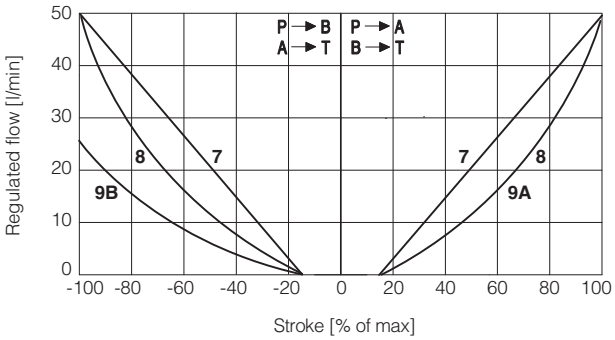
8.1 Regulation diagrams



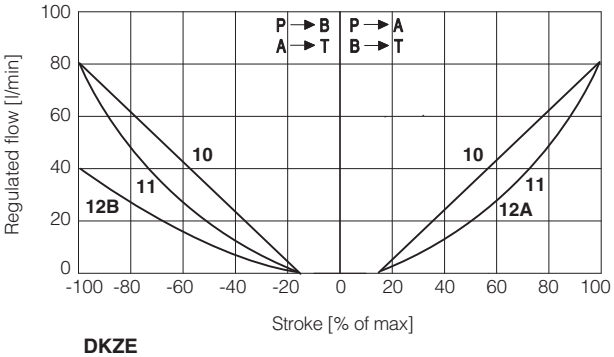
DHZE
1 = L14 **2** = L1



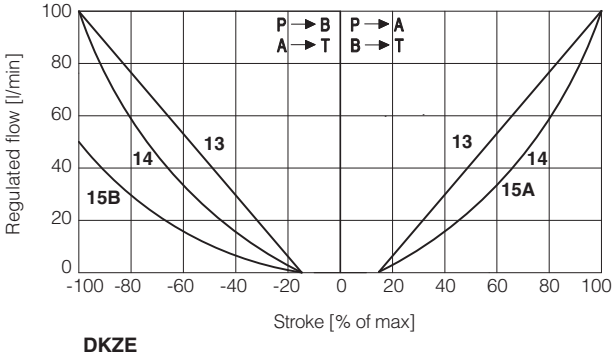
DHZE
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZE
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZE
10 = L3 **11** = S3 **12A** = D3 (P → A, A → T)
12B = D3 (P → B, B → T)



DKZE
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

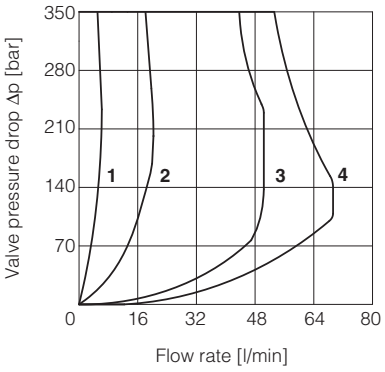
Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ - 10 V / 12 ÷ 4 mA } P → B / A → T

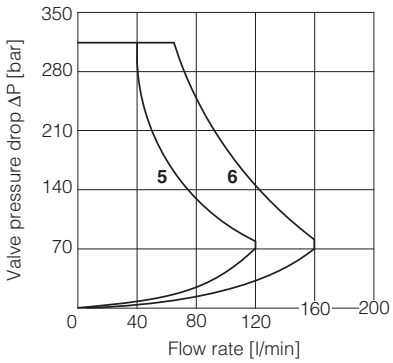
8.2 Operating limits

DHZE



1 = spool L14
2 = spool L1
3 = spool L3, S3, D3
4 = spool L5, S5, D5

DKZE



5 = spool S3, L3, D3
6 = spool S5, L5, D5

9 HYDRAULIC OPTIONS

B = DHZE-05 and DKZE-15 = solenoid at side of port A of the main stage.
DHZO-07 and DKZE-17 = E-MI-AS-IR electronics at side of port A of the main stage.

Hand lever option - only for **DHZE** with spool type S3, S5, D3, D5, L3, L5.

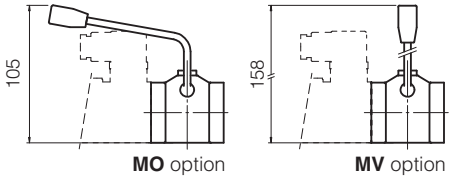
It allows to operate the valve in absence of electrical power supply.
For detailed description of DHZE with hand lever option see tech. table **E138**.

MO = Horizontal hand lever

BMO = Horizontal hand lever installed at side of port A

MV = Vertical hand lever

BMV = Vertical hand lever installed at side of port A



10 COIL VOLTAGE OPTIONS

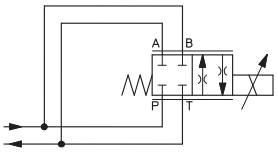
6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

11 OPERATION AS THROTTLE VALVE

Single solenoid valves
DHZE-A-051 and DKZE-A-151
can be used as simple throttle valves:
Pmax = 210 bar

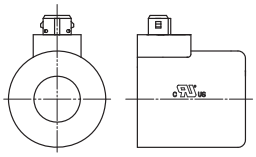
Max flow Δp= 15bar [l/min]	SPOOL TYPE					
	L14	**L1**	**L3**	**S3**	**L5**	**S5**
DHZE	4	16	60		100	
DKZE	-	-	160		200	



12 COILS WITH SPECIAL CONNECTORS

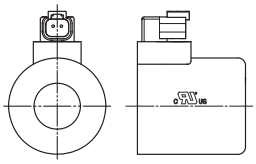
J option

Coil type COZEJ (DHZE)
Coil type CAZEJ (DKZE)
AMP Junior Timer connector
Protection degree IP67



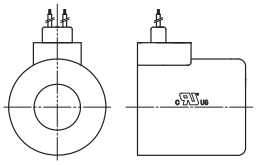
K option

Coil type COZEK (DHZE)
Coil type CAZEK (DKZE)
Deutsch connector, DT-04-2P male
Protection degree IP67

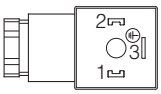


S option

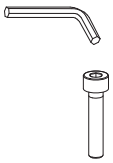
Coil type COZES (DHZE)
Coil type CAZES (DKZE)
Lead Wire connection
Cable lenght = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

14 FASTENING BOLTS AND SEALS

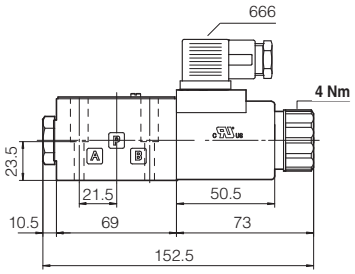
	DHZE	DKZE
	**Fastening bolts:** 4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max)

15 INSTALLATION DIMENSIONS FOR DHZE [mm]

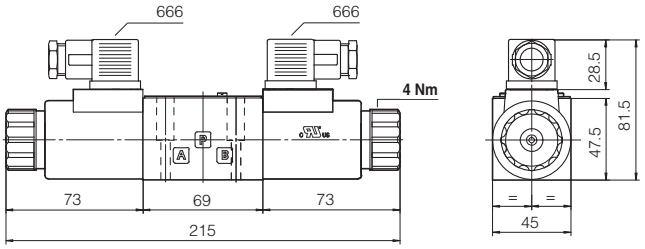
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]	
DHZE-A-05	1,5
DHZE-A-07	2
DHZE-A-05 with E-MI-AS-IR	2
DHZE-A-07 with E-MI-AS-IR	3

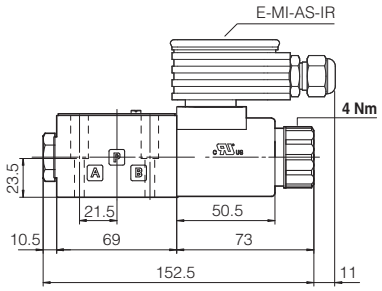
DHZE-A-05



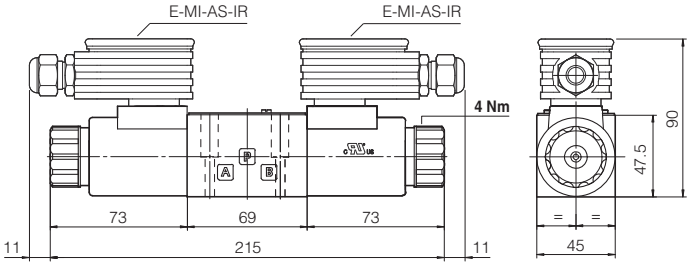
DHZE-A-07



DHZE-A-05 with E-MI-AS-IR digital driver



DHZE-A-07 with E-MI-AS-IR digital drivers



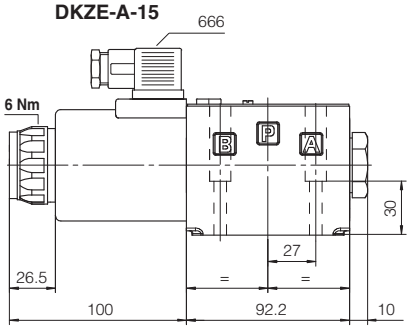
Note: for option /B the solenoid is at side of port A (only for DHZE-A-05 and DKZE-A-15)

16 INSTALLATION DIMENSIONS FOR DKZE [mm]

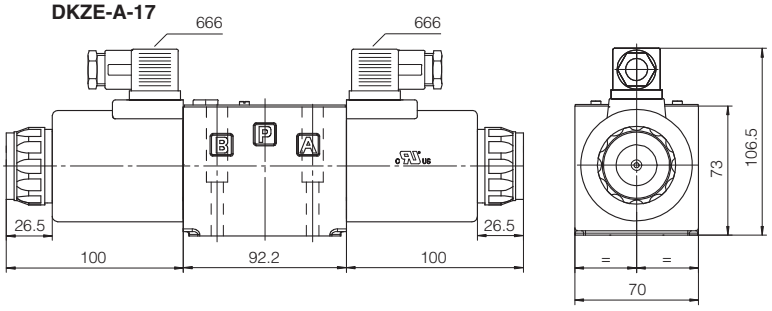
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)

Mass [kg]	
DKZE-A-15	4,5
DKZE-A-17	6,1
DKZE-A-15 with E-MI-AS-IR	5
DKZE-A-17 with E-MI-AS-IR	7,1

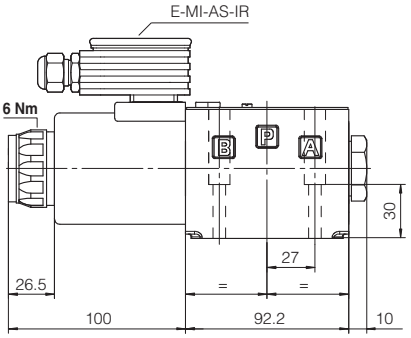
DKZE-A-15



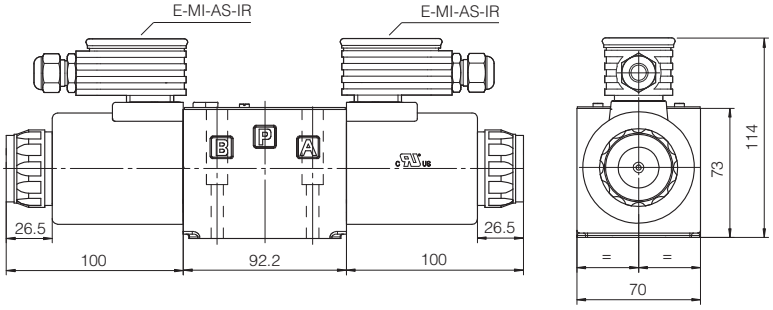
DKZE-A-17



DKZE-A-15 with E-MI-AS-IR digital driver



DKZE-A-17 with E-MI-AS-IR digital drivers



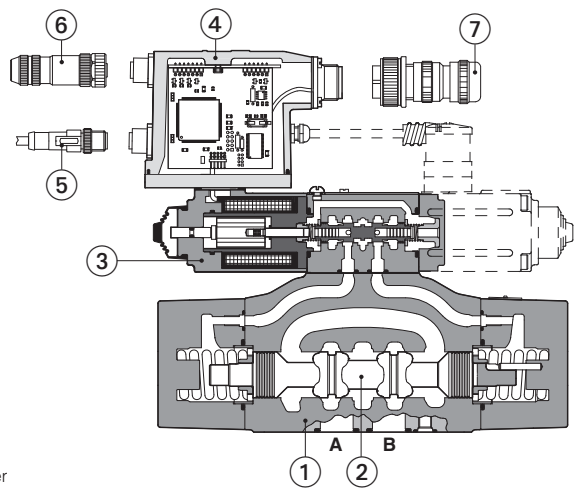
Note: for option /B the solenoid is at side of port A (only for DHZE-A-05 and DKZE-A-15)

17 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Digital proportional directional valves

piloted, without transducer, with positive spool overlap



① Valve body
② Main stage Spool
③ Pilot valve
④ On-board digital driver
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector

DPZO-AES-BC-251-*
DPZO-AES-BC-271-* (dotted line)

DPZO-A, DPZO-AEB, DPZO-AES

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1500 l/min**
Max pressure: **350 bar**

1 **MODEL CODE**

DPZO	-	AES	-	BC	-	2	71	-	L	5	/	*	/	*	*	/	*

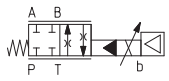
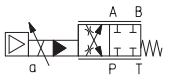
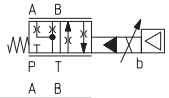
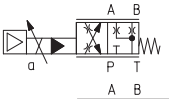
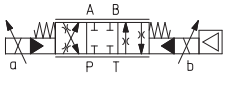
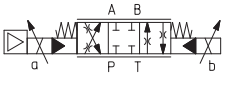
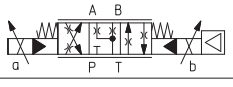
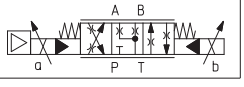
DPZO: Proportional directional valve, piloted

AES:
A = for off-board driver, see section 2
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

BC:
Fieldbus interfaces, USB port always present **(5)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

2:
Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

71:
Configuration (3):

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

L:
Spool type, regulating characteristics:
L = linear **S** = progressive **D** = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

5:
Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

Series number

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

Hydraulic options (4):
B = solenoid and on-board digital driver at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronics options, only for **AEB** and **AES** **(4)**:
C = current feedback for pressure transducer 4÷20 mA (omit for std voltage 0÷10 VDC) - only for **W**
I = current reference input 4÷20 mA (omit for std voltage ±10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector
W = power limitation function - 12 pin connector

Spool size:	**3** (L,S,D)	**5** (L,S,D)
DPZO-1 =	-	100
DPZO-2 =	160	250
DPZO-4 =	-	480
DPZO-6 =	-	640

Nominal flow (l/min) at Δp 10bar P-T

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Hydraulic symbols are represented with on-board digital driver
(4) For possible combined options, see section 13
(5) Omit for **A** execution

2 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

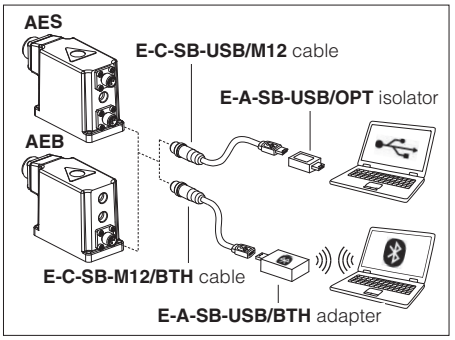
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DPZO-*-1**	**DPZO-*-2**		**DPZO-*-4**	**DPZO-*-6**
Pressure limits [bar]	ports **P**, **A**, **B**, **X** = 350; **T** = 250 (10 with internal drain /D) **Y** = 10				
Spool type	**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**		
Nominal flow Δp P-T [l/min] **(1)**					
Δp= 10 bar	100	160	250	480	640
Δp= 30 bar	160	270	430	830	1100
Max permissible flow	180	400	550	900	1500
Piloting pressure [bar]	min = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)				
Piloting volume [cm³]	1,4	3,7		9,0	21,6
Piloting flow **(2)** [l/min]	1,7	3,7		6,8	14,4
Leakage **(3)** [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time **(4)** [ms]	≤ 80	≤ 100		≤ 120	≤ 180
Hysteresis	≤ 5 [% of max regulation]				
Repeatibility	± 1 [% of max regulation]				

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) For different Δp, the max flow is in accordance to the diagrams in section 9.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard		option /6	option /18
Max. solenoid current	2,2 A		2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω		2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 17			

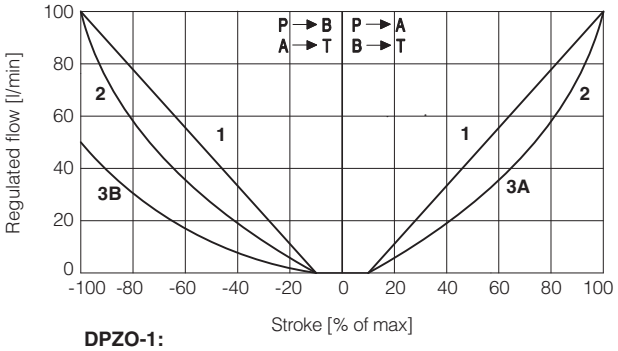
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

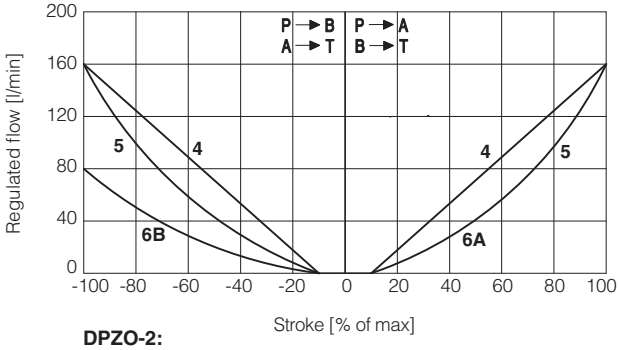
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog	
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5			
Hydraulic fluid	**Suitable seals type**		**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR		HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM		HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR		HFC	

10 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

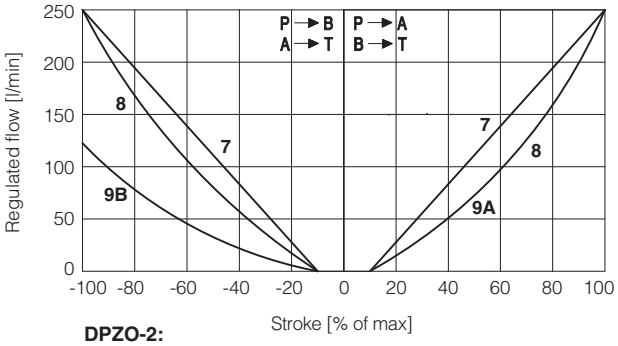
10.1 Regulation diagrams (values measure at Δp 10 bar P-T)



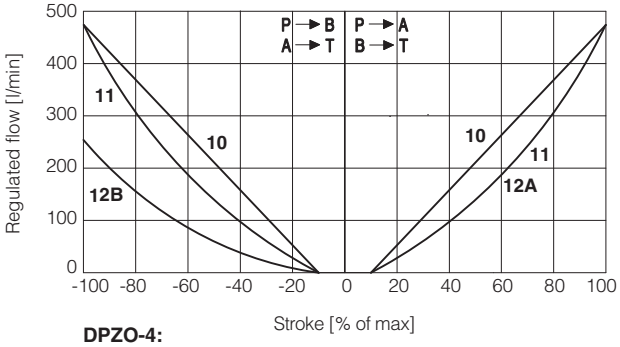
DPZO-1:
1 = L5 **2** = S5 **3A** = D5 (P → A, A → T)
3B = D5 (P → B, B → T)



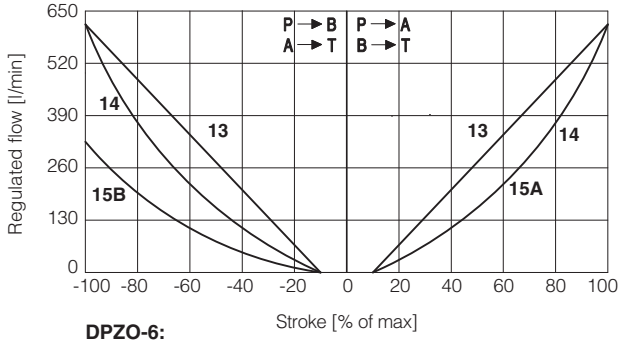
DPZO-2:
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DPZO-2:
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DPZO-4:
10 = L5 **11** = S5 **12A** = D5 (P → A, A → T)
12B = D5 (P → B, B → T)



DPZO-6:
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\begin{matrix} 0 \div +10\ V \\ 12 \div 20\ mA \end{matrix}$ } P → A / B → T

Reference signal $\begin{matrix} 0 \div -10\ V \\ 12 \div 4\ mA \end{matrix}$ } P → B / A → T

10.2 Flow /Δp diagram

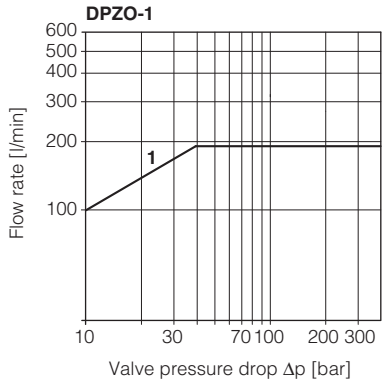
stated at 100% of spool stroke

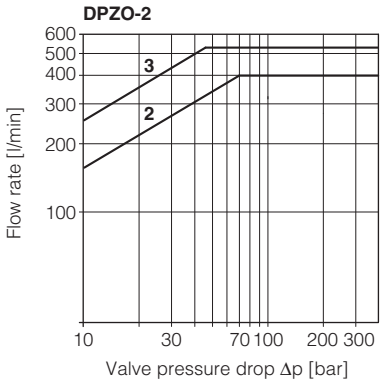
DPZO-1:
1 = spools L5, S5, D5

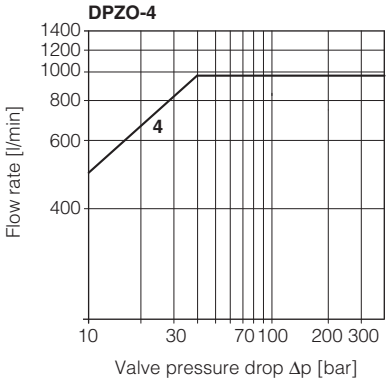
DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5

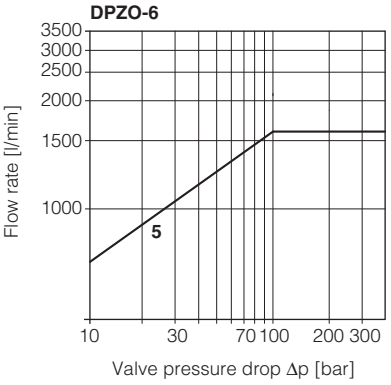
DPZO-4:
4 = spools L5, S5, D5

DPZO-6:
5 = spools L5, S5, D5



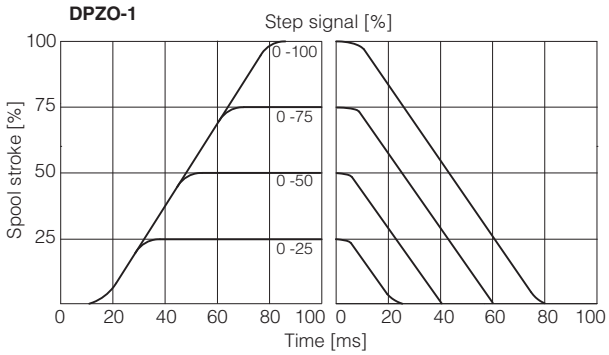


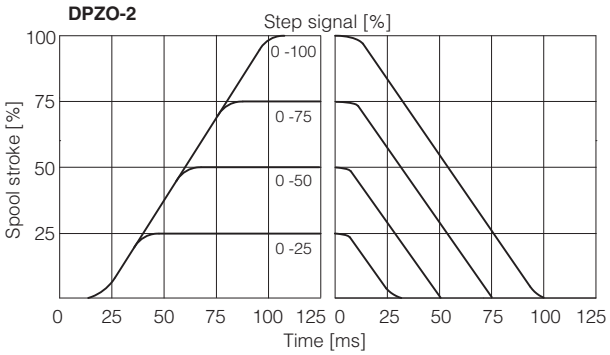


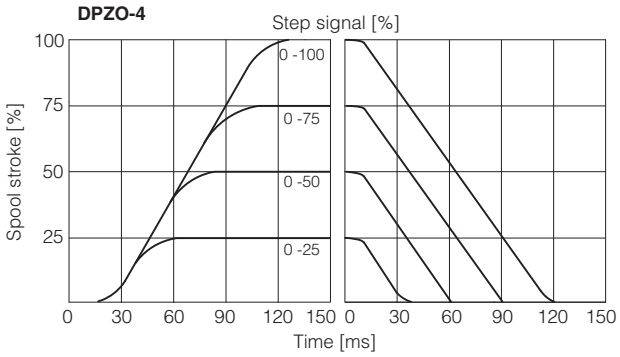


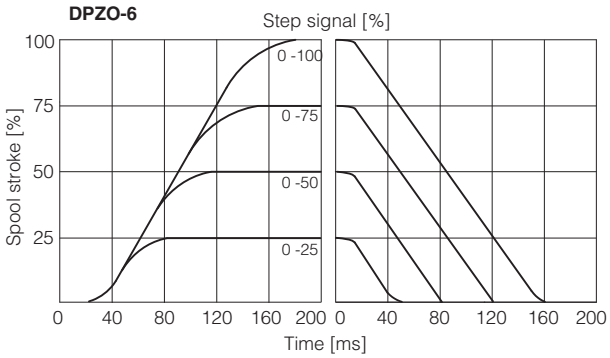
10.3 Response time (measured at pilot pressure = 100 bar)

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



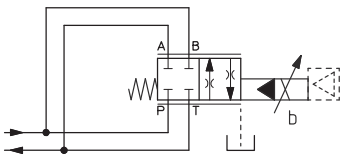






10.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar
For this application, the use of valve -TEB or -TES (see tab. FS172) is advisable (consult our technical office)



DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min] Δp = 15 bar	320	860	1600	2200

11 HYDRAULIC OPTIONS

B = DPZO-*-*5 = solenoid and on-board digital driver at side B of the main stage (side A of pilot valve).
DPZO-*-*7 = on-board digital driver at side of port B of the main stage (side A of pilot valve).

D = Internal drain.
Pilot and drain configuration can be modified as shown in section 18.
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in section 18.
The valve's standard configuration provides internal pilot and external drain.

G = Standard for size 10.
Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZO-1 and DPZO-2 = **40 bar**
DPZO-4 and DPZO-6 = **100 bar**
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

12 ELECTRONICS OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver.
Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 15.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 15.2

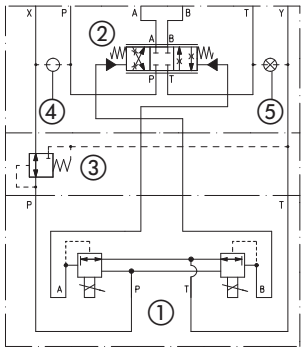
C = Only in combination with option **/W**
This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator, see tech table **D150**.
It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} \; ; \; \text{Flow Reference [INPUT+]} \right)$$

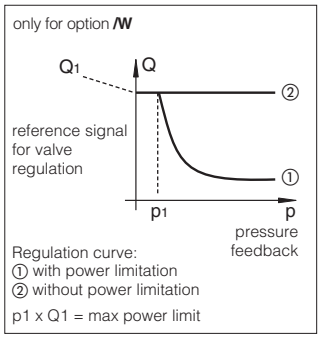
Functional Scheme

Example of configuration 7*
3 positions, spring centered



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

Hydraulic Power Limitation



13 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible
Electronics options: /IQ, /IZ, /IW, /CW, /CWI

14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** and **/W** options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC.

15.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.6 Fault output signal (FAULT) - only for **/Z** and **/W** options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

15.7 Remote pressure transducer input signal (TR+) - only for **/W** option

Analog pressure transducers can be directly connected to the driver (see 16.4).
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

16 ELECTRONIC CONNECTIONS

16.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND V0		Monitor output signal: ±5 VDC maximum range Default is ± 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

16.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**		Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is ± 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**		Do not connect	
8	**NC**		Do not connect	
		MONITOR2	2nd monitor output signal: ±5 VDC maximum range, referred to VL0. Default is 0 ÷ 5 VDC	Output - analog signal
9	**VL+**		Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**		Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

16.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

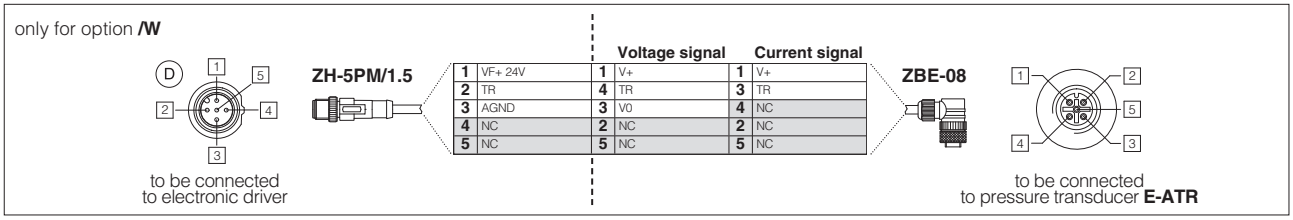
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

16.4 Remote pressure transducer connector - M12 - 5 pin - only for **/W** option - for **AEB** and **AES** (D)

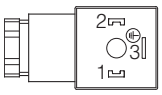
PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Connect	Connect
2	**TR**	Signal transducer maximum range ±10 VDC / ±20 mA, software selectable Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Connect	Connect
3	**AGND**	Common GND for transducer power and signals	Connect	/
4	**NC**	Not Connect	/	/
5	**NC**	Not Connect	/	/

Remote pressure transducer connection - example



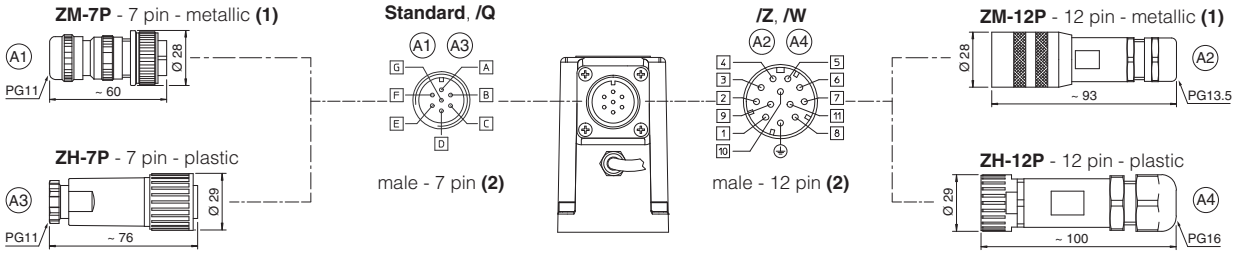
Note: connectors front view

16.5 Solenoid connection - only for **A**

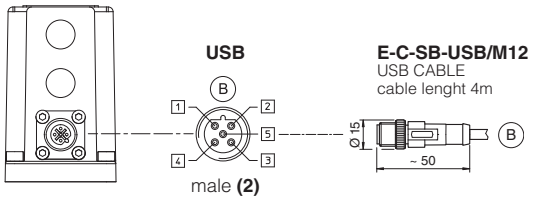
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

16.6 AEB connections layout

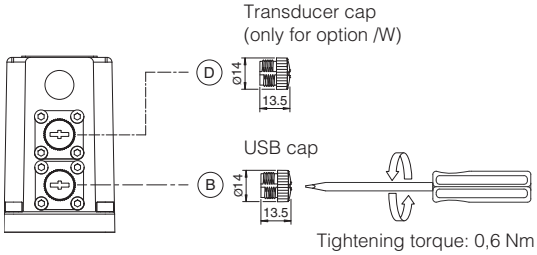
MAIN CONNECTORS



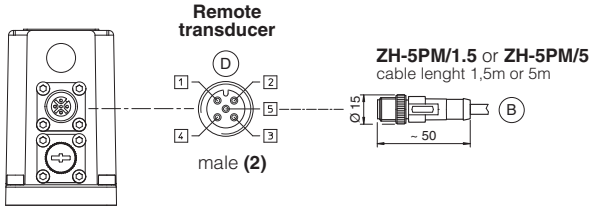
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



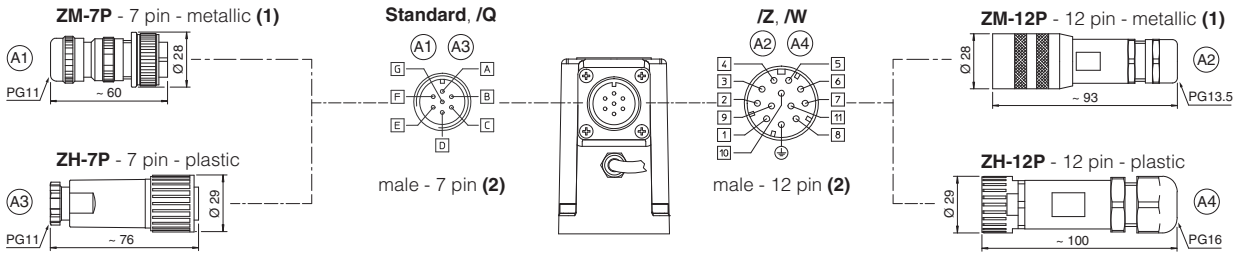
TRANSDUCER CONNECTOR - only for option **/W**



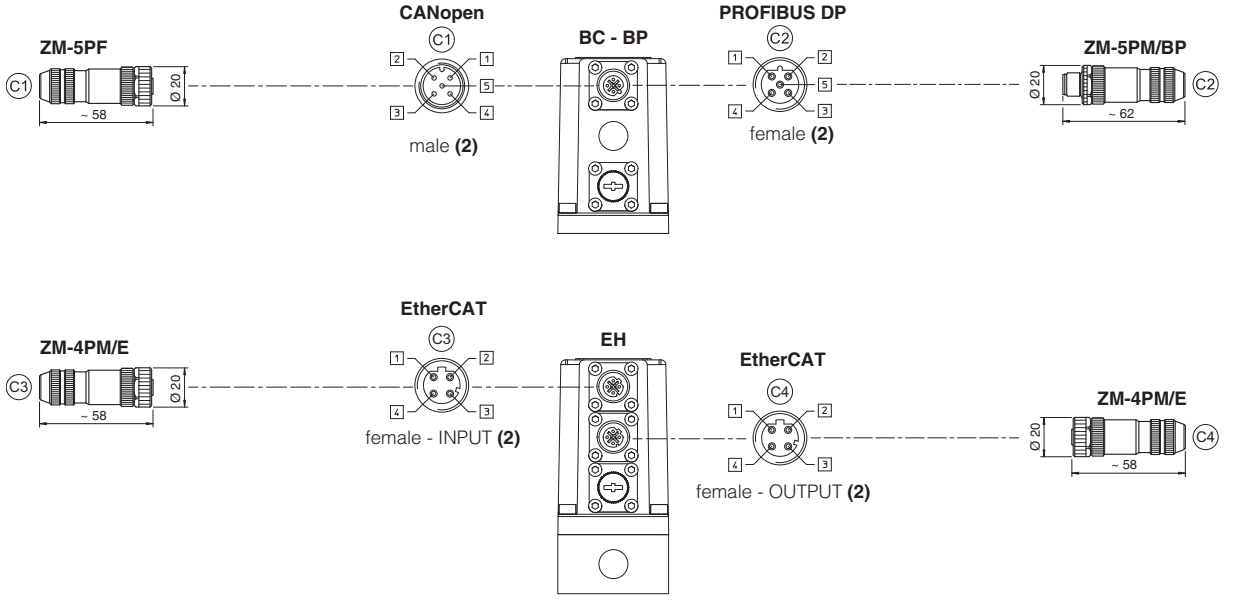
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

16.7 AES connections layout

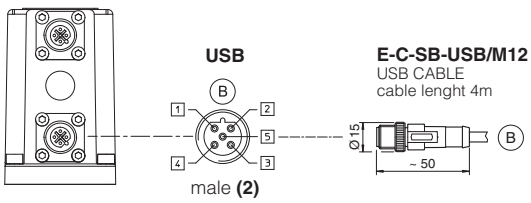
MAIN CONNECTORS



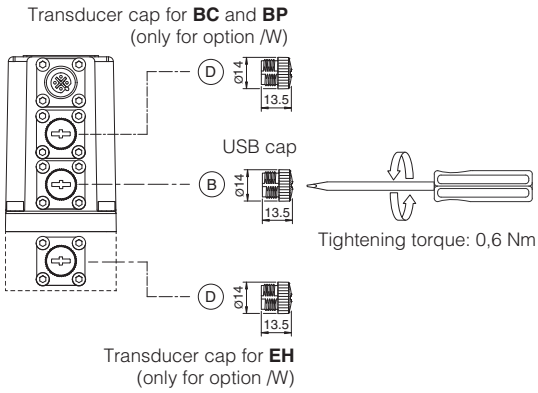
FIELDBUS CONNECTORS



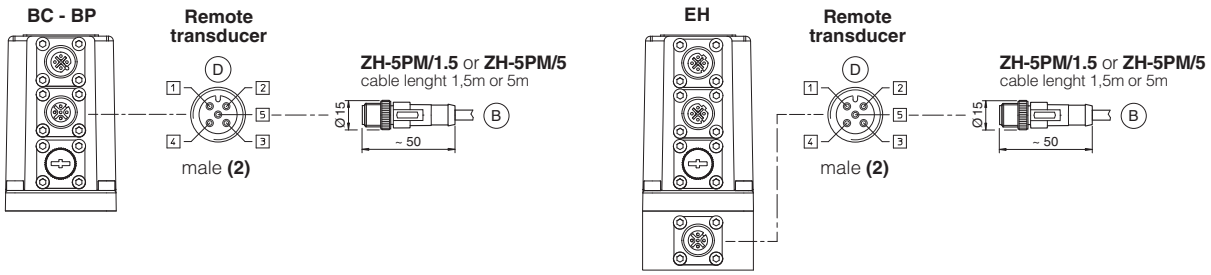
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option /W



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17 CONNECTORS CHARACTERISTICS - to be ordered separately

17.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

17.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

17.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

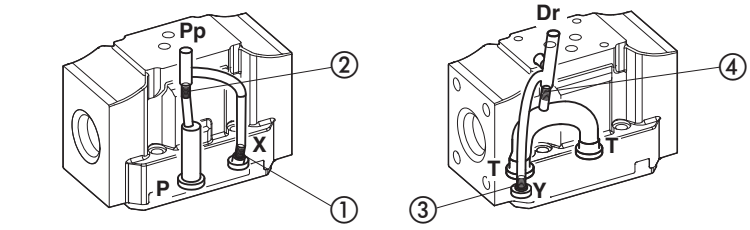
17.4 Pressure transducer connectors - only for **/W** option

CONNECTOR TYPE	TRANSDUCER	
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm²	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

18 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

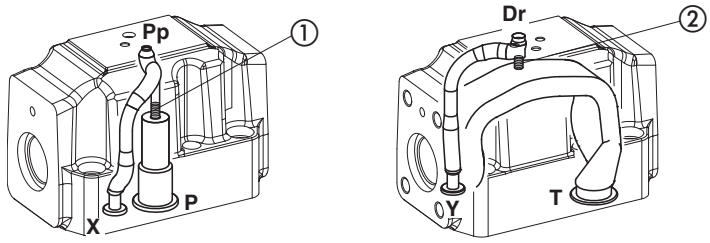
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZO-1 Pilot channels Drain channels



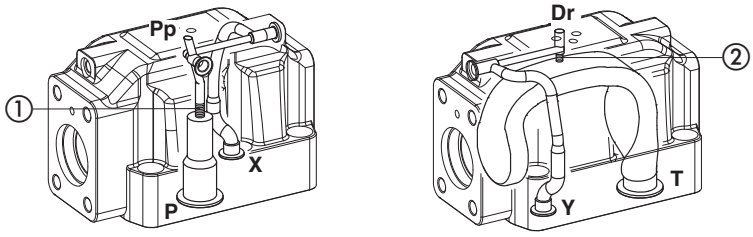
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels Drain channels



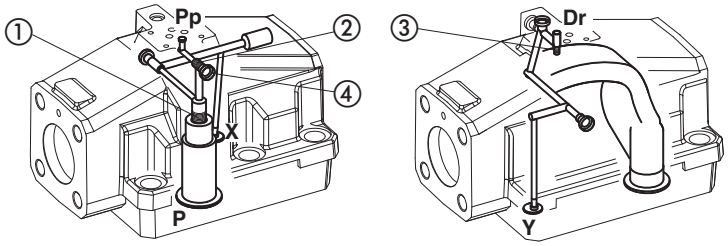
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 Pilot channels Drain channels



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels Drain channels



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Add plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orefice ② remove plug ④ = G1/8"

19 FASTENING BOLTS AND SEALS

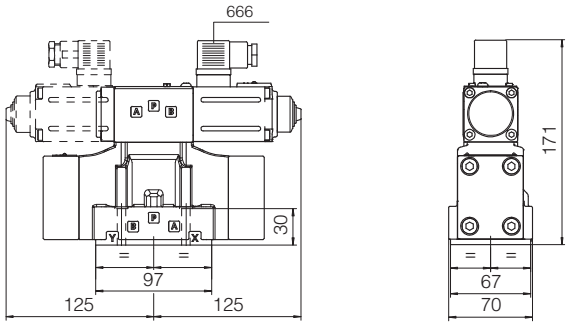
Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

20 INSTALLATION DIMENSIONS FOR DPZO-1 [mm]

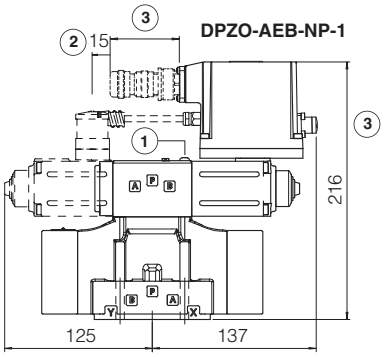
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DPZO-*-15	7,7	8,1	8,2
DPZO-*-17	8,6	9	9,1
Option /G	+0,9		

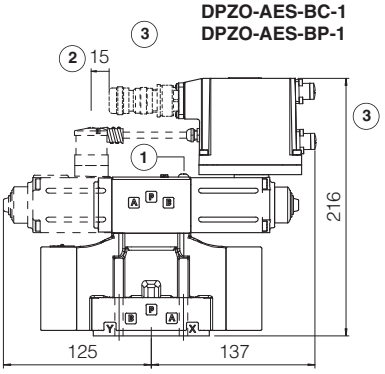
DPZO-A-1



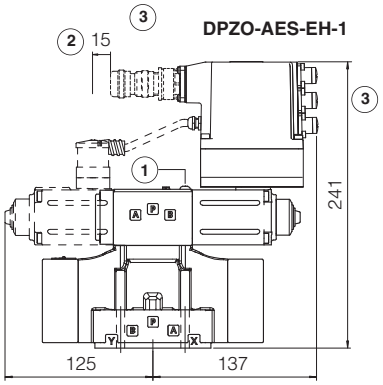
DPZO-AEB-NP-1



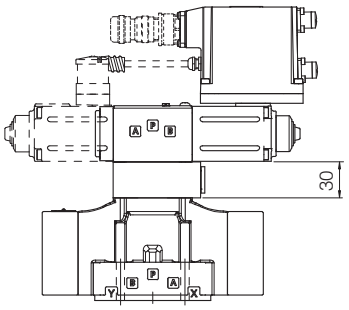
DPZO-AES-BC-1
DPZO-AES-BP-1



DPZO-AES-EH-1



option /G



Dotted line = double solenoid version

(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 16.6 and 16.7

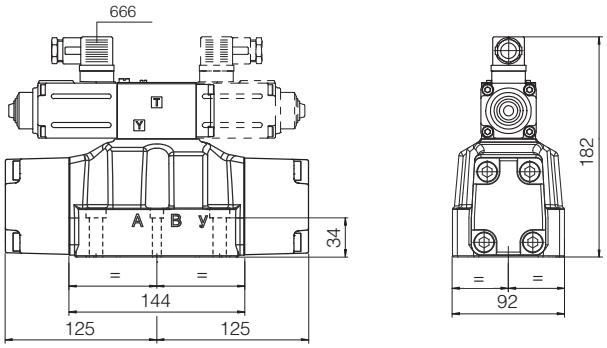
Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

21 INSTALLATION DIMENSIONS FOR DPZO-2 [mm]

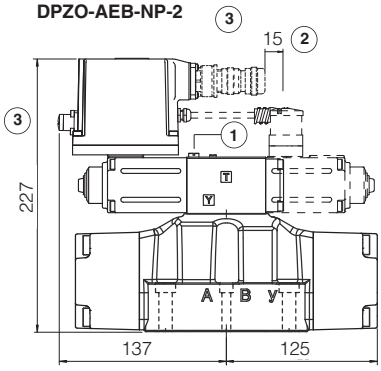
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DPZO-*-25	11,9	12,3	12,4
DPZO-*-27	12,8	13,2	13,3
Option /G	+0,9		

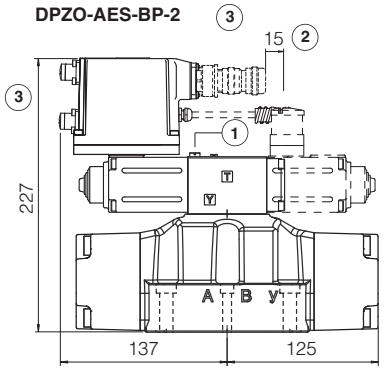
DPZO-A-2



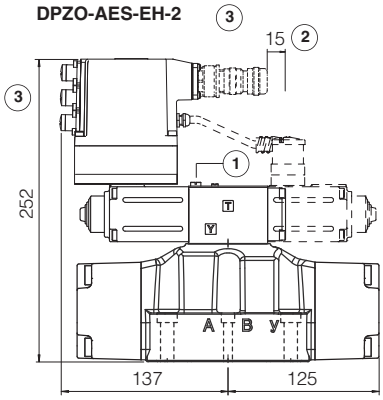
DPZO-AEB-NP-2



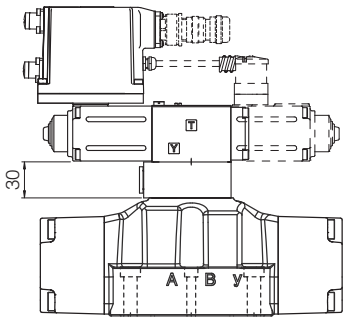
DPZO-AES-BC-2
DPZO-AES-BP-2



DPZO-AES-EH-2



option /G



Dotted line = double solenoid version

(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 16.6 and 16.7

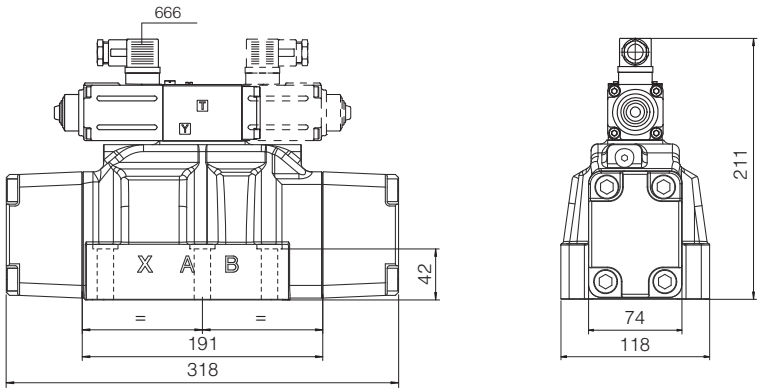
Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

22 INSTALLATION DIMENSIONS FOR DPZO-4 [mm]

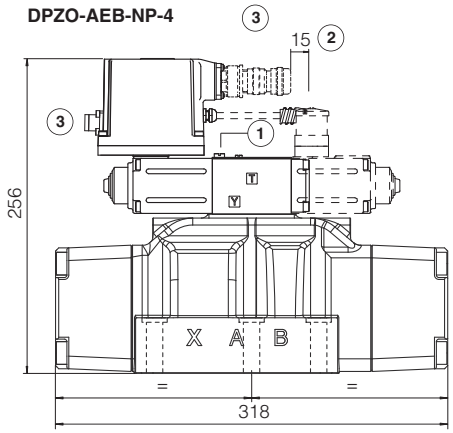
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DPZO-*-45	17,1	18	18,1
DPZO-*-47	18	18,9	19
Option /G	+0,9		

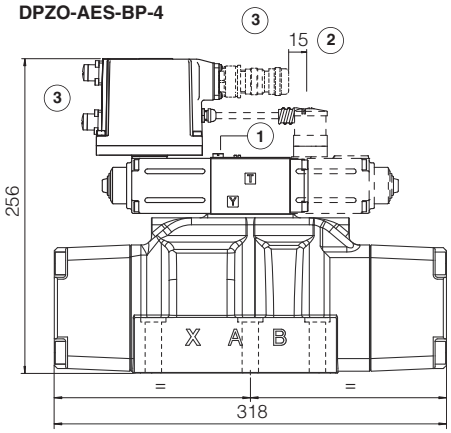
DPZO-A-4



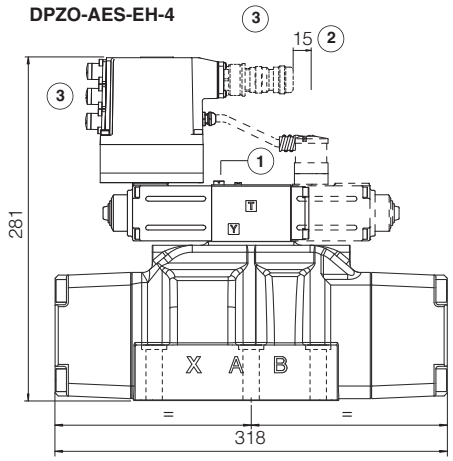
DPZO-AEB-NP-4



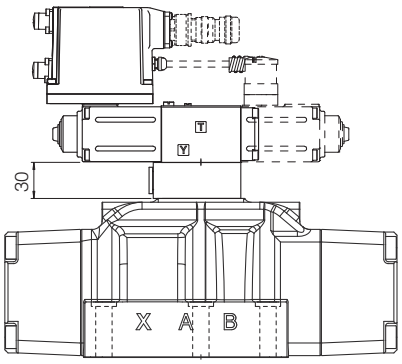
DPZO-AES-BC-4
DPZO-AES-BP-4



DPZO-AES-EH-4



option /G



Dotted line = double solenoid version

(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 16.6 and 16.7

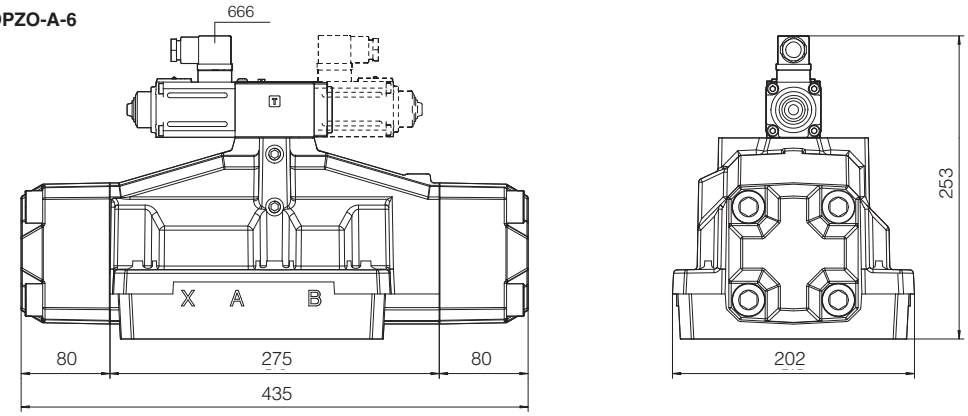
Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

23 INSTALLATION DIMENSIONS FOR DPZO-6 [mm]

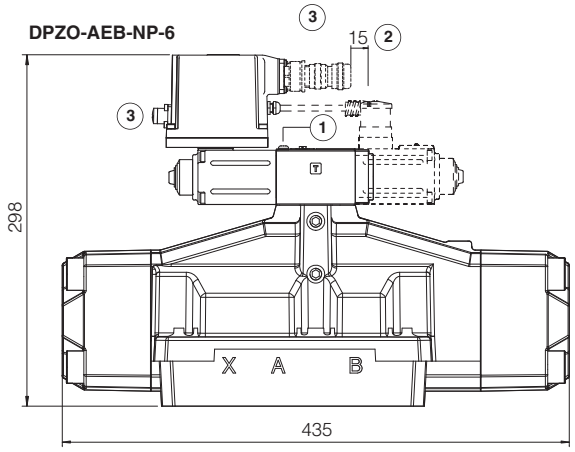
ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DPZO-*-65	42,1	42,5	42,6
DPZO-*-67	42,7	43,1	43,2
Option /G	+2,3		

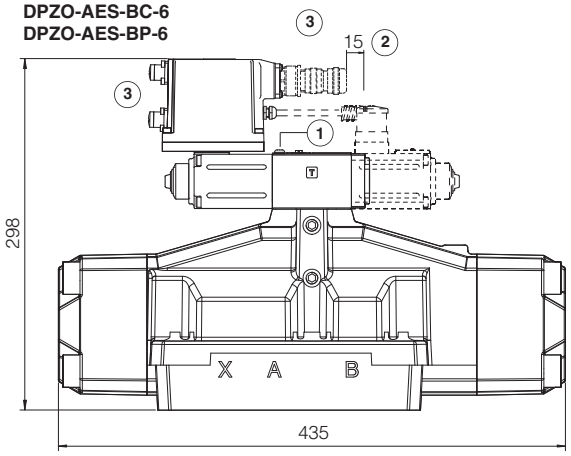
DPZO-A-6



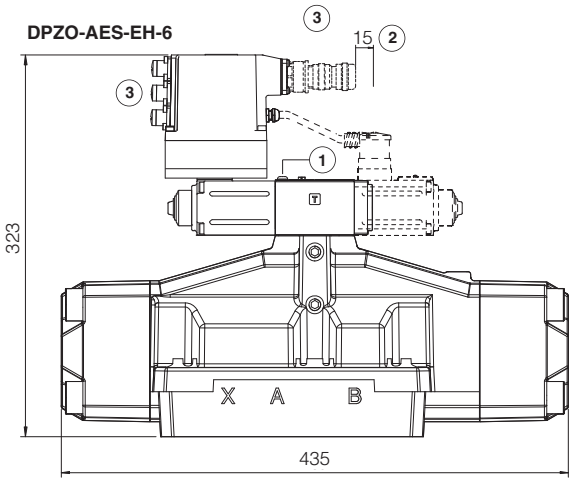
DPZO-AEB-NP-6



DPZO-AES-BC-6
DPZO-AES-BP-6

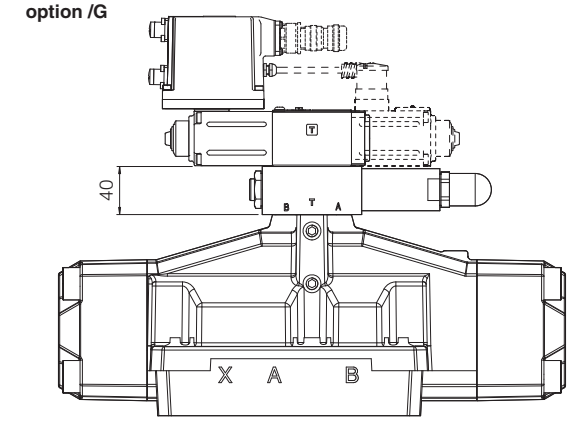


DPZO-AES-EH-6



Dotted line = double solenoid version

option /G



(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 16.6 and 16.7

Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

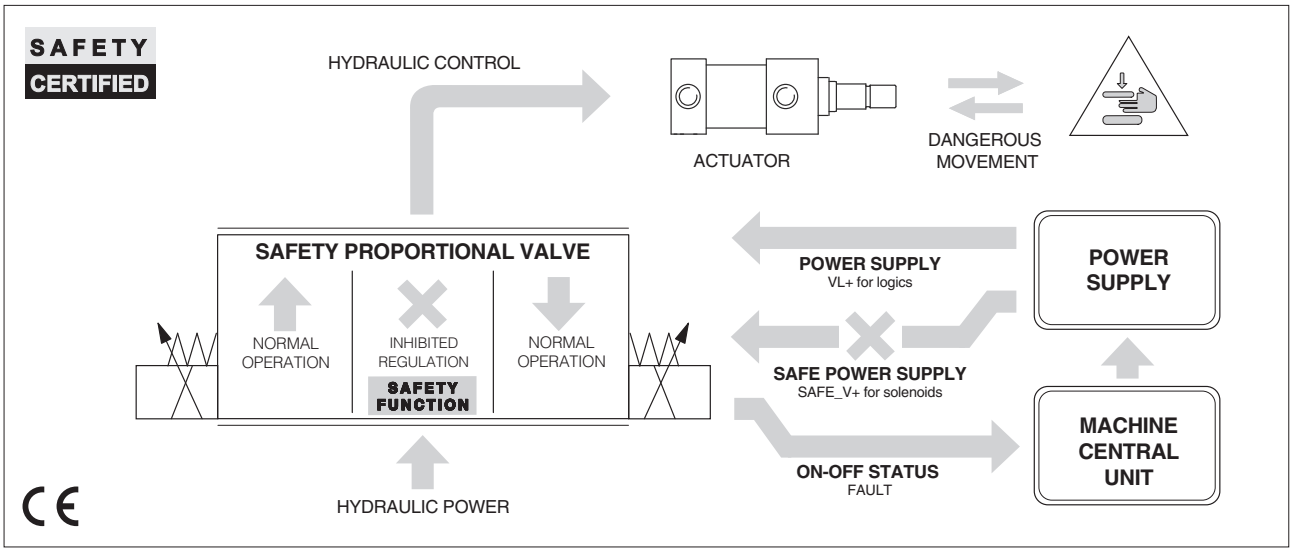
24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS900	Operating and maintenance information for proportional valves	**K800**	Electric and electronic connectors
G010	E-MI-AC analog driver	**P005**	Mounting surfaces for electrohydraulic valves
G020	E-MI-AS-IR digital driver	**QB120**	Quickstart for AEB valves commissioning
G030	E-BM-AS digital driver	**QF120**	Quickstart for AES valves commissioning
GS050	E-BM-AES digital driver		
GS500	Programming tools		

Safety proportional valves with double power supply

directional valves with on-board driver and LVDT transducer

IEC 61508 Safety Integrity Level and **ISO 13849** Performance Level - certified by



1 GENERAL DESCRIPTION

Safety proportional valves with double power supply are identified by option /U and are intended for use in hydraulic circuits of machines which must comply with safety requirements of Machine Directive 2006/42/EC.

They are designed to perform **Safety Functions**, in addition to the standard control of direction, speed, pressure/force or position of hydraulic actuators, depending to the valve features.

The Safety Function is operated to reduce the potential dangerous risks which may happen in a specific phase of the machine cycle.
It is activated by the machine central unit (PLC) which inhibits the regulation of proportional valve /U by removing the safe power supply to the valve solenoids in case of emergency or for specific requirements along the working cycle.

Upon solenoid power supply interruption, the valve driver remains active thanks to the separated power supply for logics, thus providing fault signal and communication to the machine central unit (PLC) which manages these information as diagnostic signals.

Safety proportional valves with option /U are certified by TÜV in compliance with IEC 61508 and ISO 13849

2 CERTIFICATION

IEC 61508, IEC 61511, IEC 62061	max **SIL3**	See techinical table Y010 for details about SIL, PL and safety architetures
ISO 13849	**category 1, PL c** for **non-redundant** safety architecture **category 4, PL e** for **redundant** safety architecture	

3 VALVES RANGE

Option /U is available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.

It adds the safety functions to standard control of direction, speed, pressure/force (for SP, SF, SL version) and position (for TEZ, LEZ versions).

Valve's performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

High perfomance proportionals:
DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table **FS165**
DPZO-TES - piloted, positive spool overlap - technical table **FS172**
DPZO-LES - piloted, positive spool overlap - technical table **FS175**

Servoproportionals:
DHZO-TES, DKZOR-TES - direct, zero spool overlap - technical tables **FS168**
DPZO-LES - piloted, zero spool overlap - technical table **FS178**
DLHZO-TES, DLKZOR-TES - direct, zero spool overlap - technical tables **FS180**

Servoproportionals with TEZ/LEZ axis controller:
DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables **FS620**
DPZO-LEZ - piloted, zero spool overlap - technical tables **FS630**
DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap - technical tables **FS610**

4 FUNCTIONAL DESCRIPTION

Valves with option /U are designed to receive separated power supplies for logic VL+ and solenoids SAFE_V+.
When the solenoid power supply SAFE_V+ is removed, the valve's spool is moved by the spring towards the safe rest position and then the valve regulation is consequently inhibited.
The valve's diagnostics and communication remain active thanks to the logic power supply VL+ and then the valve can continuously exchange spool position and status with the machine central unit.
The time required by the valve's spool to reach the safe position is detailed in section 5

Safe power supply - SAFE_V+

The SAFE_V+ feeds only the valve solenoids. It can be removed to cut-off the current to the solenoids in order to inhibit the valve's regulation:

- inhibited regulation: SAFE_V+ = **0 VDC**
- permitted regulation: SAFE_V+ = **24 VDC**

For double solenoids valves the power supply SAFE_V+ feeds both solenoids, then when it is removed the valve regulation is completely inhibited.

Power supply - VL+

The VL + feeds the logic and communication functions. It must always be kept ON = 24VDC to allow the real-time diagnostics of the valve status and spool position.

Fault output signal – FAULT

Fault signal is a diagnostic output which states faults or warning according to the valve status.
This signal must be monitored by the machine central unit to intercept failures which may compromise the valve safety function.
The FAULT signal is switched OFF (0 VDC) when the internal diagnostics detects valve failures or incorrect behaviour (e.g. : spool sticking, solenoid short circuits, missing coils connection, reference signal cable broken for 4 ÷ 20 mA input, etc).
For piloted valves the FAULT signal = 0 VDC indicates also the absence of pilot pressure.

5 SWITCH-OFF TIME

The switch-off time is the time between the power supply SAFE_V+ interruption and the achievement of the spool safety rest position.
It is influenced by the working conditions like flow, pressure and fluid viscosity.

The switch-off times shown in the table are considered in the following conditions:
- max flow and max pressure values as per specific technical table of each valve model
- fluid viscosity 46 mm²/s
- fluid contamination level: ISO4406 CLASS 18/16/13

The following switch-off times can be considered as the longest ones.

For different working conditions, consult Atos technical office.

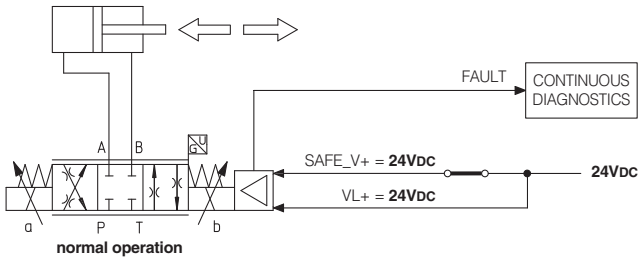
Valve model	**DHZO**	**DKZOR**	**DLHZO**	**DLKZOR**	**DPZO-1**	**DPZO-2**	**DPZO-4 DPZO-4M**	**DPZO-6**	**DPZO-8**
Switch-off time [ms]	50	80	40	60	180	250	300	350	400

6 FUNCTIONAL EXAMPLES

The following examples show the condition of a double solenoid valve and of the controlled actuator depending to the SAFE_ENABLE status.

Valve normal operation

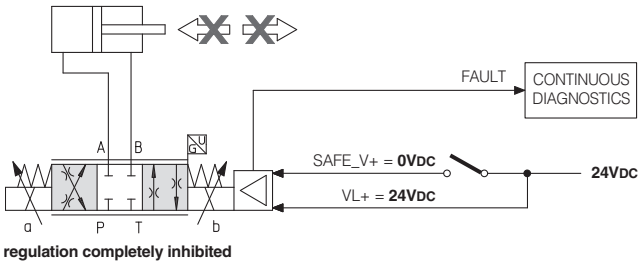
Safe Power Supply [VDC]	Power Supply [VDC]
SAFE_V+	**VL+**
24	24



normal operation

Valve safe operation with regulation completely inhibited

Safe Power Supply [VDC]	Power Supply [VDC]
SAFE_V+	**VL+**
0	24



regulation completely inhibited

INHIBITED SPOOL POSITION SAFE_V+ = **0VDC**

PERMITTED SPOOL POSITION SAFE_V+ = **24VDC**

INHIBITED DIRECTION

PERMITTED DIRECTION

7 INHIBITED / PERMITTED SPOOL POSITION

The below tables show the inhibited / permitted spool position depending to the SAFE_V+ status for all models of safety proportional valves.

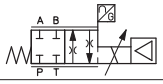
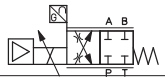
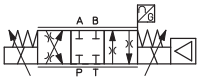
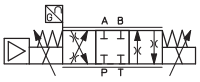
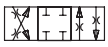
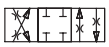
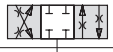
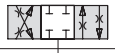
Note: the inhibition of the actuator direction may be affected by other valves present in the circuit, then the whole hydraulic system where the valve /U is applied must be considered.

7.1 High performance proportionals

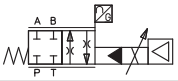
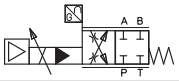
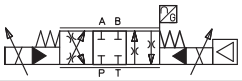
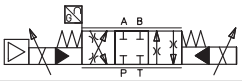
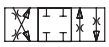
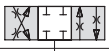
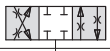
INHIBITED SPOOL POSITION

PERMITTED SPOOL POSITION

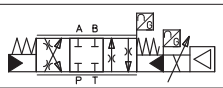
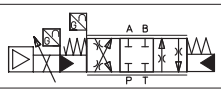
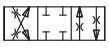
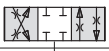
DHZO-TES, DKZOR-TES - direct operated, positive spool overlap - technical table **FS165**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **51, 53** standard	Configuration **51, 53** option /B	Configuration **71, 72, 73** standard	Configuration **71, 72, 73** option /B
SAFE_V+	VL+				
24	24				
0	24				
		①	①	①	①

DPZO-TES - pilot operated, positive spool overlap - technical table **FS172**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **51, 53** standard	Configuration **51, 53** option /B	Configuration **71, 73** standard	Configuration **71, 73** option /B
SAFE_V+	VL+				
24	24				
0	24				
		①	①	①	①

DPZO-LES - pilot operated, positive spool overlap - technical table **FS175**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **71, 73** standard	Configuration **71, 73** option /B
SAFE_V+	VL+		
24	24		
0	24		
		①	①

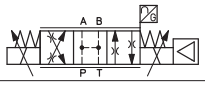
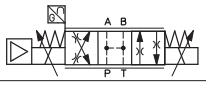
① = Spool safety rest position

7.2 Servoproportionals

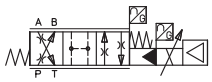
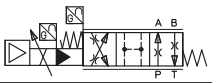
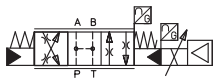
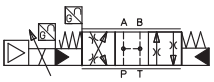
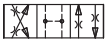
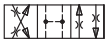
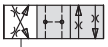
INHIBITED SPOOL POSITION

PERMITTED SPOOL POSITION

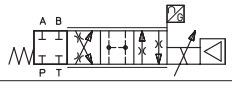
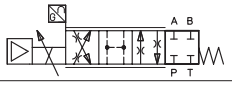
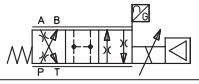
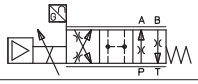
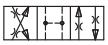
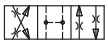
DHZO-TES/TEZ, DKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS168**, **FS620**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **70** standard	Configuration **70** option /B
SAFE_V+	VL+		
24	24		
0	24		
		②	②

DPZO-LES, DPZO-LEZ - pilot operated, zero spool overlap - technical table **FS178**, **FS630**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **60** standard	Configuration **60** option /B	Configuration **70** standard	Configuration **70** option /B
SAFE_V+	VL+				
24	24				
0	24				
		①	①	②	②

DLHZO-TES/TEZ, DLKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS180, FS610**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **40** with fail safe 1 or 3 standard	Configuration **40** with fail safe 1 or 3 option /B	Configuration **60** without fail safe standard	Configuration **60** without fail safe option /B
SAFE_V+	VL+				
24	24				
0	24				
		①	①	①	①

① = Spool safety rest position

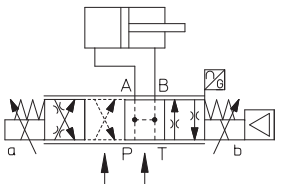
② = Spool safety rest position for valves with zero spool overlap, configuration 70 - see 7.3

7.3 Safety rest position - for valves with zero spool overlap, configuration 70

In absence of solenoid power supply (SAFE_V+ = 0), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of interruption of solenoid power supply, the actuator moves towards an undefined direction (due to the tolerances of the zero spool overlap), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



Spool position with solenoid power supply ON and reference signal = 0 (zero overlap position)

Spool offset position 1% to 6% of total stroke with solenoid power supply OFF (central safety rest position)

8 ELECTRONIC CONNECTIONS

8.1 Main connector signals - 12 pin - options /U

PIN	TES LES	TEZ LEZ	TECHNICAL SPECIFICATIONS	NOTES
1	**SAFE_V+**		Safe power supply 24 VDC for solenoid	Input - power supply
2	**SAFE_V0**		Safe power supply 0 VDC for solenoid	Gnd - power supply
3	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**Q_INPUT+**		Flow (spool position) reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
		P_INPUT+	Position reference input signal: ±10 VDC / ±20 mA maximum range	
5	**INPUT-**		Negative reference input signal for Q_INPUT+, F_INPUT+ and P_INPUT+	Input - analog signal
6	**Q_MONITOR**		Flow (spool position) monitor output signal: ±10 VDC / ±20 mA maximum range, referred to VL0. Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
		P_MONITOR	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to VL0	
7	**F_INPUT+**	**(1)**	Pressure/force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**F_MONITOR**	**(1)**	Pressure/force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to VL0 Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**VL+**		Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**		Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

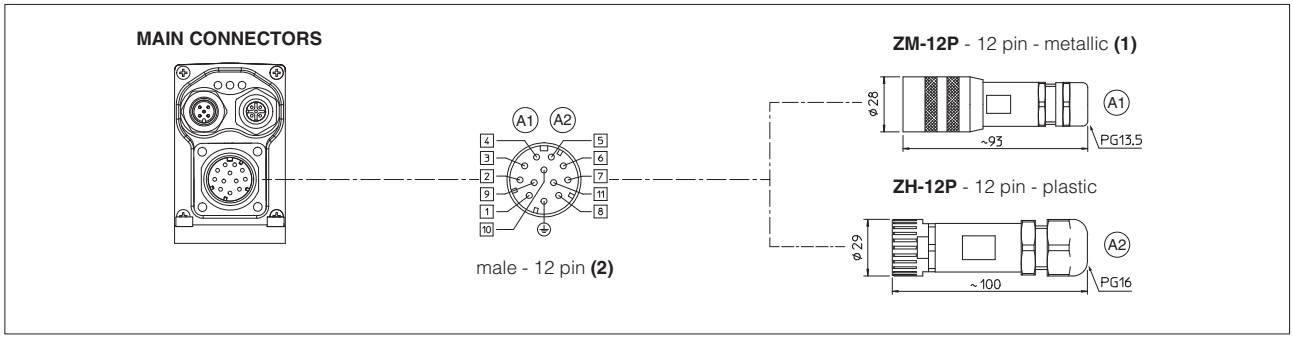
(1) Connection NOT available for **TES/LES** in **SN** execution

9 ELECTRICAL CHARACTERISTICS

SIGNALS	SPECIFICATIONS	NOTES
SAFE_V+ **VL+**	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
FAULT	ON state depends on input power supply VL+: ON state > VL+ - 2V @ max 50 mA e.g. in case of VL+ = 24V, the ON state > 22V OFF state < 1 V; External negative voltage not allowed (e.g. due to inductive loads)	Output - on/off signal

Note: for the electrical characteristic of all other signals, refer to the technical table of each valve model - see section 3

9.1 Connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements
(2) Pin layout always referred to driver's view
For fieldbus and/or transducers connections, refer to specific technical tables of each valve model - see section 3

10 RELATED DOCUMENTATION

General tables:

Y010 Basics for safety components
FS001 Basics for digital electrohydraulics
FS500 Digital proportional valves with P/Q control
FS900 Operating and maintenance information for proportional valves
GS500 Programming tools
GS510 Fieldbus
K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves

Valves technical tables:

FS165 DHZO-TES, DKZOR-TES, direct operated
FS172 DPZO-TES, pilot operated
FS175 DPZO-LES, pilot operated
FS168 DHZO-TES, DKZOR-TES, direct operated, zero spool overlap
FS180 DLHZO-TES, DLKZOR-TES, direct operated, sleeve execution
FS178 DPZO-LES, pilot operated, zero spool overlap
FS610 DLHZO-TEZ, DLKZOR-TEZ digital proportional valves with on-board axis card
FS620 DHZO-TEZ, DKZOR-TEZ digital proportional valves with on-board axis card
FS630 DPZO-LEZ digital proportional valves with on-board axis card

Commissioning and troubleshooting tables:

QF300 Quickstart for TES direct operated proportional valves (supplied with the valve)
QF320 Quickstart for TES/LES pilot operated proportional valves (supplied with the valve)

Operating and fieldbus manuals for TES and LES:

E-MAN-RI-LES - TES and LES drivers user manual
E-MAN-RI-LES-S - TES and LES drivers with P/Q control user manual
E-MAN-S-BC - CANopen protocol programming manual
E-MAN-S-BP - PROFIBUS DP protocol programming manual
E-MAN-S-EH - EtherCAT protocol programming manual
E-MAN-S-EW - POWERLINK protocol programming manual
E-MAN-S-EI - EtherNet/IP protocol programming manual
E-MAN-S-EP - PROFINET IRT protocol programming manual

Operating and fieldbus manuals for TEZ and LEZ:

Z-MAN-RI-LEZ - TEZ and LEZ controllers user manual
Z-MAN-RI-LEZ-S - TEZ and LEZ controllers with P/Q control user manual
Z-MAN-S-BC - CANopen protocol programming manual
Z-MAN-S-BP - PROFIBUS DP protocol programming manual
Z-MAN-S-EH - EtherCAT protocol programming manual
Z-MAN-S-EW - POWERLINK protocol programming manual
Z-MAN-S-EI - EtherNet/IP protocol programming manual
Z-MAN-S-EP - PROFINET IRT protocol programming manual

SIL safety manuals for operating, installation and maintenance (on request):

TT366 DHZO-TES/TEZ, DKZOR-TES/TEZ
TT367 DLHZO-TES/TEZ, DLKZOR-TES/TEZ
TT368 DPZO-TES/LES/LEZ

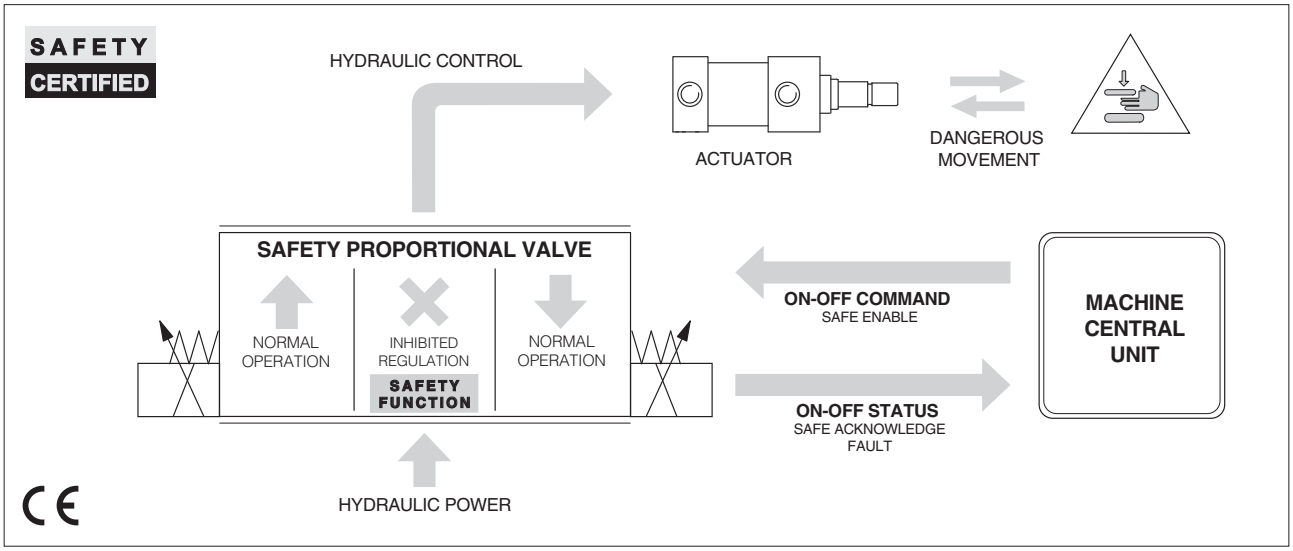
TÜV certificates (on request):

C-IS-722117697-01 Safety proportional valves, direct operated
C-IS-722117689-01 Safety proportional valves, piloted operated

Safety proportional valves with on-off signals

directional valves with on-board driver and LVDT transducer

IEC 61508 Safety Integrity Level and **ISO 13849** Performance Level - certified by



1 GENERAL DESCRIPTION

Safety proportional valves with on-off signals are identified by option /K and are intended for use in hydraulic circuits of machines which must comply with safety requirements of Machine Directive 2006/42/EC.

They are designed to perform **Safety Functions**, in addition to the standard control of direction, speed, pressure/force or position of hydraulic actuators, depending to the valve features.

The Safety Function is operated to reduce the potential dangerous risks which may happen in a specific phase of the machine cycle.
It is activated by the machine central unit (PLC) which inhibits the regulation of proportional valve /K via on-off enable signals in case of emergency or for specific requirements along the working cycle.

Upon valve's disable command input, the valve driver generates on-off output signals as soon the spool has reached the safety position, confirming that hydraulic regulation has been inhibited. The machine central unit (PLC) manages this information as "safe condition".

Safety proportional valves with option /K are certified by TÜV in compliance with IEC 61508 and ISO 13849

2 CERTIFICATION

IEC 61508, IEC 61511, IEC 62061	max **SIL 2** for **non-redundant** safety architecture max **SIL 3** for **redundant** safety architecture	See techinical table Y010 for details about SIL, PL and safety architetures
ISO 13849	**category 1, PL c** for **non-redundant** safety architecture **category 4, PL e** for **redundant** safety architecture	

3 VALVES RANGE

Option /K is available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.

It adds the safety functions to standard control of direction, speed, pressure/force (for SP, SF, SL version) and position (for TEZ, LEZ versions).

Valve's performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

High perfomance proportionals:
DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table **FS165**
DPZO-TES - piloted, positive spool overlap - technical table **FS172**
DPZO-LES - piloted, positive spool overlap - technical table **FS175**

Servoproportionals:
DHZO-TES, DKZOR-TES - direct, zero spool overlap - technical tables **FS168**
DPZO-LES - piloted, zero spool overlap - technical table **FS178**
DLHZO-TES, DLKZOR-TES - direct, zero spool overlap - technical tables **FS180**

Servoproportionals with TEZ/LEZ axis controller:
DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables **FS620**
DPZO-LEZ - piloted, zero spool overlap - technical tables **FS630**
DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap - technical tables **FS610**

4 FUNCTIONAL DESCRIPTION

Valves with option /K are designed to receive on-off enable signals from the machine central unit in order to inhibit the valve's regulation.
When this enable signal is switched OFF, the current to the valve's solenoid is safely cut-off, while the valve's diagnostics and communication remain active to continuously exchange its status with the machine central unit.
In consequence of the solenoid current cut-off, the valve's spool is moved by the spring towards the safe rest position and then the valve regulation is consequently inhibited.
When the spool has reached the safe position, the valve's driver generates an on-off output signal confirming to the machine central unit that the valve is in SAFE condition.
The time required by the valve's spool to reach the safe position is detailed in section 5

Safe enable input signal - SAFE_ENABLE

The SAFE_ENABLE is the command signal to cut-off the current to the solenoids in order to inhibit the valve's regulation:

- inhibited regulation: SAFE_ENABLE = **0 VDC**
- permitted regulation: SAFE_ENABLE = **24 VDC**

Double solenoids valves are equipped with two independent enable circuits SAFE_ENABLE 1 and SAFE_ENABLE 2 permitting to:

a) cut-off the current to both solenoids when the valve regulation must be inhibited in both directions
b) cut-off the current to one solenoid when only one side of the valve regulation must be inhibited. This condition permits to intercept the actuator movement in one direction, permitting the actuator movement in the opposite direction (typical in motion/non-motion controls)

Safe enable acknowledge output signal - SAFE_ENABLE_ACK

The SAFE_ENABLE_ACK is the output signal generated by the driver to confirm that the valve has effectively reached the safe position in consequence of SAFE_ENABLE command switch-off.
SAFE_ENABLE_ACK is switched ON (24 VDC) when the internal diagnostics verifies that solenoid current has been cut-off and the spool, monitored by the LVDT transducer, has reached the safe position.

Fault output signal – FAULT

Fault signal is a diagnostic output which states faults or warning according to the valve's status
This signal must be monitored by the machine central unit in addition to the SAFE_ENABLE_ACK signal, to intercept failures which may compromise the valve safety function.
The FAULT signal is switched OFF (0 VDC) when the internal diagnostics detects valve failures or incorrect behavior (e.g. : spool sticking, solenoid short circuits, missing coils connection, reference signal cable broken for 4 ÷ 20 mA input, etc)
For piloted valves the FAULT signal = 0 VDC indicates also the absence of pilot pressure.

5 SWITCH-OFF TIME

The valve switch-off time is the time between the SAFE_ENABLE signal = 0 VDC and the SAFE_ENABLE ACK signal = 24 VDC.
It is influenced by the working conditions like flow, pressure and fluid viscosity.

The switch-off times shown in the table are considered in the following conditions:
- max flow and max pressure values as per specific technical table of each valve model
- fluid viscosity 46 mm^2/s
- fluid contamination level: ISO4406 CLASS 18/16/13

The following switch-off times can be considered as the longest ones.

For different working conditions, consult Atos technical office.

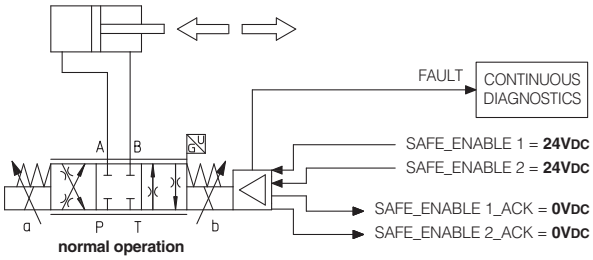
Valve model	**DHZO**	**DKZOR**	**DLHZO**	**DLKZOR**	**DPZO-1**	**DPZO-2**	**DPZO-4 DPZO-4M**	**DPZO-6**	**DPZO-8**
Switch-off time [ms]	50	80	40	60	180	250	300	350	400

6 FUNCTIONAL EXAMPLES

The following examples show the condition of a double solenoid valve and of the controlled actuator depending to the SAFE_ENABLE status.

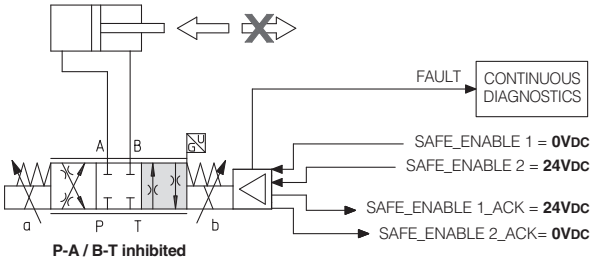
Valve normal operation

Input signals [VDC]		Output signals [VDC]	
SAFE_ENABLE 1	**SAFE_ENABLE 2**	**SAFE_ENABLE 1_ACK**	**SAFE_ENABLE 2_ACK**
24	24	0	0



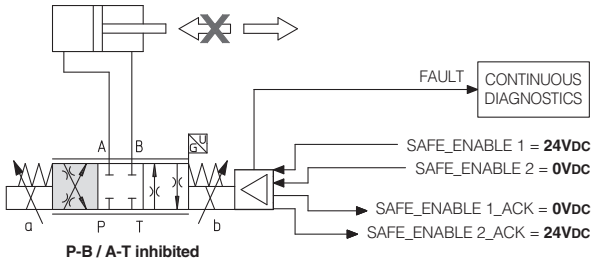
Valve safe operation with P-A/B-T regulation inhibited to prevent the actuator forward movement

Input signals [VDC]		Output signals [VDC]	
SAFE_ENABLE 1	**SAFE_ENABLE 2**	**SAFE_ENABLE 1_ACK**	**SAFE_ENABLE 2_ACK**
0	24	24	0



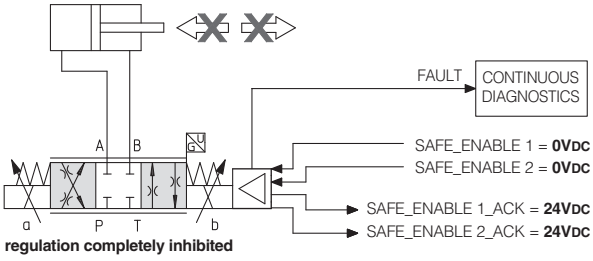
Valve safe operation with P-B/A-T regulation inhibited to prevent the actuator backward movement

Input signals [VDC]		Output signals [VDC]	
SAFE_ENABLE 1	**SAFE_ENABLE 2**	**SAFE_ENABLE 1_ACK**	**SAFE_ENABLE 2_ACK**
24	0	0	24



Valve safe operation with regulation completely inhibited

Input signals [VDC]		Output signals [VDC]	
SAFE_ENABLE 1	**SAFE_ENABLE 2**	**SAFE_ENABLE 1_ACK**	**SAFE_ENABLE 2_ACK**
0	0	24	24



INHIBITED SPOOL POSITION SAFE_ENABLE = **0VDC**

PERMITTED SPOOL POSITION SAFE_ENABLE = **24VDC**

INHIBITED DIRECTION

PERMITTED DIRECTION

7 INHIBITED / PERMITTED SPOOL POSITION

The below tables show the inhibited / permitted spool position depending to the SAFE_ENABLE status for all models of safety proportional valves.

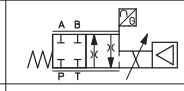
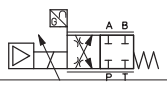
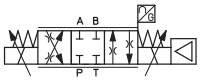
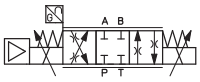
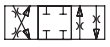
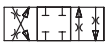
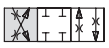
Note: the inhibition of the actuator direction may be affected by other valves present in the circuit, then the whole hydraulic system where the valve /K is applied must be considered.

7.1 High performance proportionals

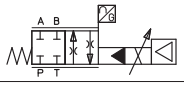
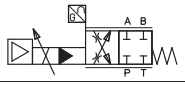
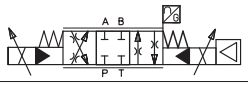
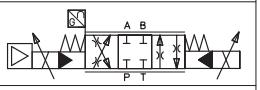
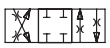
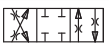
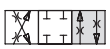
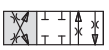
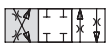
INHIBITED SPOOL POSITION

PERMITTED SPOOL POSITION

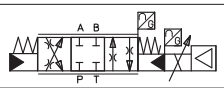
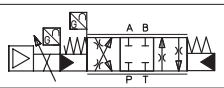
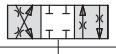
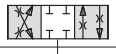
DHZO-TES, DKZOR-TES - direct operated, positive spool overlap - technical table **FS165**

Input signals [VDC]		Output signals [VDC]		Configuration **51, 53**		Configuration **71, 72, 73**	
				standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK				
24		0					
0		24					
24	24	0	0	①	①		
0	24	24	0				
24	0	0	24				
0	0	24	24				
						①	①

DPZO-TES - pilot operated, positive spool overlap - technical table **FS172**

Input signals [VDC]		Output signals [VDC]		Configuration **51, 53**		Configuration **71, 73**	
				standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK				
24		0					
0		24					
24	24	0	0	①	①		
0	24	24	0				
24	0	0	24				
0	0	24	24				
						①	①

DPZO-LES - pilot operated, positive spool overlap - technical table **FS175**

Input signals [VDC]	Output signals [VDC]	Configuration **71, 73**	
		standard	option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK		
24	0		
0	24		
		①	①

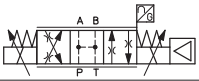
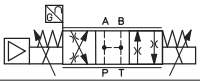
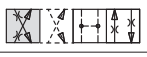
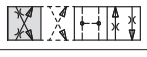
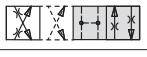
① = Spool safety rest position

7.2 Servoproportionals

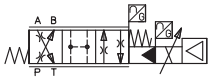
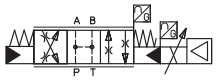
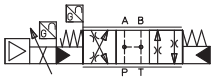
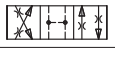
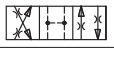
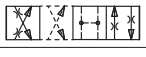
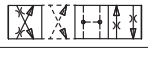
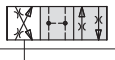
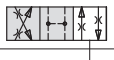
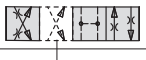
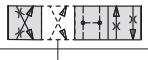
INHIBITED SPOOL POSITION

PERMITTED SPOOL POSITION

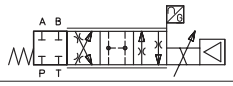
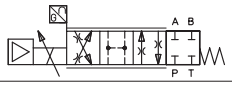
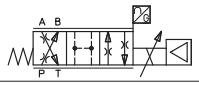
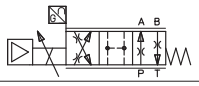
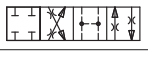
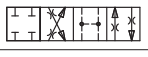
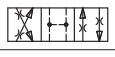
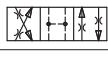
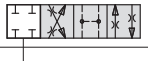
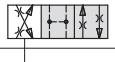
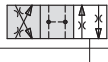
DHZO-TES/TEZ, DKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS168**, **FS620**

Input signals [VDC]		Output signals [VDC]		Configuration **70**	
				standard	option /B
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK		
24	24	0	0		
0	24	24	0		
24	0	0	24		
0	0	24	24		
				②	②

DPZO-LES, DPZO-LEZ - pilot operated, zero spool overlap - technical table **FS178**, **FS630**

Input signals [VDC]	Output signals [VDC]	Configuration **60**		Configuration **70**	
		standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK				
24	0				
0	24				
		①	①	②	②

DLHZO-TES/TEZ, DLKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS180, FS610**

Input signals [VDC]	Output signals [VDC]	Configuration **40** with fail safe 1 or 3		Configuration **60** without fail safe	
		standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK				
24	0				
0	24				
		①	①	①	①

① = Spool safety rest position

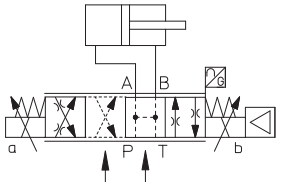
② = Spool safety rest position for valves with zero spool overlap, configuration 70 - see 7.3

7.3 Safety rest position - for valves with zero spool overlap, configuration 70

In absence of solenoid power supply (SAFE_ENABLE1 = 0 and SAFE_ENABLE2 = 0), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of interruption of solenoid power supply, the actuator moves towards an undefined direction (due to the tolerances of the zero spool overlap), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



Spool position with solenoid power supply ON and reference signal = 0 (zero overlap position)

Spool offset position 1% to 6% of total stroke with solenoid power supply OFF (central safety rest position)

8 ELECTRONIC CONNECTIONS

8.1 Main connector signals - 12 pin - options /K

PIN	TES LES	TEZ LEZ	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**SAFE_ENABLE1**		Enable (24 VDC) or disable (0 VDC) the solenoid at side of the driver and position transducer, referred to V0	Input - on/off signal
4	**Q_INPUT+**		Flow (spool position) reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
		P_INPUT+	Position reference input signal: ±10 VDC / ±20 mA maximum range	
5	**INPUT-**		Negative reference input signal for Q_INPUT+, F_INPUT+ and P_INPUT+	Input - analog signal
6	**Q_MONITOR**		Flow (spool position) monitor output signal: ±10 VDC / ±20 mA maximum range, referred to V0. Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
		P_MONITOR	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to V0	
7	**F_INPUT+** **(1)**		Pressure/force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**SAFE_ENABLE1_ACK**		Safe condition acknowledged (24 VDC) or unacknowledged (0 VDC) for solenoid at side of the driver and position transducer, referred to V0	Output - on/off signal
9	**SAFE_ENABLE2_ACK** **(2)**		Safe condition acknowledged (24 VDC) or unacknowledged (0 VDC) for solenoid at the opposite side of the driver and position transducer, referred to V0	Output - on/off signal
10	**SAFE_ENABLE2** **(2)**		Enable (24 VDC) or disable (0 VDC) the solenoid at the opposite side of the driver and position transducer, referred to V0	Input - on/off signal
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to V0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

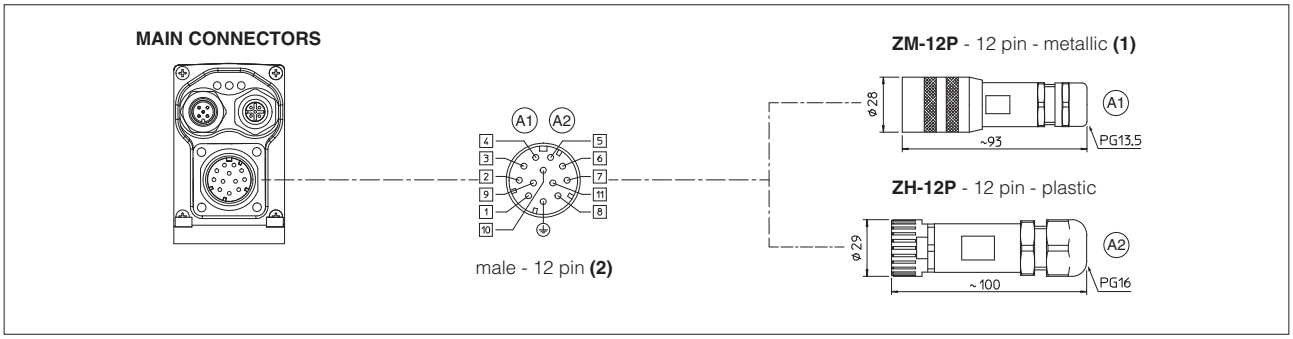
(1) Connection NOT available for **TES/LES** in **SN** execution
(2) Connections available only for double solenoid valves

9 ELECTRICAL CHARACTERISTICS

SIGNALS	SPECIFICATIONS	NOTES
SAFE_ENABLE1 **SAFE_ENABLE2**	Input range: -3 ÷ 5 VDC (OFF state), 15 ÷ 30 VDC (ON state), 5 ÷ 15 VDC (not accepted) Input impedance: Ri > 10 kW	Input - on/off signal
SAFE_ENABLE1_ACK **SAFE_ENABLE2_ACK**	ON state depends on input power supply V+: ON state > V+ - 2V @ max 50 mA e.g. in case of V+ = 24V, the ON state > 22V OFF state < 1 V; External negative voltage not allowed (e.g. due to inductive loads)	Output - on/off signal
FAULT		

Note: for the electrical characteristic of all other signals, refer to the technical table of each valve model - see section 3

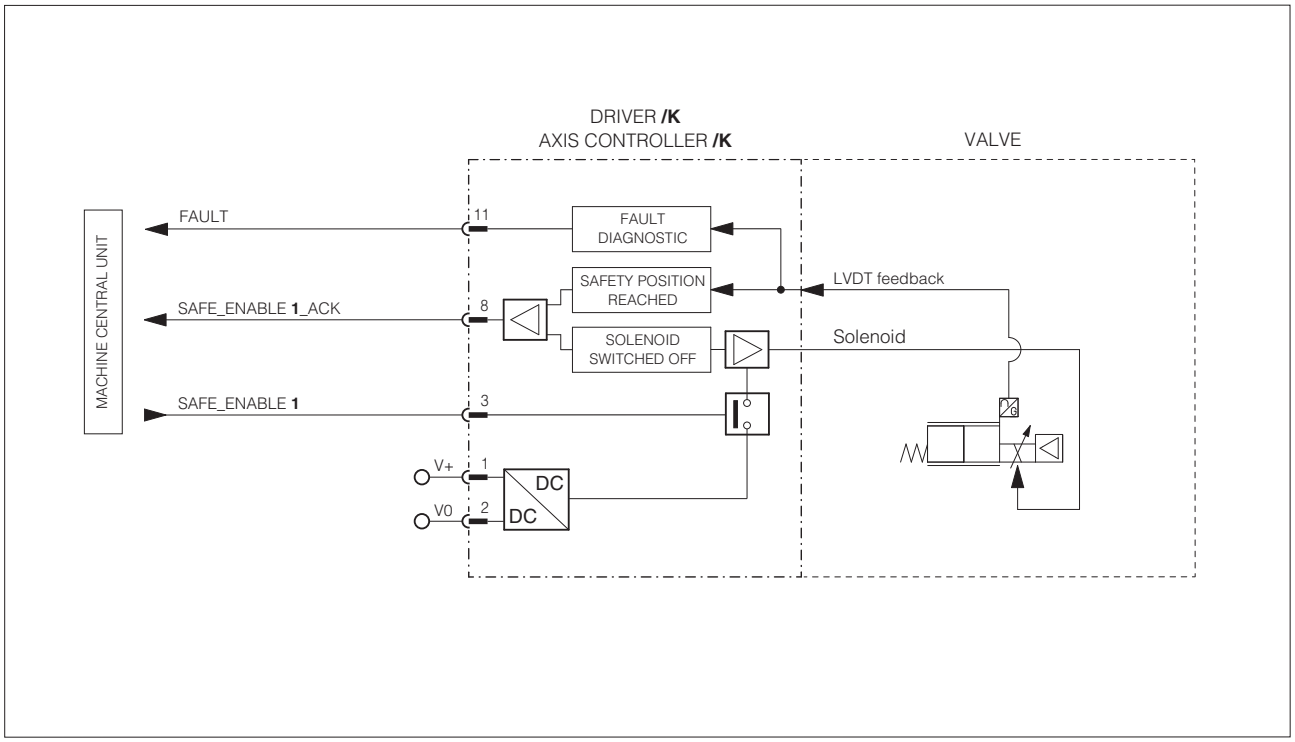
9.1 Connections layout



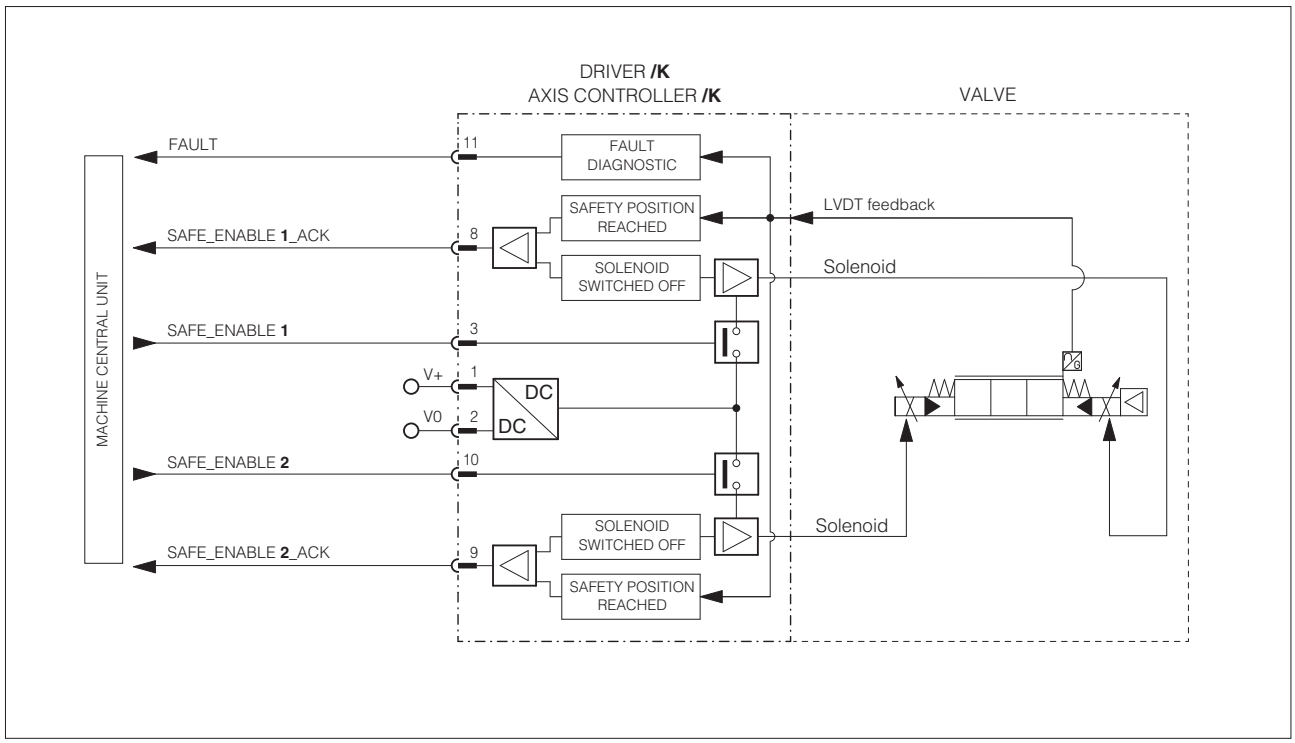
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements
(2) Pin layout always referred to driver's view
For fieldbus and/or transducers connections, refer to specific technical tables of each valve model - see section 3

10 BLOCK DIAGRAMS

10.1 Single solenoid valves



10.2 Double solenoid valves



11 RELATED DOCUMENTATION

General tables:

Y010 Basics for safety components
FS001 Basics for digital electrohydraulics
FS500 Digital proportional valves with P/Q control
FS900 Operating and maintenance information for proportional valves
GS500 Programming tools
GS510 Fieldbus
K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves

Valves technical tables:

FS165 DHZO-TES, DKZOR-TES, direct operated
FS172 DPZO-TES, pilot operated
FS175 DPZO-LES, pilot operated
FS168 DHZO-TES, DKZOR-TES, direct operated, zero spool overlap
FS180 DLHZO-TES, DLKZOR-TES, direct operated, sleeve execution
FS178 DPZO-LES, pilot operated, zero spool overlap
FS610 DLHZO-TEZ, DLKZOR-TEZ digital proportional valves with on-board axis card
FS620 DHZO-TEZ, DKZOR-TEZ digital proportional valves with on-board axis card
FS630 DPZO-LEZ digital proportional valves with on-board axis card

Commissioning and troubleshooting tables:

QF300 Quickstart for TES direct operated proportional valves (supplied with the valve)
QF320 Quickstart for TES/LES pilot operated proportional valves (supplied with the valve)

Operating and fieldbus manuals for TES and LES:

E-MAN-RI-LES - TES and LES drivers user manual
E-MAN-RI-LES-S - TES and LES drivers with P/Q control user manual
E-MAN-S-BC - CANopen protocol programming manual
E-MAN-S-BP - PROFIBUS DP protocol programming manual
E-MAN-S-EH - EtherCAT protocol programming manual
E-MAN-S-EW - POWERLINK protocol programming manual
E-MAN-S-EI - EtherNet/IP protocol programming manual
E-MAN-S-EP - PROFINET IRT protocol programming manual

Operating and fieldbus manuals for TEZ and LEZ:

Z-MAN-RI-LEZ - TEZ and LEZ controllers user manual
Z-MAN-RI-LEZ-S - TEZ and LEZ controllers with P/Q control user manual
Z-MAN-S-BC - CANopen protocol programming manual
Z-MAN-S-BP - PROFIBUS DP protocol programming manual
Z-MAN-S-EH - EtherCAT protocol programming manual
Z-MAN-S-EW - POWERLINK protocol programming manual
Z-MAN-S-EI - EtherNet/IP protocol programming manual
Z-MAN-S-EP - PROFINET IRT protocol programming manual

SIL safety manuals for operating, installation and maintenance (on request):

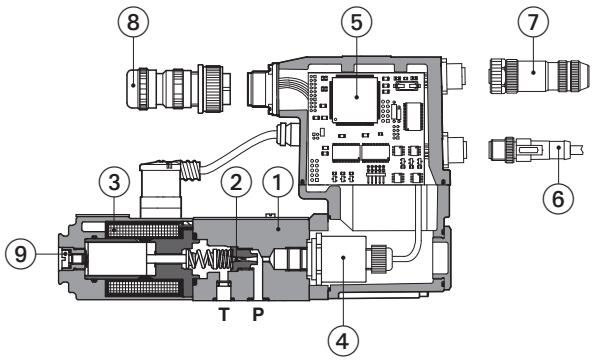
TT366 DHZO-TES/TEZ, DKZOR-TES/TEZ
TT367 DLHZO-TES/TEZ, DLKZOR-TES/TEZ
TT368 DPZO-TES/LES/LEZ

TÜV certificates (on request):

C-IS-722117697-01 Safety proportional valves, direct operated
C-IS-722117689-01 Safety proportional valves, piloted operated

Digital proportional relief valves **high performance**

direct, with on-board pressure transducer



RZMO-RES-P-BC-010

① Valve body
② Poppet
③ Proportional solenoid
④ On-board pressure transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

RZMO-R , RZMO-REB, RZMO-RES

Poppet type direct operated digital proportional relief valves with on-board pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **4 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO	-	REB	-	P	-	NP	-	010	/	210	/	*	/	*	*	/	*

RZMO: Proportional pressure relief valve, direct

REB: **R** = for off-board driver, see section 3; **REB** = basic on-board digital driver **(1)**; **RES** = full on-board digital driver **(2)**

P = with integral pressure transducer

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present; **BC** = CANopen; **BP** = PROFIBUS DP; **EH** = EtherCAT

Configuration:
010 = regulation on port P, discharge in T (direct operated version)

Max regulated pressure:
100 = 100 bar; **315** = 315 bar; **210** = 210 bar; **350** = 350 bar

Electronic options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Dynamic response preset, see section 15:
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

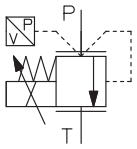
Series number

Seals material, see section 10:
- = NBR
PE = FKM
BT = HNBR

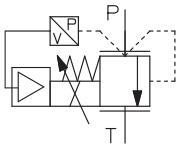
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZMO-R



RZMO-REB RZMO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

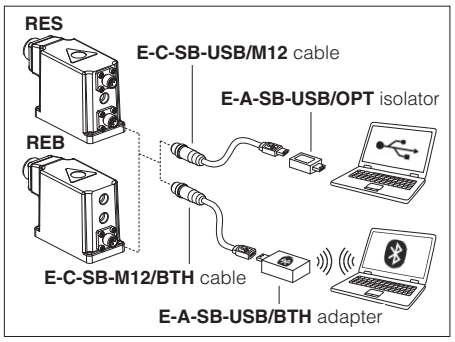
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZMO-*-010**
Max regulated pressure	[bar]	100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 11
Max flow	[l/min]	4
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 55
Hysteresis		≤ 0,3 [% of max pressure]
Linearity		≤ 1,0 [% of max pressure]
Repeatability		≤ 0,2 [% of max pressure]
Thermal drift		zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

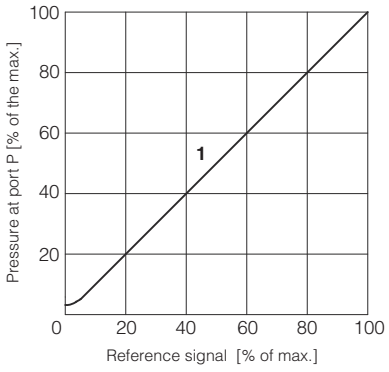
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

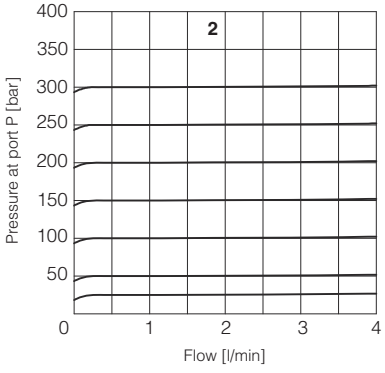
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog		
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5			
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**	
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922	
Flame resistant with water	NBR, HNBR	HFC		

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

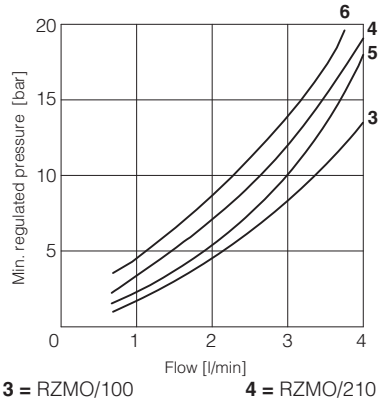
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-6 Min. pressure/flow diagrams
with zero reference signal



3 = RZMO/100 **4 =** RZMO/210
5 = RZMO/315 **6 =** RZMO/350

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

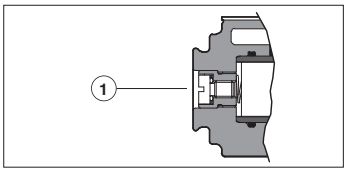
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

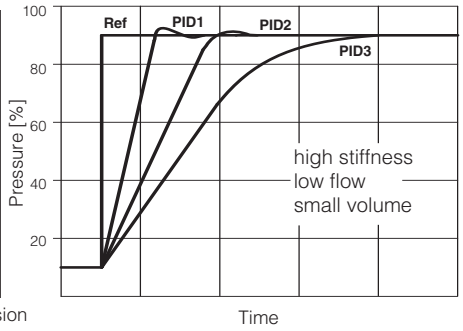


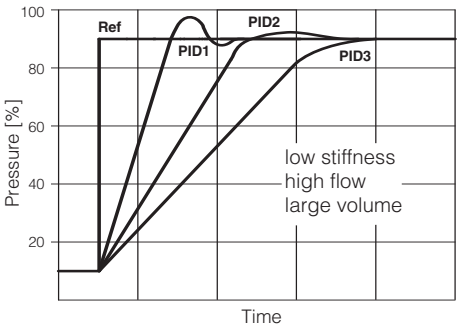
15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	Dynamic response example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)
The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option
The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)
The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Pressure monitor output signal (P_MONITOR)
The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard
To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for **/Z** option
Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) **Standard** and **/Q** option - for **REB** and **RES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) **/Z** option - for **REB** and **RES**

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for **REB** (B) and **RES** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

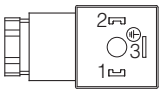
(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

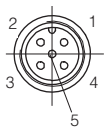
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

18.4 Solenoid connection - only for **R**

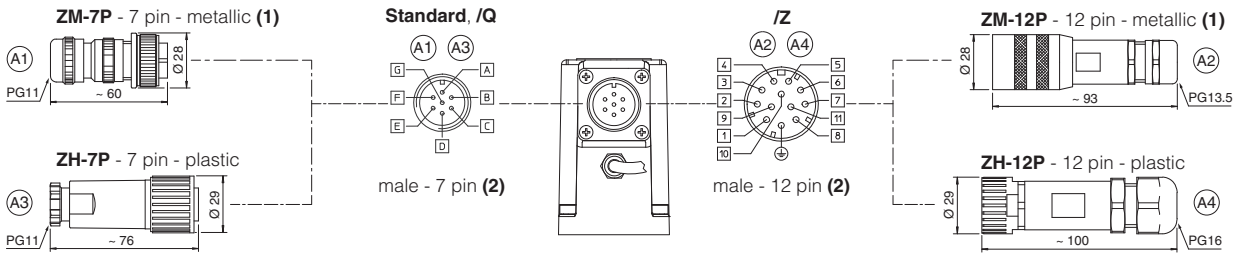
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.5 Pressure transducer connection - only for **R**

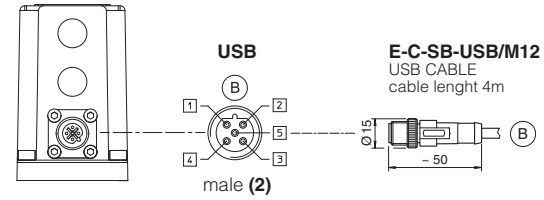
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

18.6 REB connections layout

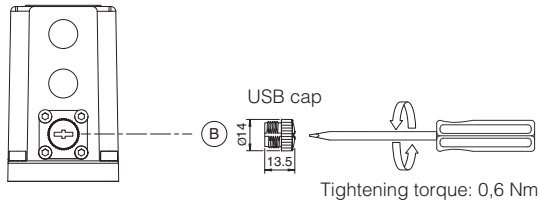
MAIN CONNECTORS



USB CONNECTOR



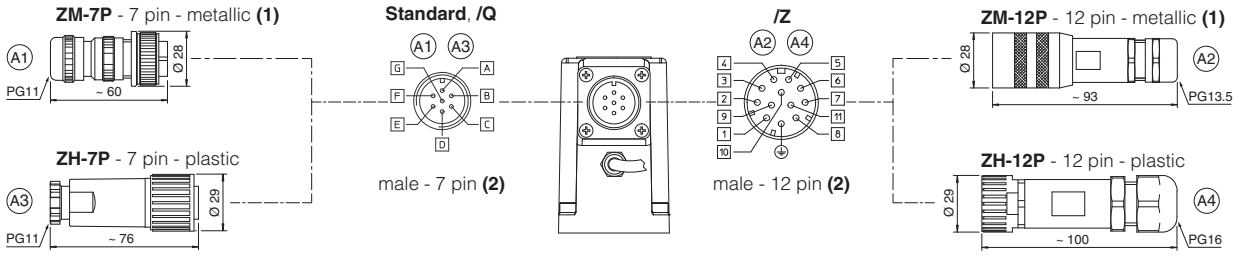
PLASTIC PROTECTION CAPS - supplied with the valves



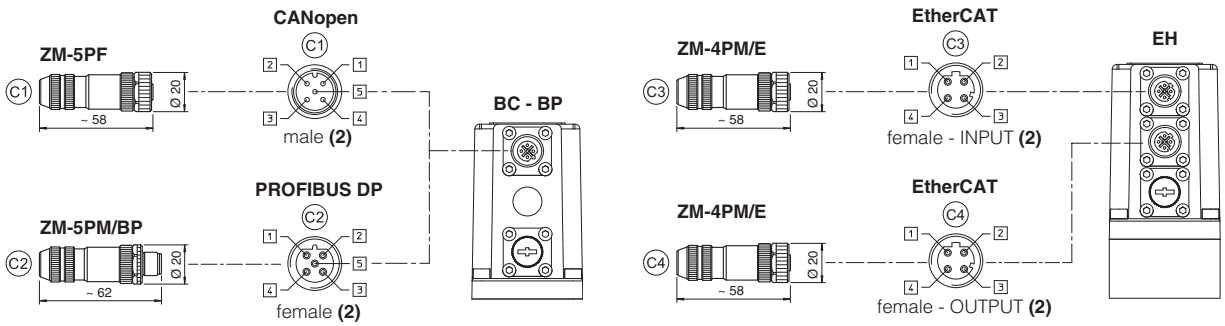
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 RES connections layout

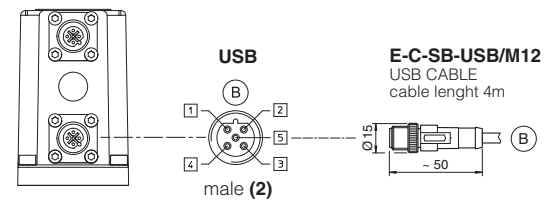
MAIN CONNECTORS



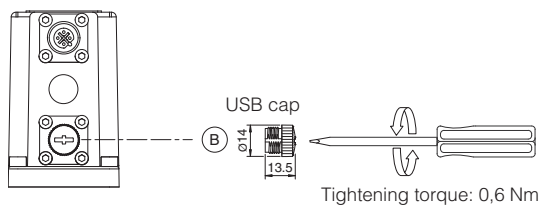
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

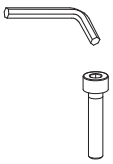
19.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 FASTENING BOLTS AND SEALS



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals:

2 OR 108

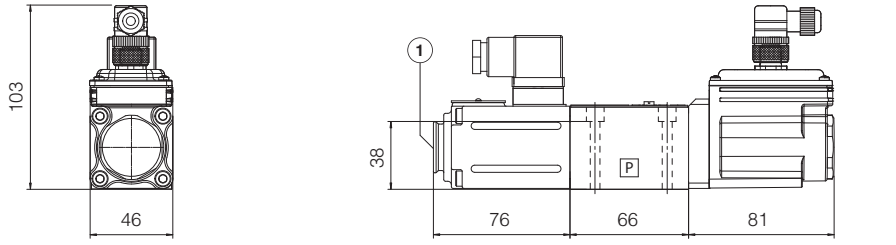
Diameter of ports P, T: Ø 5 mm

21 INSTALLATION DIMENSIONS [mm]

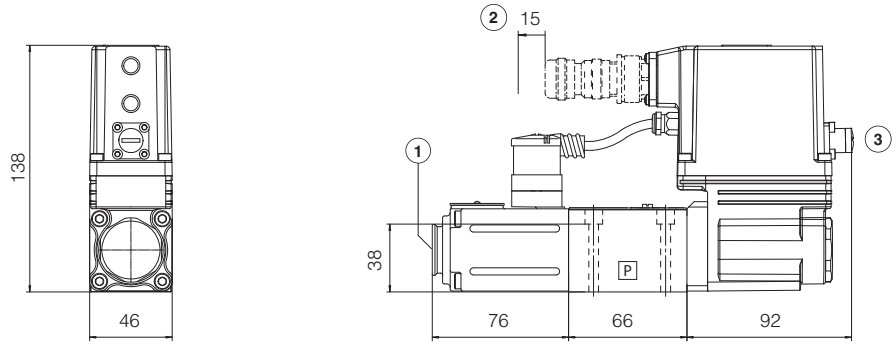
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

Mass [kg]		
R	**REB, RES**	**RES-EH**
2,1	2,6	2,7

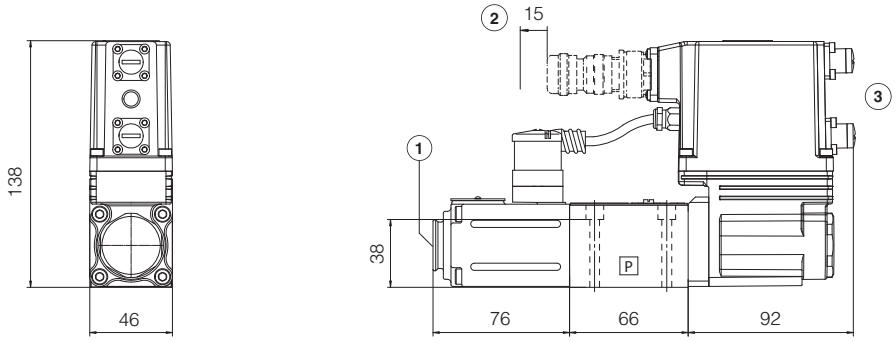
RZMO-R-P



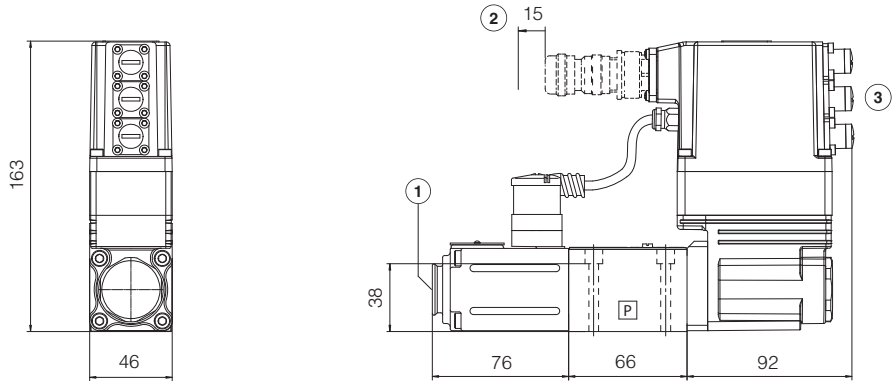
RZMO-REB-P-NP



RZMO-RES-P-BP
RZMO-RES-P-BC



RZMO-RES-P-EH



(1) = Air bleeding, see section 14

(2) = Space to remove the connectors

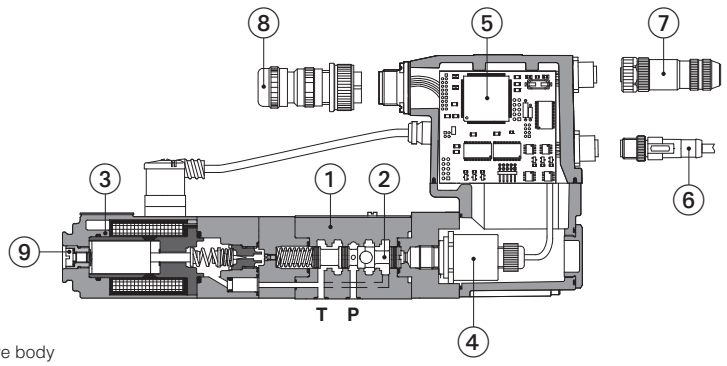
(3) = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
GS203	E-BM-RES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB400	Quickstart for REB valves commissioning
QF400	Quickstart for RES valves commissioning

Digital proportional relief valves **high performance**

piloted, with on-board pressure transducer



① Valve body
② Poppet
③ Proportional solenoid
④ On-board pressure transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

RZMO-RES-P-BC-030

RZMO-R , RZMO-REB, RZMO-RES

Spool type piloted digital proportional relief valves with on-board pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **40 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO	-	REB	-	P	-	NP	-	030	/	210	/	*	/	*	*	/	*

RZMO
Proportional pressure relief valve, piloted

REB
R = for off-board driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P
P = with integral pressure transducer

NP
Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

030
Configuration:
030 = regulation on port P, discharge in T (pilot operated version)

210
Max regulated pressure:
100 = 100 bar **315** = 315 bar
210 = 210 bar **350** = 350 bar

*****
Electronic options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

*****
Dynamic response preset, see section 15 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

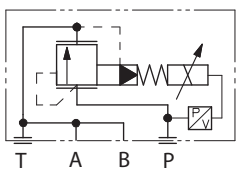
*****
Series number

*****
Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

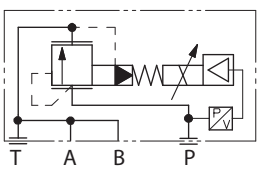
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZMO-R



RZMO-REB RZMO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

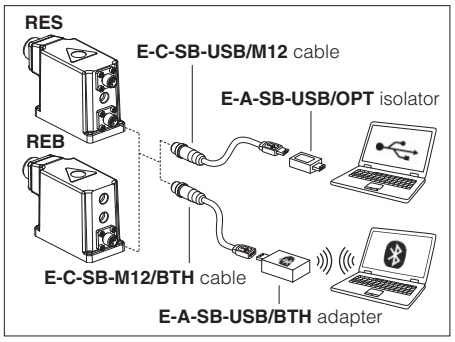
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZMO-*-030**
Max regulated pressure	[bar]	100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 11
Min ÷ Max flow	[l/min]	2,5 ÷ 40
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 45
Hysteresis		≤ 0,5 [% of max pressure]
Linearity		≤ 1,0 [% of max pressure]
Repeatability		≤ 0,2 [% of max pressure]
Thermal drift		zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

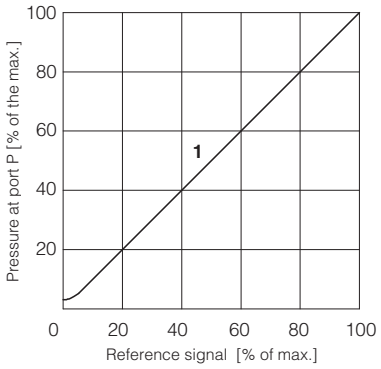
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

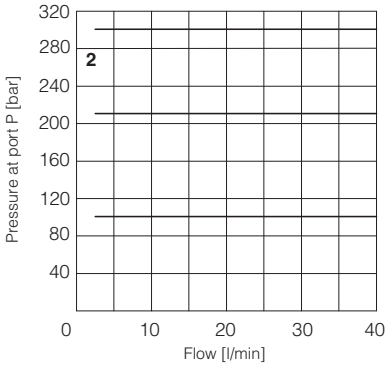
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

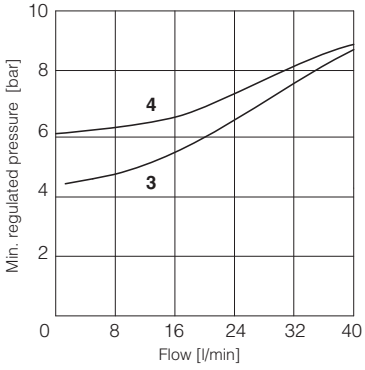
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3-4 Minimum pressure/flow diagrams
with zero reference signal



3 = All the models (except /350)
4 = All the models (only /350)

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

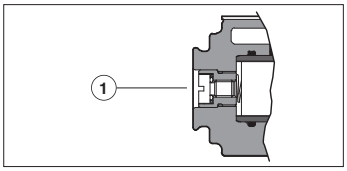
Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

14 AIR BLEEDING



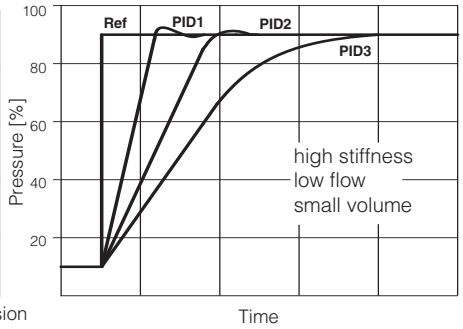
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

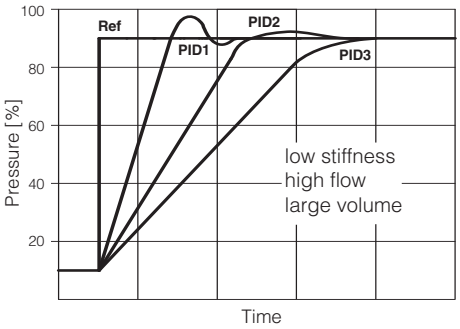
15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)
The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option
The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)
The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Pressure monitor output signal (P_MONITOR)
The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard
To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for **/Z** option
Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

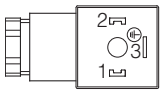
(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

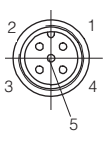
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

18.4 Solenoid connection - only for R

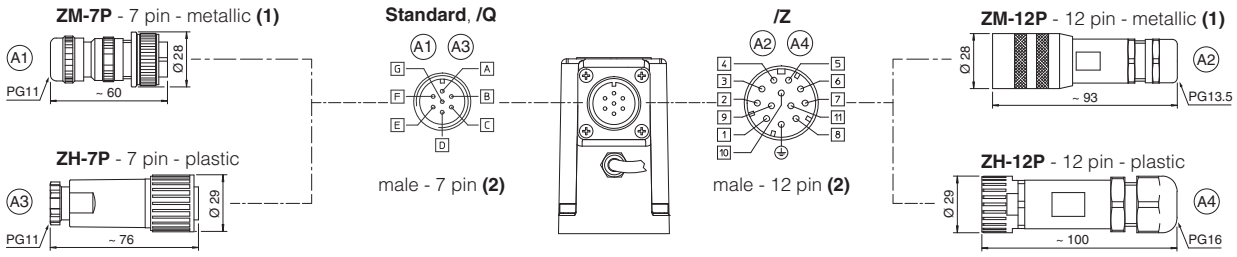
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.5 Pressure transducer connection - only for R

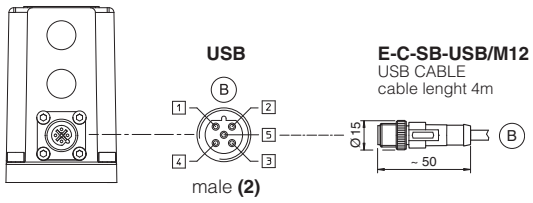
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

18.6 REB connections layout

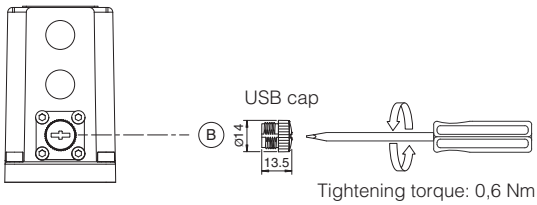
MAIN CONNECTORS



USB CONNECTOR



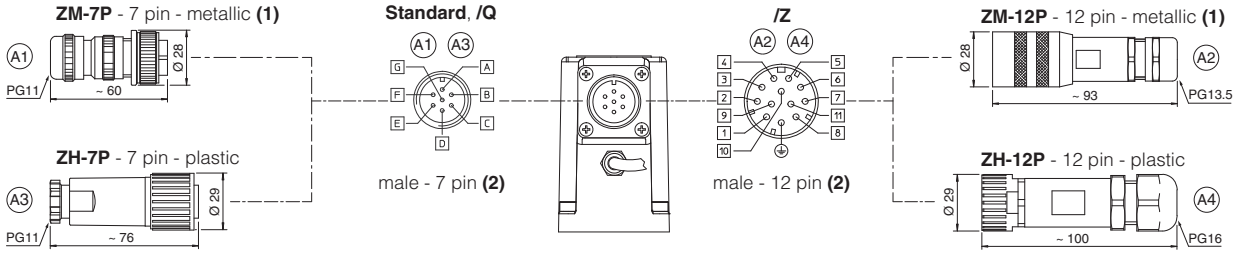
PLASTIC PROTECTION CAPS - supplied with the valves



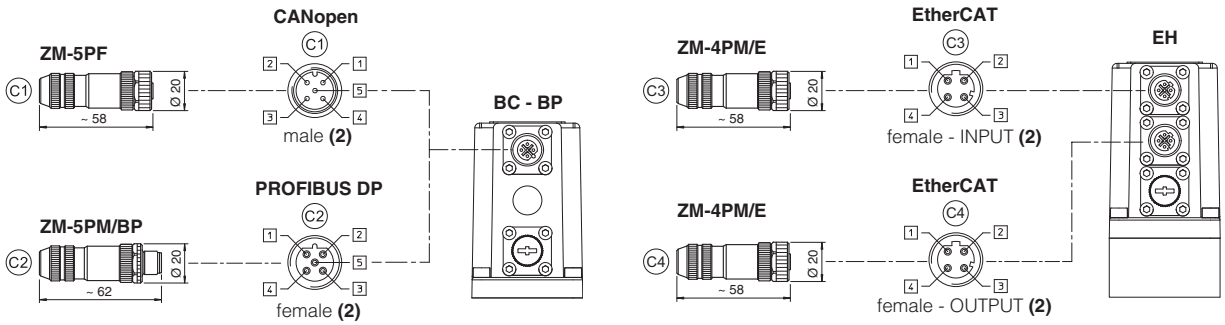
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 RES connections layout

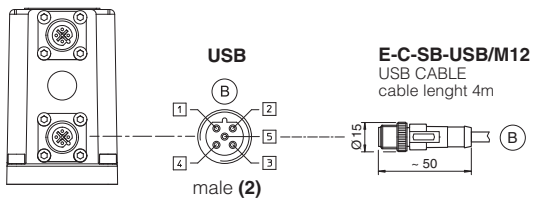
MAIN CONNECTORS



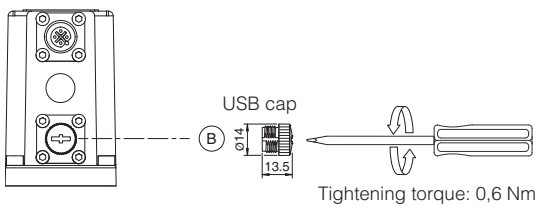
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

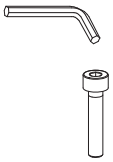
19.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 FASTENING BOLTS AND SEALS



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals:

2 OR 108

Diameter of ports P, T: Ø 7,5 mm

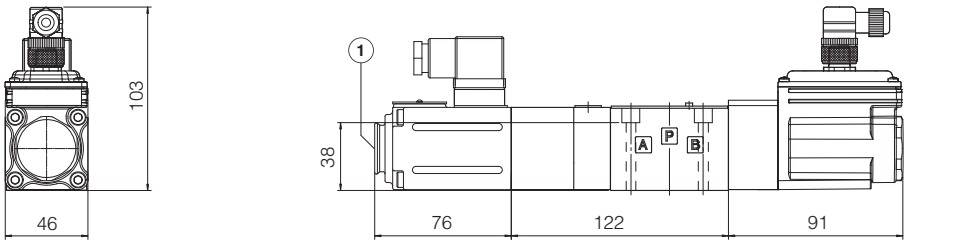
Ports A, B connected to port T

21 INSTALLATION DIMENSIONS [mm]

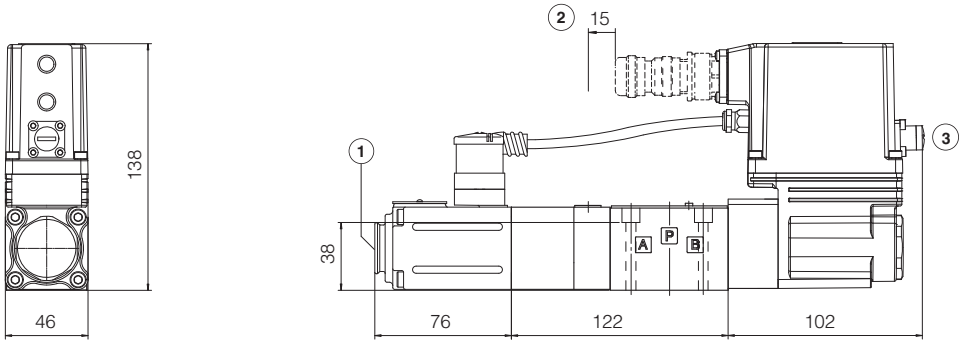
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
R	**REB, RES**	**RES-EH**
3,1	3,6	3,7

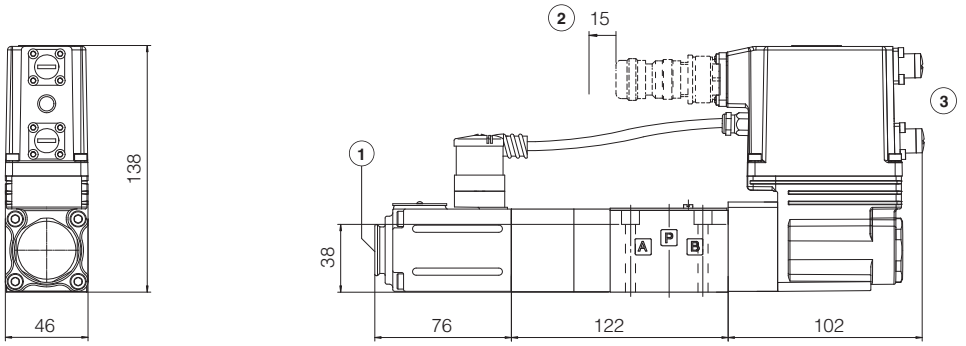
RZMO-R-P



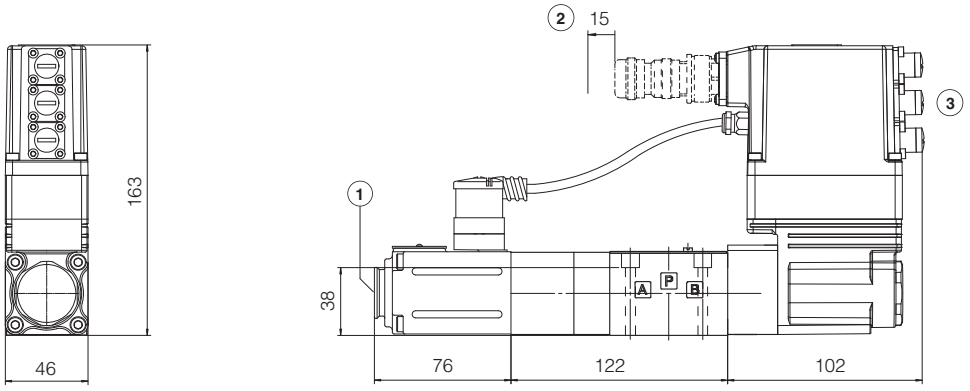
RZMO-REB-P-NP



RZMO-RES-P-BP
RZMO-RES-P-BC



RZMO-RES-P-EH



(1) = Air bleeding, see section 14

(2) = Space to remove the connectors

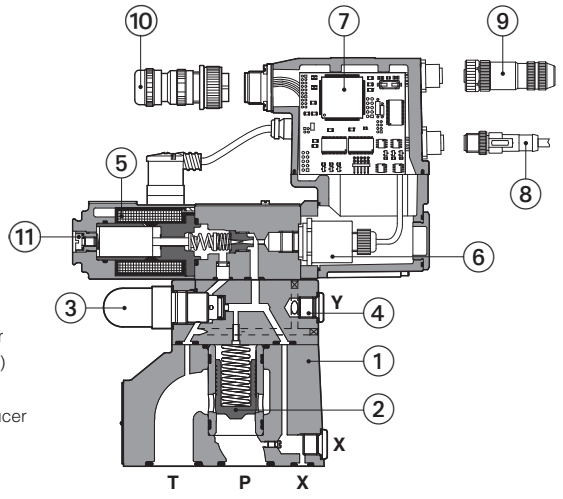
(3) = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Digital proportional relief valves **high performance**

piloted, with on-board pressure transducer



① Valve body
② Main poppet
③ Mechanical pressure limiter
④ Drain port G 1/4" (option /Y)
⑤ Proportional solenoid
⑥ On-board pressure transducer
⑦ On-board digital driver
⑧ USB connector
⑨ Fieldbus connector
⑩ Main connector
⑪ Screw for air bleeding

AGMZO-RES-P-BC-20

AGMZO-R,
AGMZO-REB, AGMZO-RES

Poppet type, piloted, digital proportional relief valves with on-board pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10**, **20**, **32** - ISO 6264
Max flow: **200**, **400**, **600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGMZO	-	RES	-	P	-	BC	-	10	/	315	/	*	/	*	*	/	*

AGMZO: Proportional pressure relief valve, piloted

RES:
R = for separated driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

BC:
Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

10: **Valve size** ISO 6264: **10, 20, 32**

315: **Max regulated pressure**:
100 = 100 bar **210** = 210 bar **315** = 315 bar **350** = 350 bar

*****: **Hydraulic options (4)**:
E = external pilot
Y = external drain (only pipe connection G ¼")
Electronics options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

*****: **Dynamic response preset**, see section 18:
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

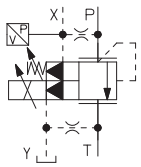
*****: Series number

*****: **Seals material,** see section 10:
- = NBR
PE = FKM
BT = HNBR

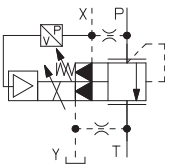
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS

AGMZO-R



AGMZO-REB AGMZO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

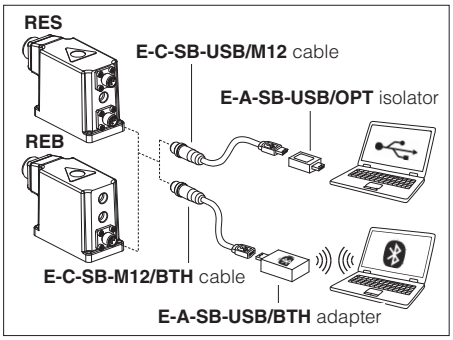
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**AGMZO-*-10**	**AGMZO-*-20**	**AGMZO-*-32**
Max regulated pressure	[bar]	100; 210; 315; 350		
Max pressure at port P	[bar]	350		
Max pressure at port T	[bar]	210		
Min regulated pressure	[bar]	see min. pressure / flow diagrams at section 11		
Max flow	[l/min]	200	400	600
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 80	≤ 100	≤ 115
Hysteresis		≤ 0,5 [% of max pressure]		
Linearity		≤ 1,0 [% of max pressure]		
Repeatability		≤ 0,2 [% of max pressure]		
Thermal drift		zero point displacement < 1% at ΔT = 40°C		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 18

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 22			

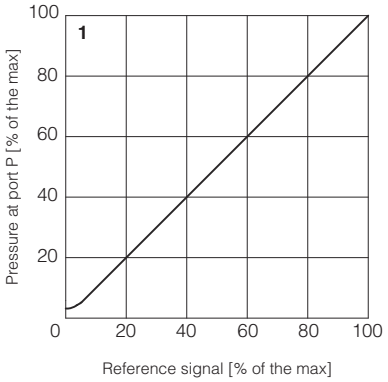
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

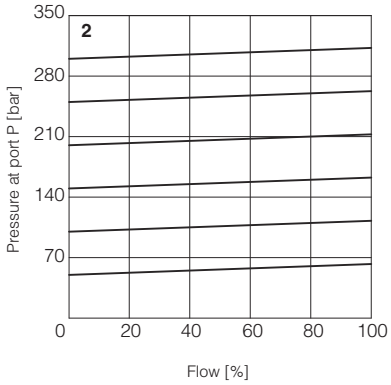
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

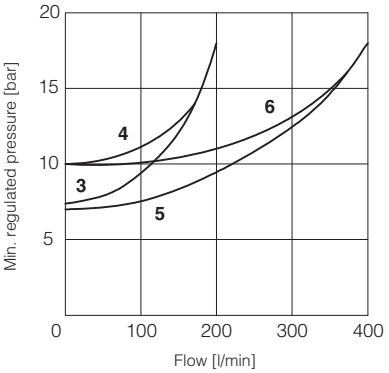


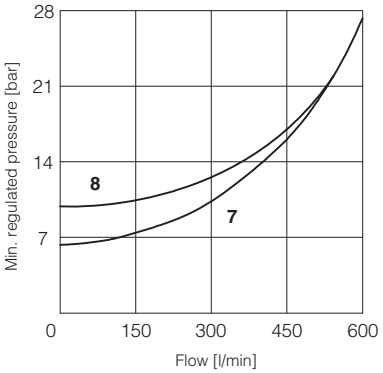
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



3-8 = Min. pressure/flow diagrams
with zero reference signal

3 = AGMZO-*-10/100, 210, 315
4 = AGMZO-*-10/350
5 = AGMZO-*-20/100, 210, 315
6 = AGMZO-*-20/350
7 = AGMZO-*-32/100, 210, 315
8 = AGMZO-*-32/350

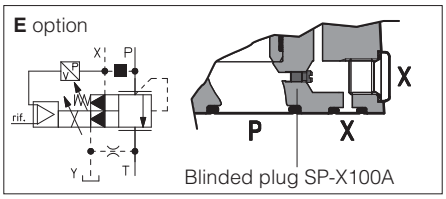


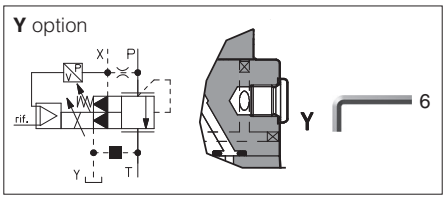


12 HYDRAULIC OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").

Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.





13 ELECTRONICS OPTIONS - only for REB and RES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 20.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 20.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 20.2

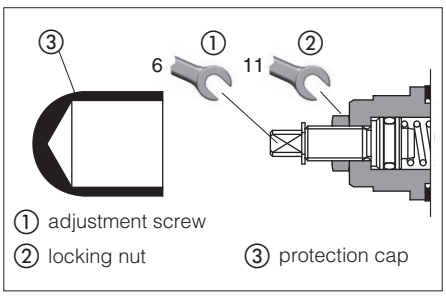
14 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible
Electronics options: /IQ, /IZ

15 MECHANICAL PRESSURE LIMITER

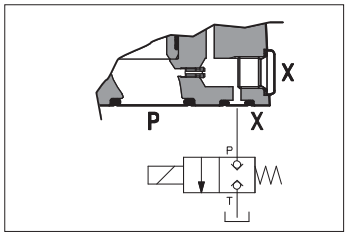
The AGMZO are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



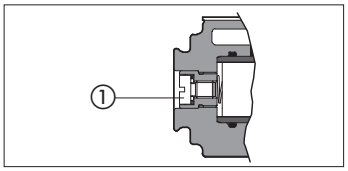
16 REMOTE PRESSURE UNLOADING

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).
This function can be used in emergency to unload the system pressure by-passing the proportional control.



17 AIR BLEEDING

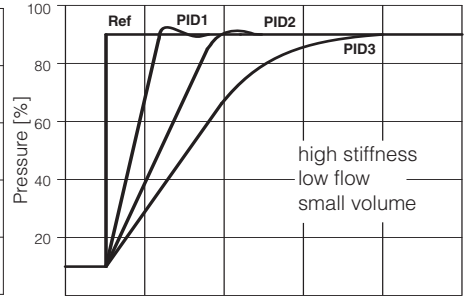
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

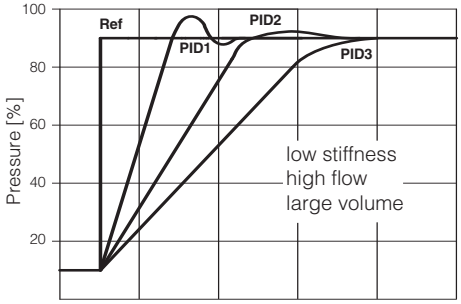


18 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	Dynamic response example diagrams at side
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop





(1) interchangeable with previous TERS version

Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

19 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

20.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

20.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

20.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

21 ELECTRONIC CONNECTIONS

21.1 Main connector signals - 7 pin (A1) **Standard** and **/Q** option - for **REB** and **RES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND / V0		Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

21.2 Main connector signals - 12 pin (A2) **/Z** option - for **REB** and **RES**

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for P_INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 Communication connectors - for **REB** (B) and **RES** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin** (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

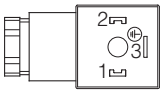
(C2) **BP fieldbus execution, connector - M12 - 5 pin** (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin** (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

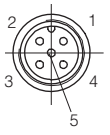
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

21.4 Solenoid connection - only for **R**

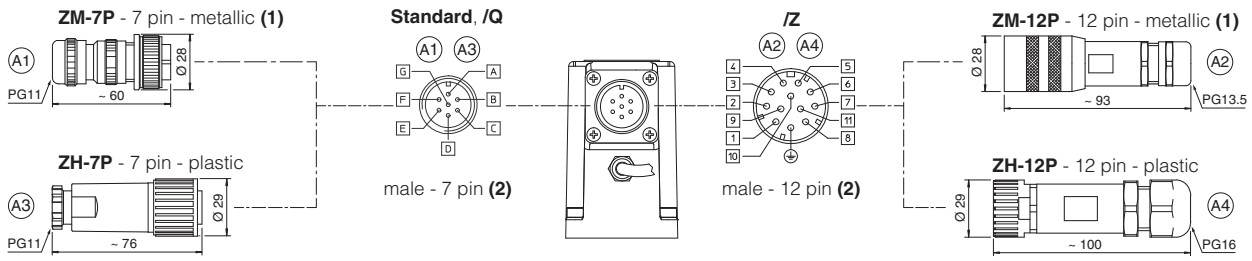
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

21.5 Pressure transducer connection - only for **R**

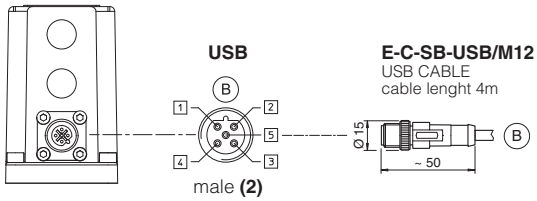
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

21.6 REB connections layout

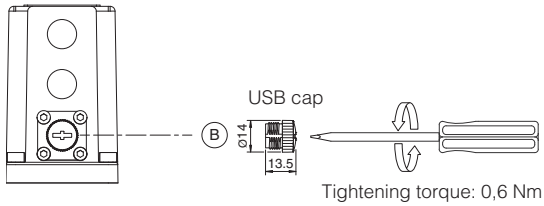
MAIN CONNECTORS



USB CONNECTOR



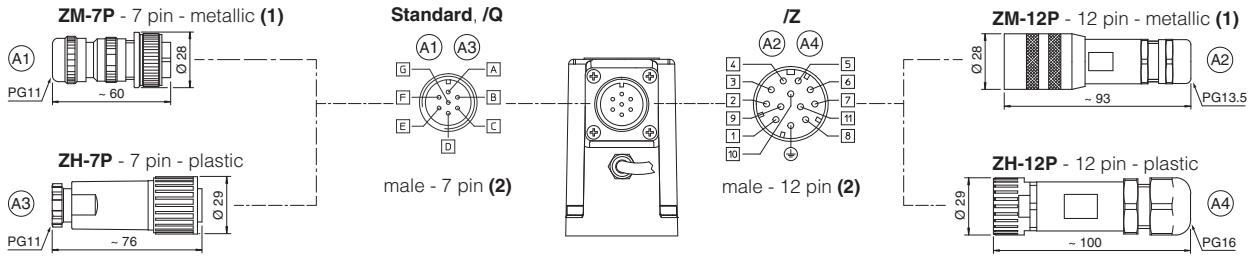
PLASTIC PROTECTION CAPS - supplied with the valves



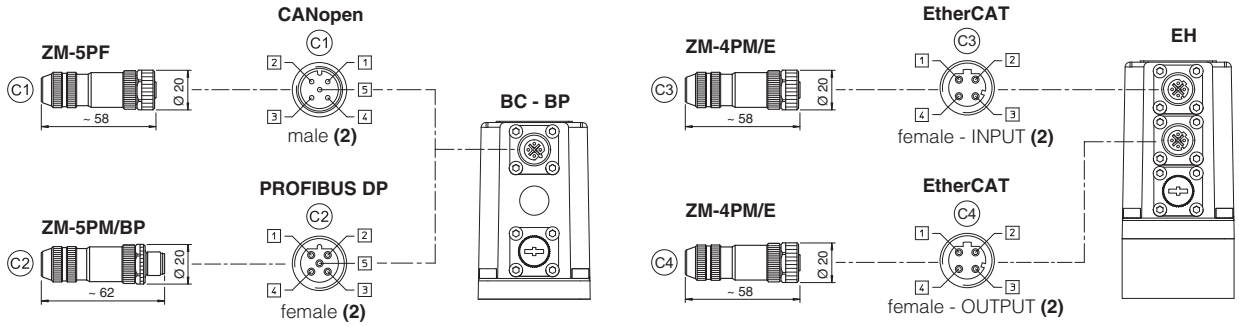
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

21.7 RES connections layout

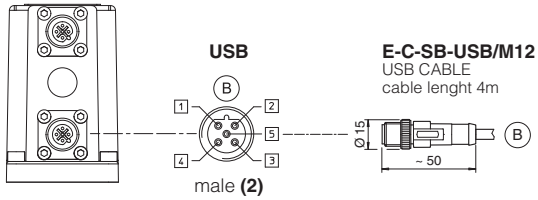
MAIN CONNECTORS



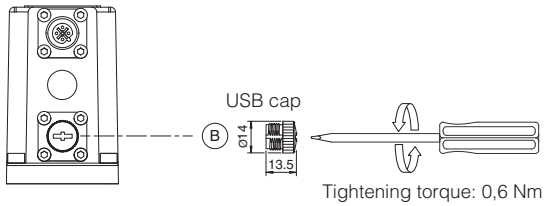
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

22.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

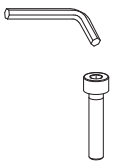
22.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

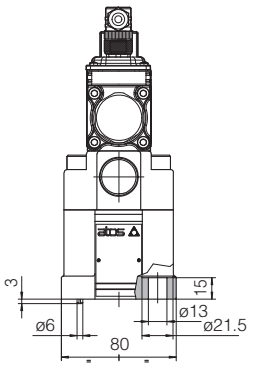
23 FASTENING BOLTS AND SEALS

	AGMZO-*-10	AGMZO-*-20	AGMZO-*-32
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**Seals:** 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

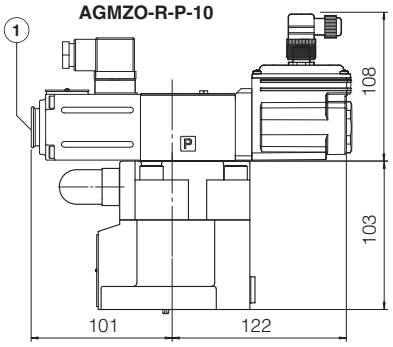
SIZE 10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

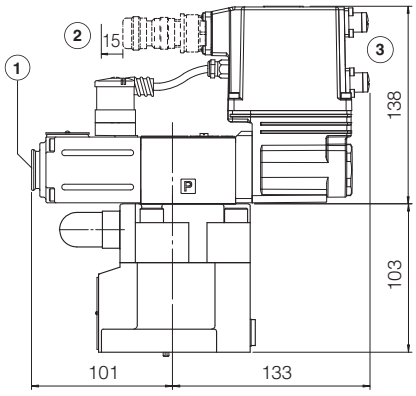
	Mass [kg]		
	R	REB, RES	RES-EH
AGMZO-*-10	5,7	6,2	6,3



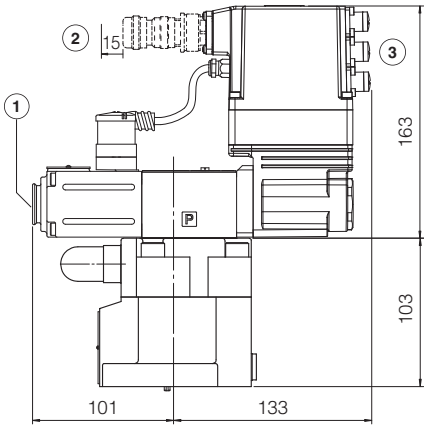
AGMZO-R-P-10



AGMZO-REB-P-NP-10
AGMZO-RES-P-BC-10
AGMZO-RES-P-BP-10



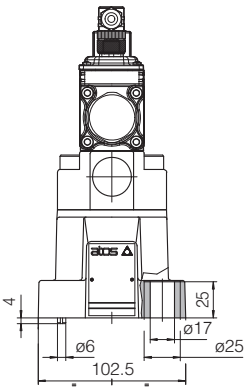
AGMZO-RES-P-EH-10



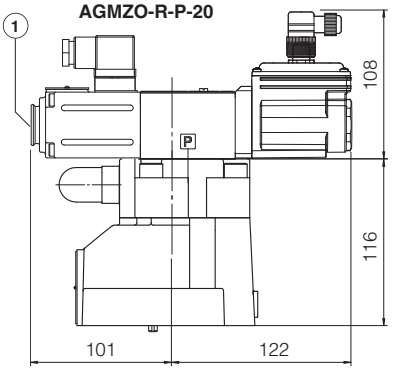
SIZE 20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

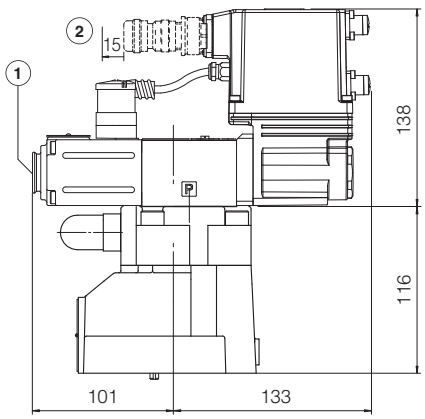
	Mass [kg]		
	R	REB, RES	RES-EH
AGMZO-*-20	6,9	7,4	7,5



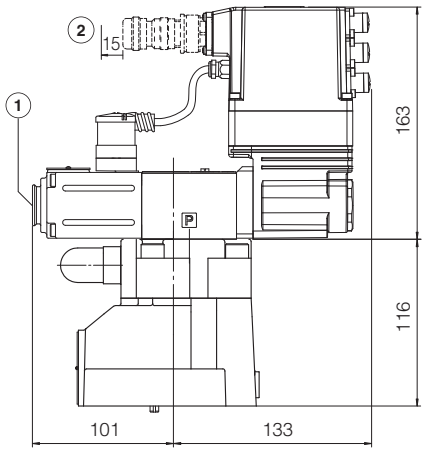
AGMZO-R-P-20



AGMZO-REB-P-NP-20
AGMZO-RES-P-BC-20
AGMZO-RES-P-BP-20



AGMZO-RES-P-EH-20



(1) = Air bleeding, see section 17

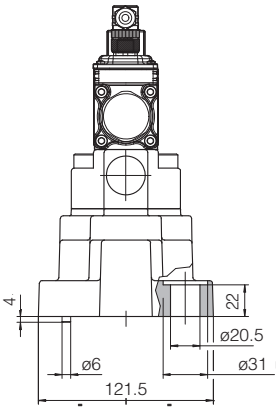
(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 21.6 and 21.7

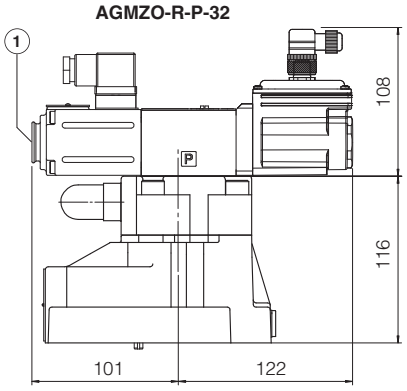
SIZE 32

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)
(with M20 fixing holes instead of standard M18)

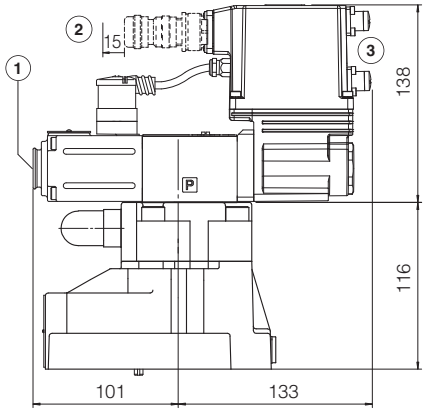
	Mass [kg]		
	R	**REB, AES**	**RES-EH**
AGMZO-*-32	8,3	8,8	8,9



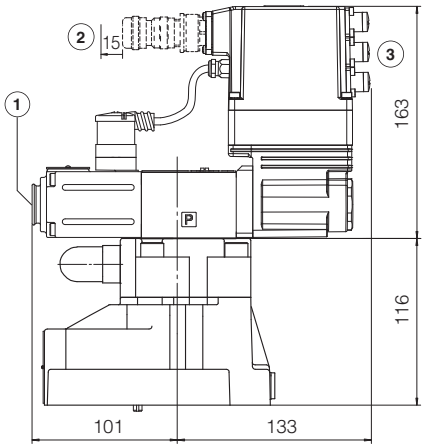
AGMZO-R-P-32



AGMZO-REB-P-NP-32
AGMZO-RES-P-BC-32
AGMZO-RES-P-BP-32



AGMZO-RES-P-EH-32



(1) = Air bleeding, see section 17

(2) = Space to remove the connectors

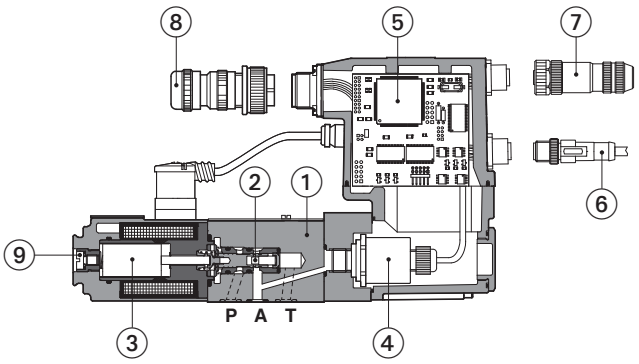
(3) = The dimensions of all connectors must be considered, see section 21.6 and 21.7

25 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Digital proportional reducing valves **high performance**

direct, with on-board pressure transducer



① Valve body
② Poppet
③ Proportional solenoid
④ On-board pressure transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

RZGO-RES-P-BC-010

RZGO-R , RZGO-REB, RZGO-RES

Spool type, direct, digital proportional reducing valves with on-board pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **12 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZGO	- REB	- P	- NP	- 010	/ 210	/ *	/ *	* / *

RZGO: Proportional pressure reducing valve, direct

REB:
R = for off-board driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

NP:
Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

010:
Configuration:
010 = regulation on port A, discharge in T (direct operated version)

210:
Max regulated pressure:
32 = 32 bar **100** = 100 bar **210**= 210 bar

*****:
Electronic options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

*****:
Dynamic response preset, see section 15 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

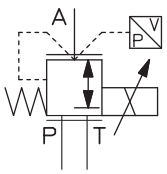
*****:
Series number

*****:
Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

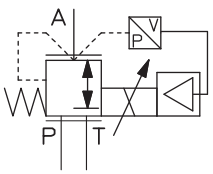
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZGO-R



RZGO-REB RZGO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

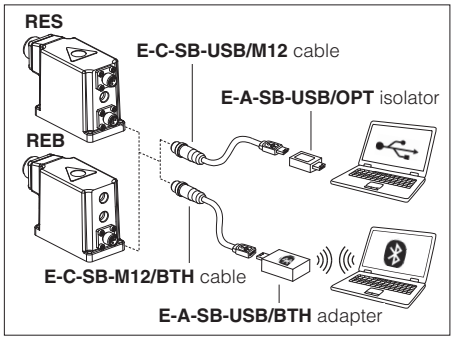
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZGO-*-010**
Max regulated pressure	[bar]	32; 100; 210
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure **(1)**	[bar]	0,8
Max flow	[l/min]	12
Response time 0-100% step signal (depending on installation) **(2)**	[ms]	≤ 40
Hysteresis		≤ 0,3 [% of max pressure]
Linearity		≤ 1,0 [% of max pressure]
Repeatability		≤ 0,2 [% of max pressure]
Thermal drift		zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,4 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

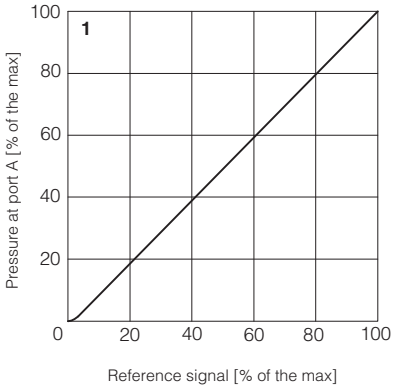
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

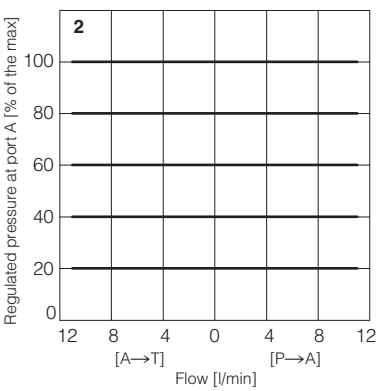
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

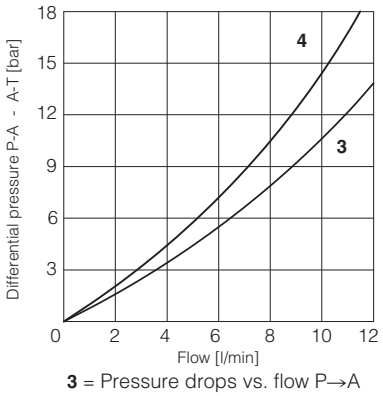
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = Pressure drops vs. flow P→A
4 = Pressure drops vs. flow A→T

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

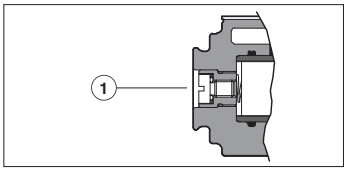
Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

14 AIR BLEEDING



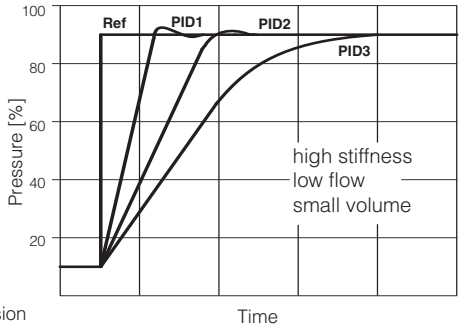
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

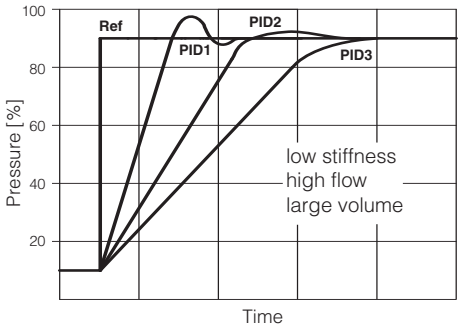
15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

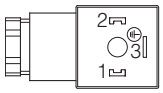
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

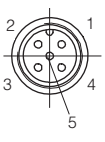
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

18.4 Solenoid connection - only for R

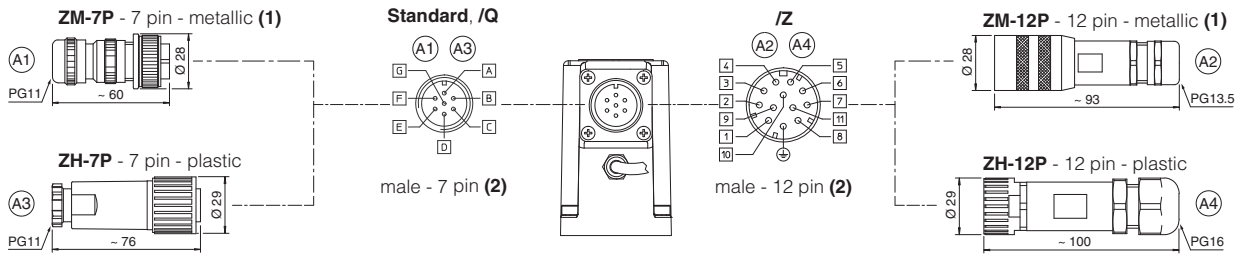
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.5 Pressure transducer connection - only for R

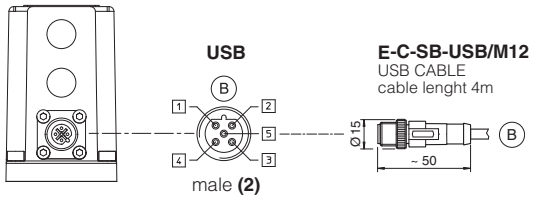
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

18.6 REB connections layout

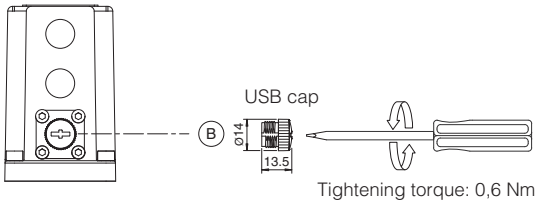
MAIN CONNECTORS



USB CONNECTOR



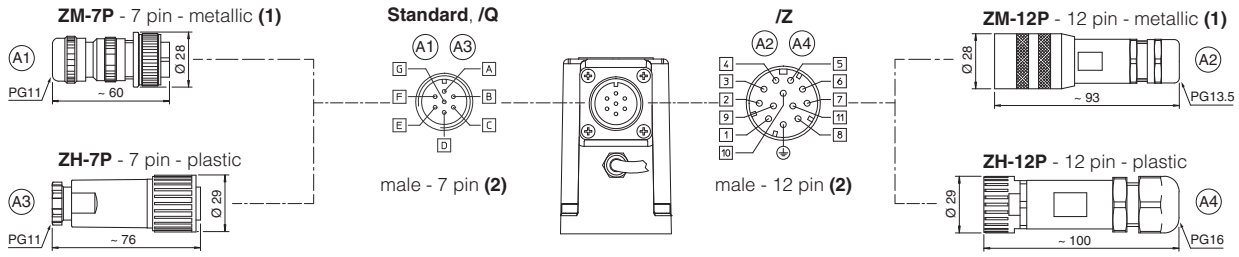
PLASTIC PROTECTION CAPS - supplied with the valves



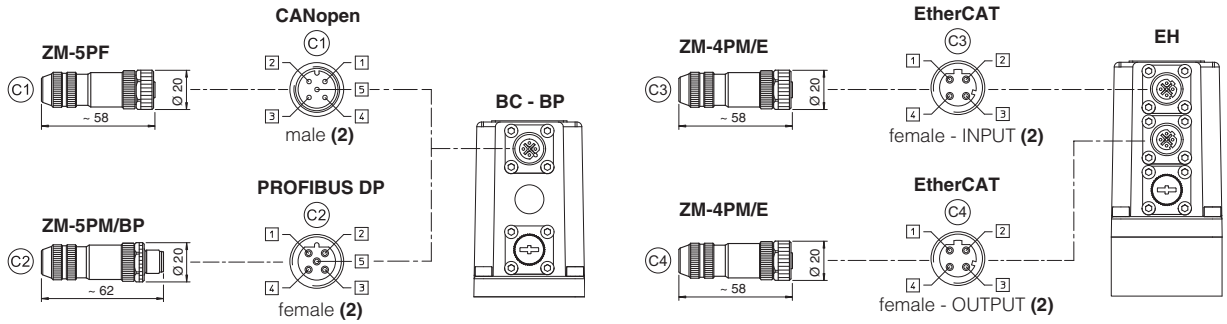
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 RES connections layout

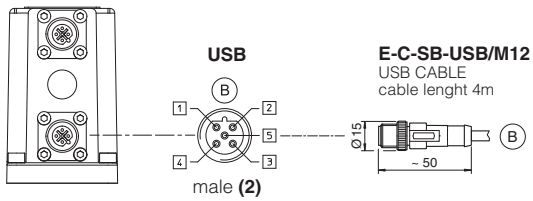
MAIN CONNECTORS



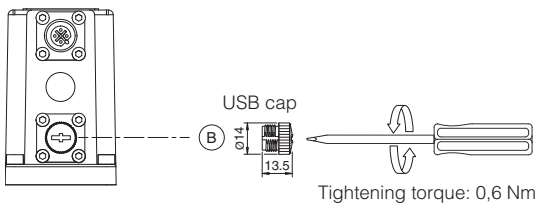
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

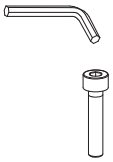
19.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 FASTENING BOLTS AND SEALS



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals:

4 OR 108

Diameter of ports P, A, T: Ø 5 mm

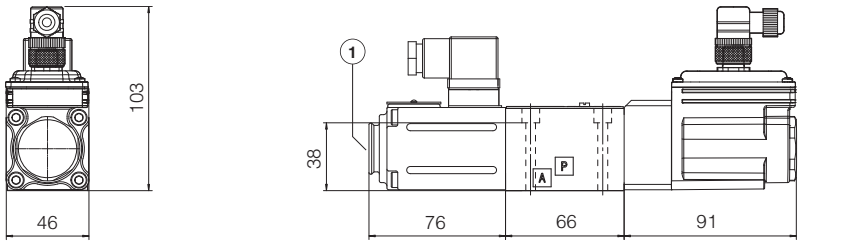
Port B not used

21 INSTALLATION DIMENSIONS [mm]

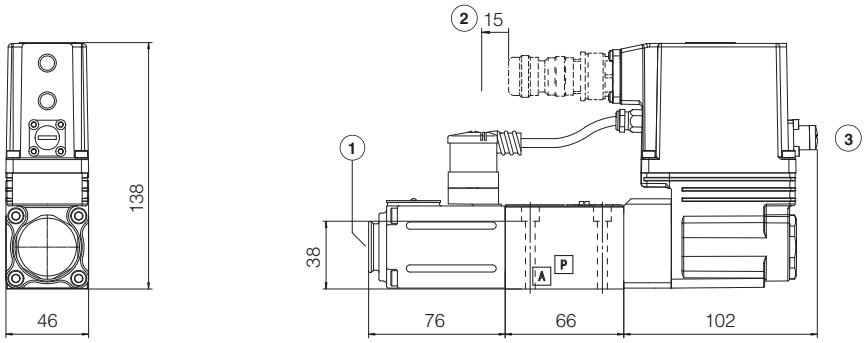
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
R	**REB, RES**	**RES-EH**
2,2	2,7	2,8

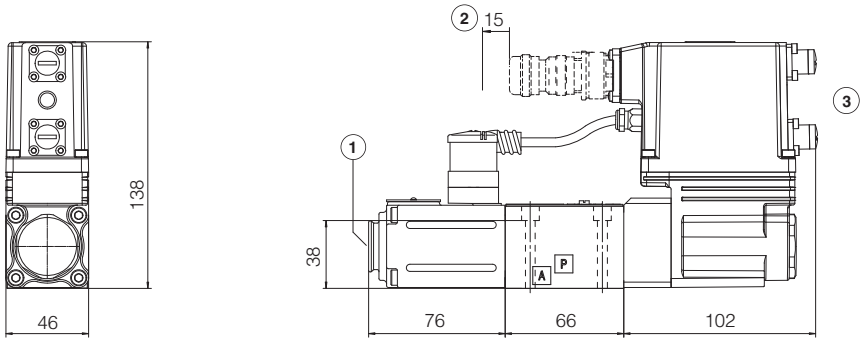
RZGO-R-P



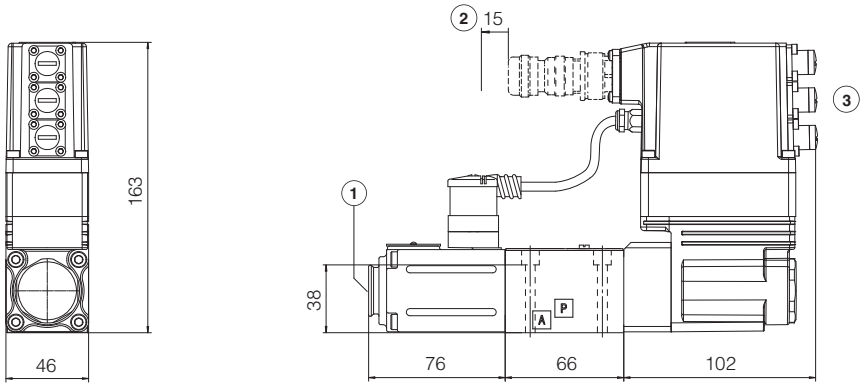
RZGO-REB-P-NP



RZGO-RES-P-BP
RZGO-RES-P-BC



RZGO-RES-P-EH



(1) = Air bleeding, see section 14

(2) = Space to remove the connectors

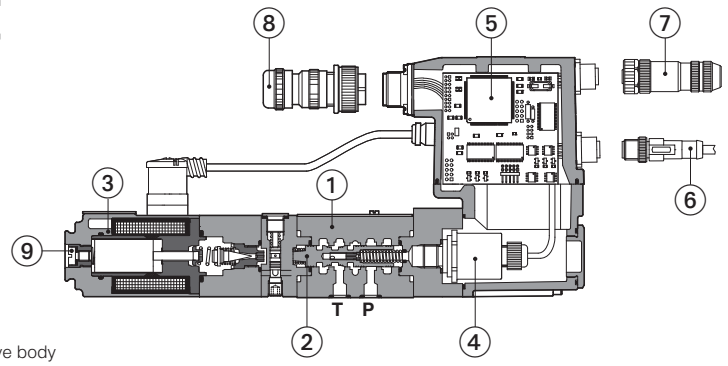
(3) = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Proportional reducing valves high performance

piloted, with on-board pressure transducer



① Valve body
② Spool
③ Proportional solenoid
④ On-board pressure transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

RZGO-RES-P-BC-033

RZGO-R , RZGO-REB, RZGO-RES

Spool type, piloted, digital proportional reducing valves with integral pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **40 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZGO	- REB	- P	- NP	- 033	/ 210	/ *	/ *	* /	*

RZGO: Proportional pressure reducing valve, piloted

REB:
R = for off-board driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

NP: **Fieldbus interfaces,** USB port always present **(3)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

033: **Configuration**:
033 = regulation on port A, discharge in T (pilot operated version)

210: **Max regulated pressure**:
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

*****: **Electronic options,** only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

*****: **Dynamic response preset,** see section 15 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

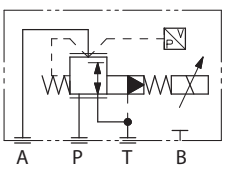
*****: Series number

*****: **Seals material,** see section 10 :
- = NBR
PE = FKM
BT = HNBR

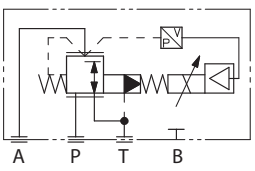
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZGO-R



RZGO-REB RZGO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

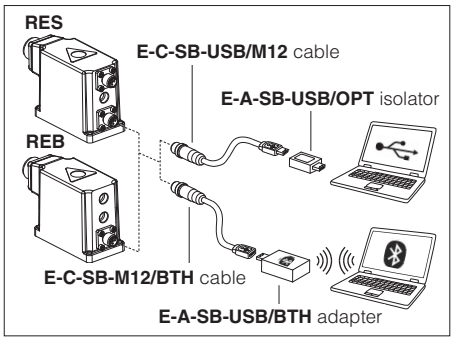
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZGO-*-033**
Max regulated pressure	[bar]	100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagrams at section 11
Min ÷ Max flow	[l/min]	2,5 ÷ 40
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 35
Hysteresis		≤ 0,5 [% of max pressure]
Linearity		≤ 1,0 [% of max pressure]
Repeatability		≤ 0,5 [% of max pressure]
Thermal drift		zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

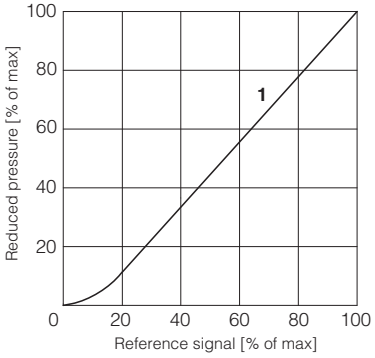
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

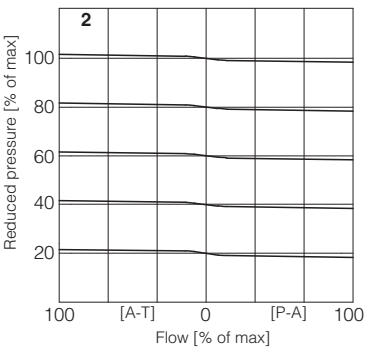
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

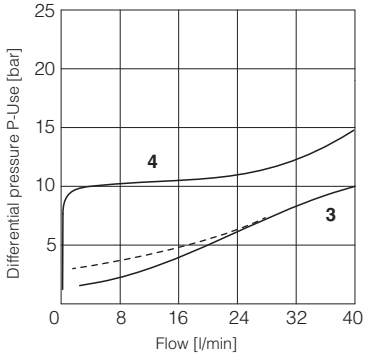
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = A → T (dotted line for pressure range /350)
4 = Pressure drops vs. flow P n A

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

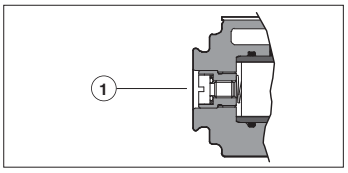
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

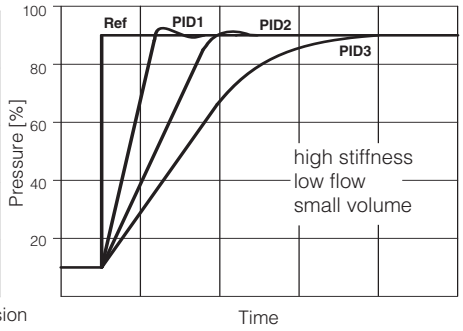


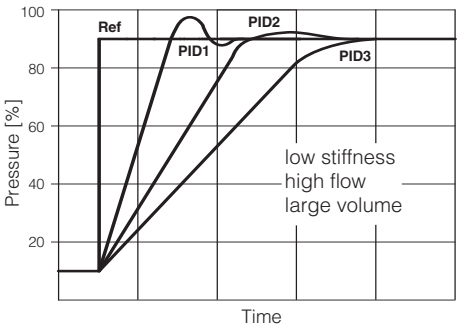
15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	Dynamic response example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)
The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option
The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)
The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Pressure monitor output signal (P_MONITOR)
The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard
To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for **/Z** option
Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

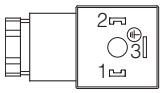
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

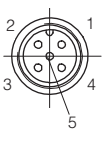
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

18.4 Solenoid connection - only for R

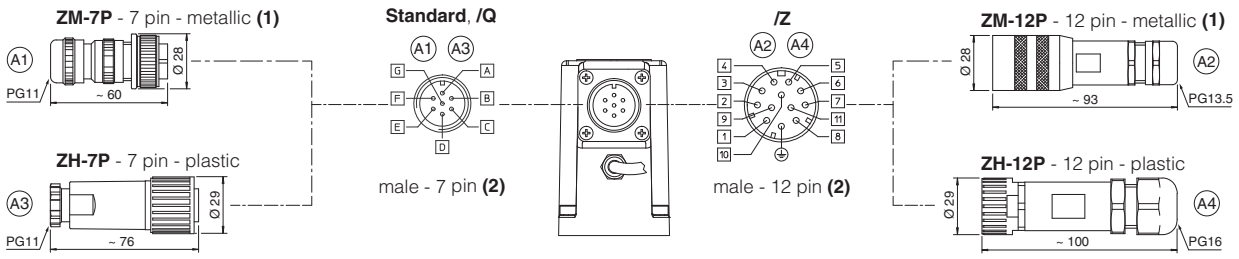
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.5 Pressure transducer connection - only for R

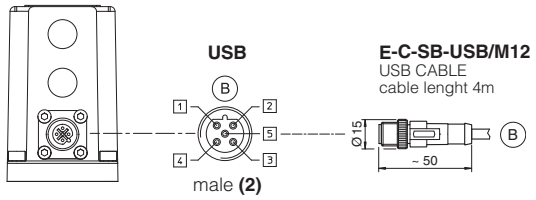
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

18.6 REB connections layout

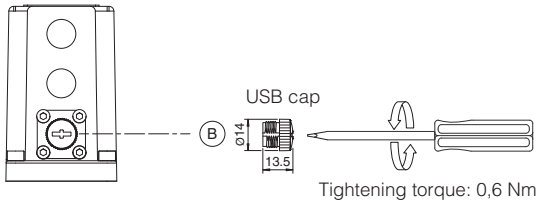
MAIN CONNECTORS



USB CONNECTOR



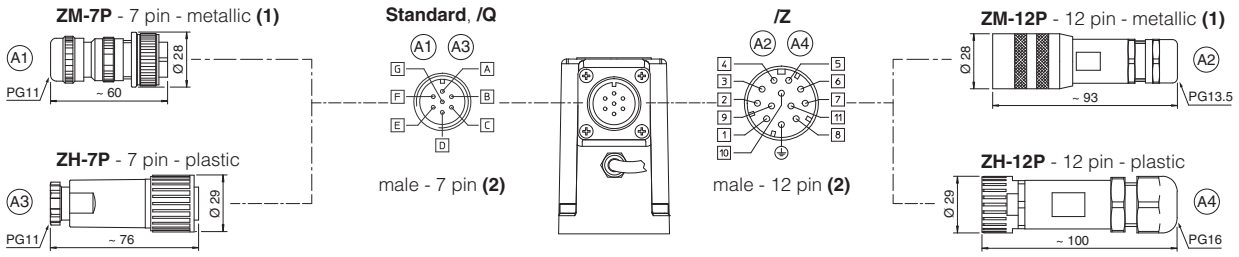
PLASTIC PROTECTION CAPS - supplied with the valves



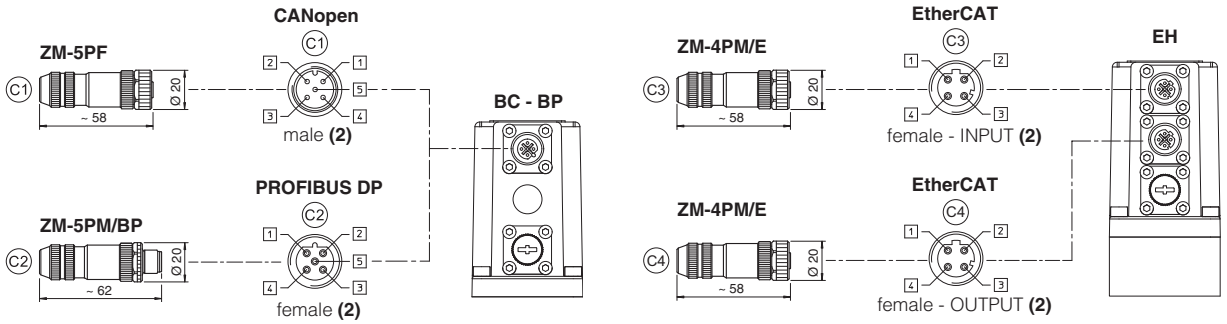
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 RES connections layout

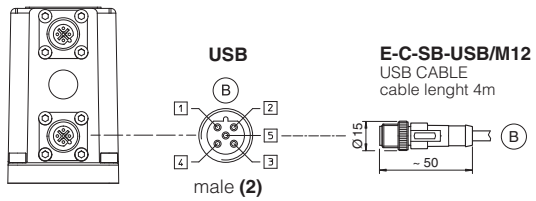
MAIN CONNECTORS



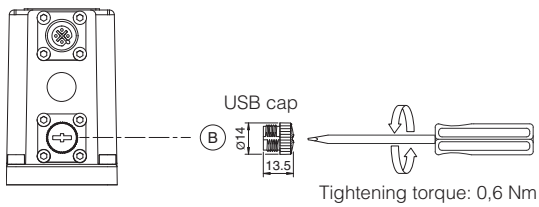
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

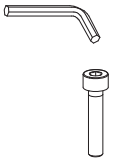
19.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 FASTENING BOLTS AND SEALS



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals:

4 OR 108

Diameter of ports P, A, T: Ø 7,5 mm

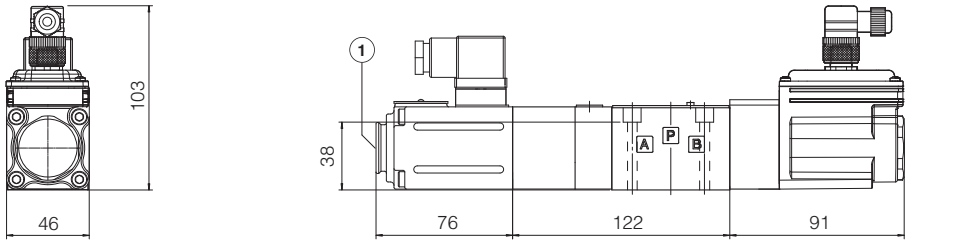
Port B not used

21 INSTALLATION DIMENSIONS [mm]

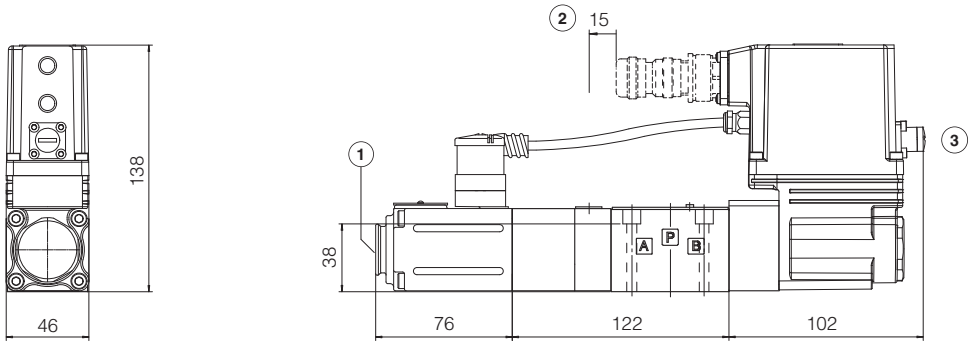
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
R	**REB, RES**	**RES-EH**
3,0	3,5	3,6

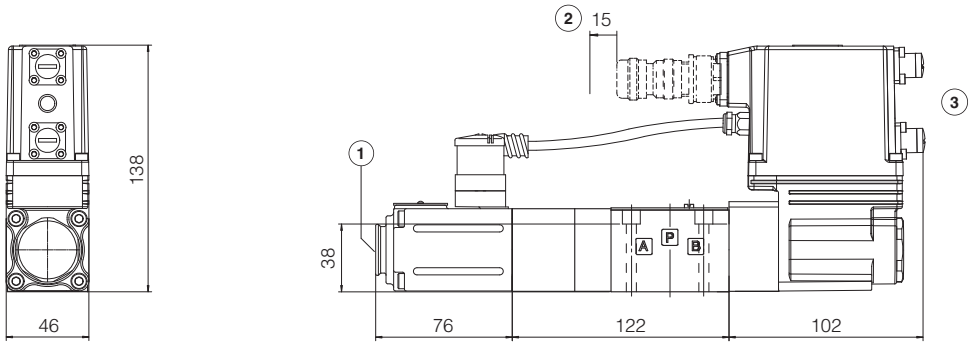
RZGO-R-P



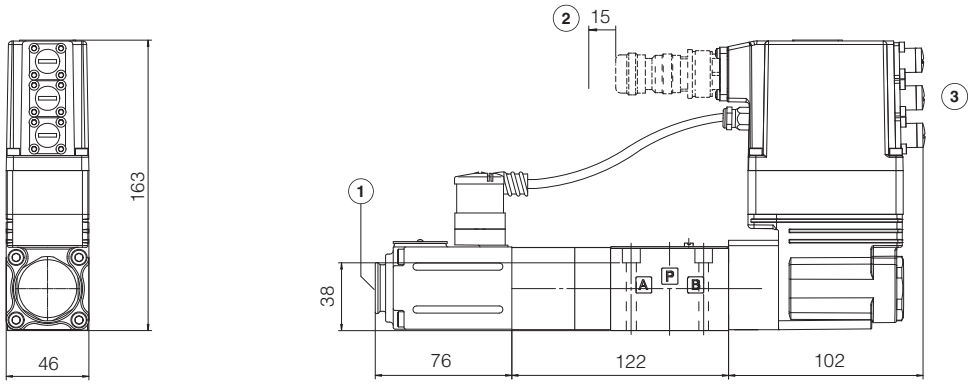
RZGO-REB-P-NP



RZGO-RES-P-BP
RZGO-RES-P-BC



RZGO-RES-P-EH



(1) = Air bleeding, see section 14

(2) = Space to remove the connectors

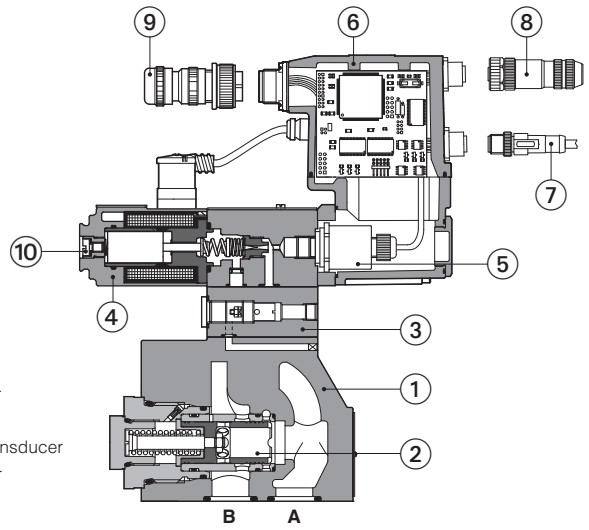
(3) = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Proportional reducing valves high performance

piloted, with on-board pressure transducer



① Valve body
② Main spool
③ Pilot flow compensator
④ Proportional solenoid
⑤ On-board pressure transducer
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector
⑩ Screw for air bleeding

AGRCZO-RES-P-BC-20

AGRCZO-R,
AGRCZO-REB, AGRCZO-RES

Piloted, digital proportional reducing valves with integral pressure transducer for pressure closed loop controls.

R without on-board digital driver, to be coupled with separated driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** and **20** - ISO 5781
Max flow: **160** and **300 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGRCZO	-	RES	-	P	-	BC	-	10	/	315	/	*	/	*	*	/	*

AGRCZO: Proportional pressure reducing valve, piloted

RES:
R = for separated driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

BC:
Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

10: **Valve size** ISO 5781: **10, 20**

315:
Max regulated pressure:
100 = 100 bar **210** = 210 bar **315** = 315 bar **350** = 350 bar

*****: **Hydraulic options (4)**:
P = with integral mechanical pressure limiter
R = with integral check valve for free reverse flow

*****: **Electronics options,** only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

*****: **Dynamic response preset**, see section 16:
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

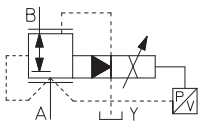
*****: Series number

*****: **Seals material,** see section 10:
- = NBR
PE = FKM
BT = HNBR

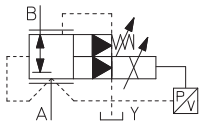
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS

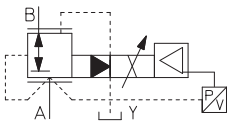
AGRCZO-R



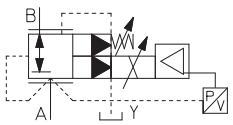
AGRCZO-R-*/P



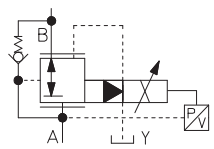
AGRCZO-REB
AGRCZO-RES



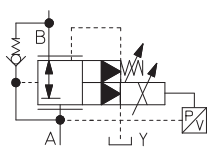
AGRCZO-REB-*/P
AGRCZO-RES-*/P



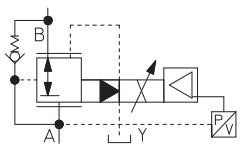
AGRCZO-R-*/R



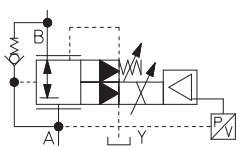
AGRCZO-R-*/PR



AGRCZO-REB-*/R
AGRCZO-RES-*/R



AGRCZO-REB-*/PR
AGRCZO-RES-*/PR



3 OFF-BOARD ELECTRONIC DRIVER - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

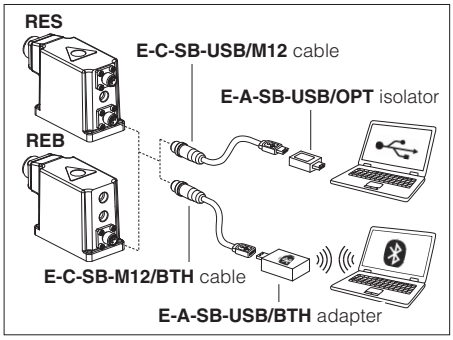
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**AGRCZO-*-10**	**AGRCZO-*-20**
Max regulated pressure	[bar]	100; 210; 315; 350	
Min regulated pressure	[bar]	1; 3 (only for /350)	
Max pressure at port A or B	[bar]	350	
Max pressure at port Y	[bar]	pilot drain always external, to be directly connected to tank at zero pressure	
Max flow	[l/min]	160	300
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 45	≤ 50
Hysteresis		≤ 0,5 [% of max pressure]	
Linearity		≤ 1,0 [% of max pressure]	
Repeatability		≤ 0,2 [% of max pressure]	
Thermal drift		zero point displacement < 1% at ΔT = 40°C	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 16

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

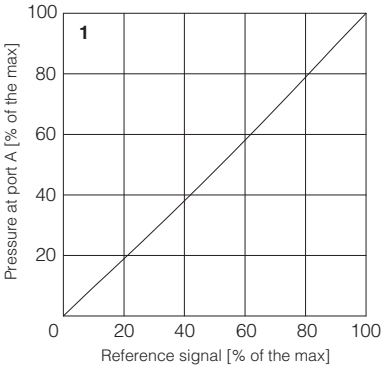
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

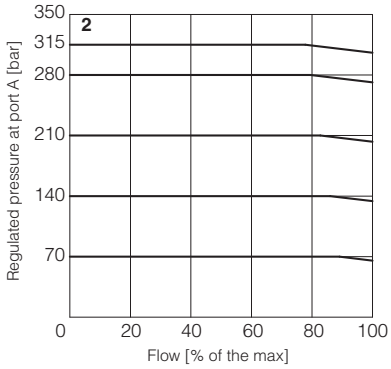
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams
with flow rate Q = 10 l/min

2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min

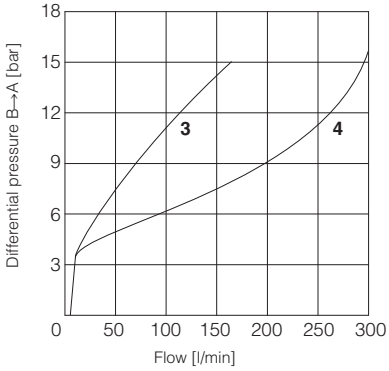


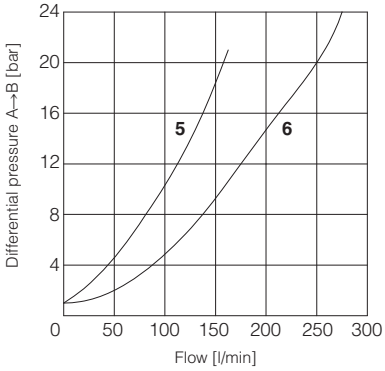


3-6 Pressure drop/flow diagrams
with zero reference signal

Differential pressure B→A
3 = AGRCZO-*-10
4 = AGRCZO-*-20

Differential pressure A→B (through check valve)
5 = AGRCZO-*-10/*/R
6 = AGRCZO-*-20/*/R

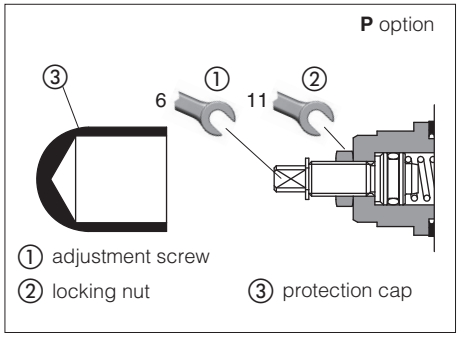




12 HYDRAULIC OPTIONS

P = This option provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

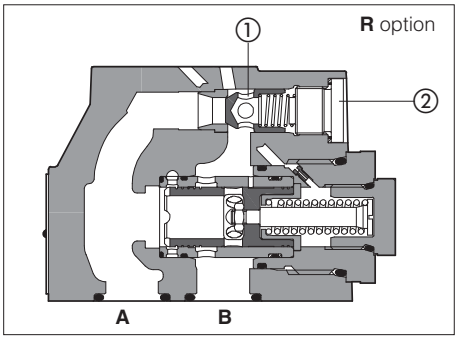
- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



R = This option provides a integral check valve for free reverse flow A→B

① Check valve - cracking pressure = 0,5 bar

② Plug



13 ELECTRONICS OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 18.5 for signal specifications.

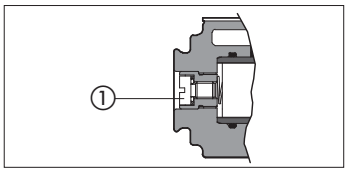
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 18.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 18.2

14 POSSIBLE COMBINED OPTIONS

for **R**: /PR

for **REB** and **RES**: /IP, /IQ, /IR, /IZ, /PQ, /PR, /PZ, /QR, /RZ, /IPQ, /IPR, /IPZ, /IQR, /IRZ, /PQR, /PRZ, /IPQR, /IPRZ

15 AIR BLEEDING



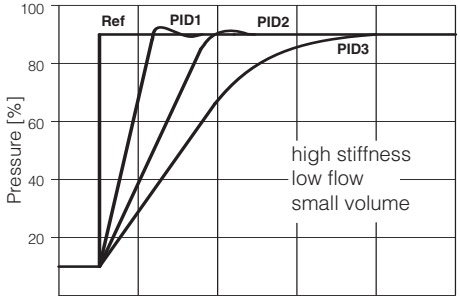
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

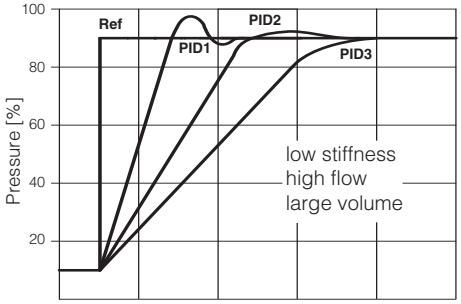
16 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

17 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z**

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

18.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

19 ELECTRONIC CONNECTIONS

19.1 Main connector signals - 7 pin (A1) **Standard** and **/Q** option - for **REB** and **RES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND / V0		Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

19.2 Main connector signals - 12 pin (A2) **/Z** option - for **REB** and **RES**

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for P_INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

19.3 Communication connectors - for **REB** (B) and **RES** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin** (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

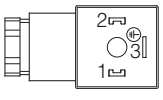
(C2) **BP fieldbus execution, connector - M12 - 5 pin** (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin** (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

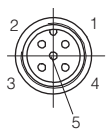
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

19.4 Solenoid connection - only for **R**

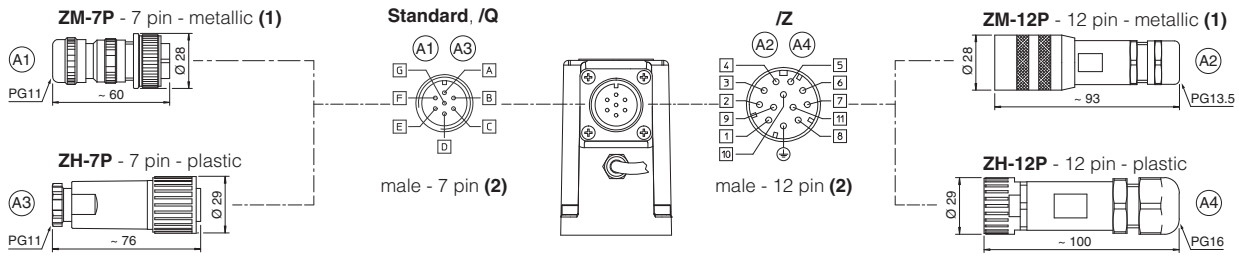
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

19.5 Pressure transducer connection - only for **R**

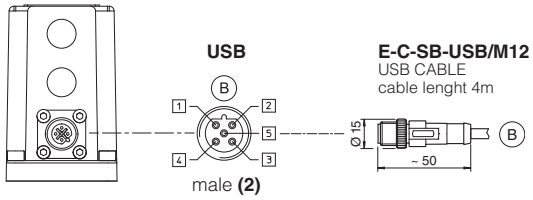
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

19.6 REB connections layout

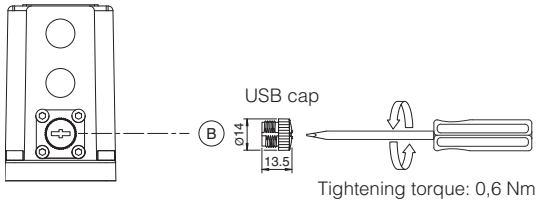
MAIN CONNECTORS



USB CONNECTOR



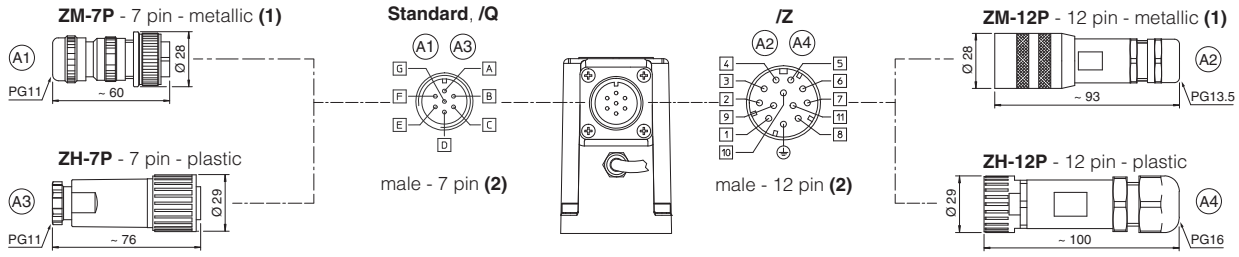
PLASTIC PROTECTION CAPS - supplied with the valves



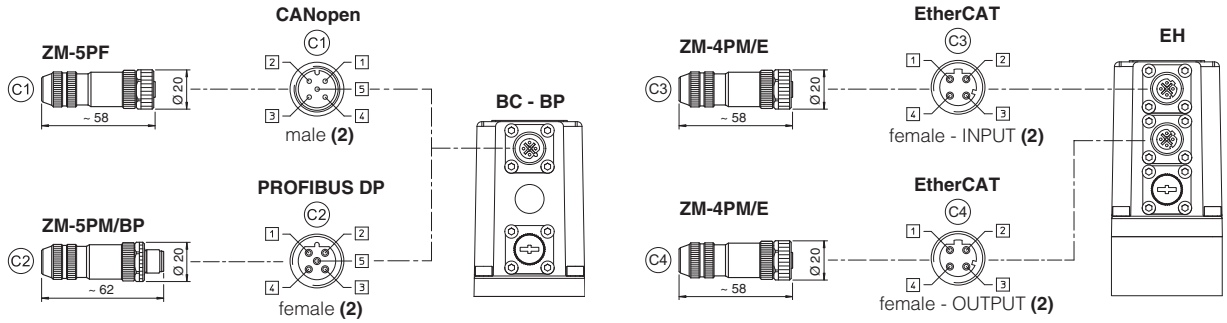
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19.7 RES connections layout

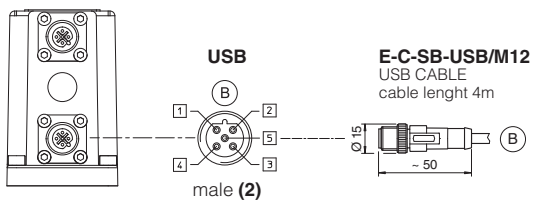
MAIN CONNECTORS



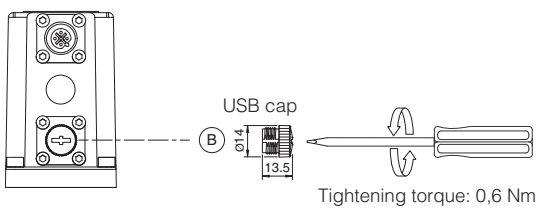
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

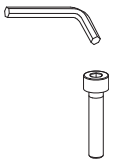
20.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

21 FASTENING BOLTS AND SEALS

	AGRCZO-*-10	**AGRCZO-*-20**
	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm
	**Seals:** 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm

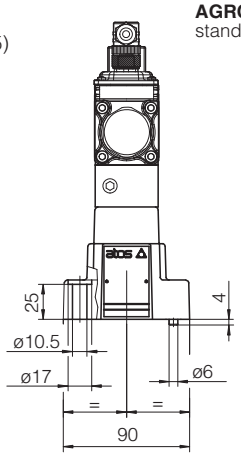
22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

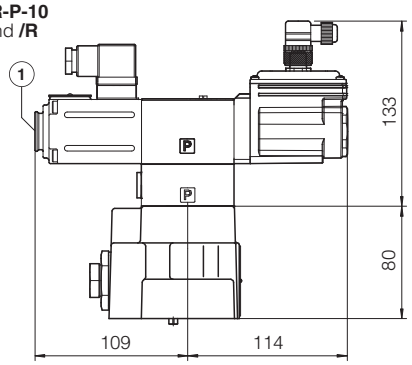
23 INSTALLATION DIMENSIONS FOR AGRCZO-10 [mm]

ISO 5781: 2000
Mounting surface: 5781-06-07-0-00 (see table P005)

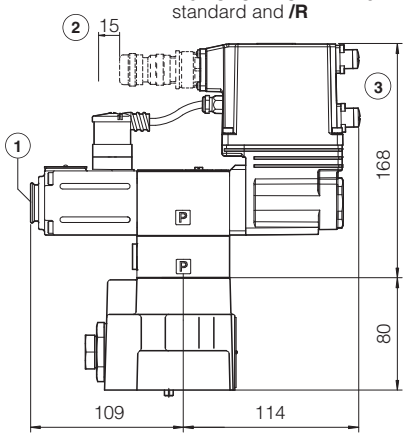
	Mass [kg]		
	R	**REB, RES**	**RES-EH**
AGRCZO-*-10	5,8	6,3	6,4
Option /P	+0,5		



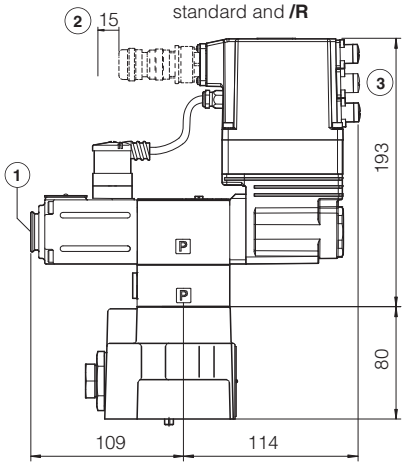
AGRCZO-R-P-10
standard and **/R**



AGRCZO-REB-P-NP-10
AGRCZO-RES-P-BC-10
AGRCZO-RES-P-BP-10
standard and **/R**



AGRCZO-RES-P-EH-10
standard and **/R**

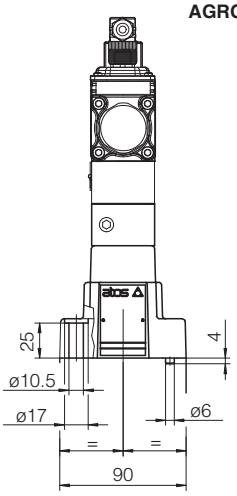


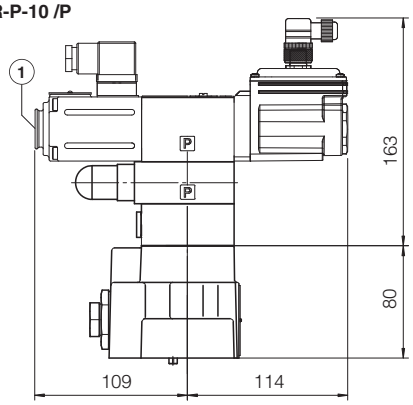
(1) = Air bleeding, see section 15

(2) = Space to remove the connectors

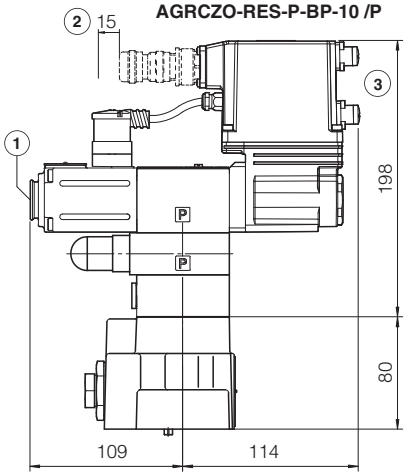
(3) = The dimensions of all connectors must be considered, see section 19.6 and 19.7

AGRCZO-R-P-10 /P

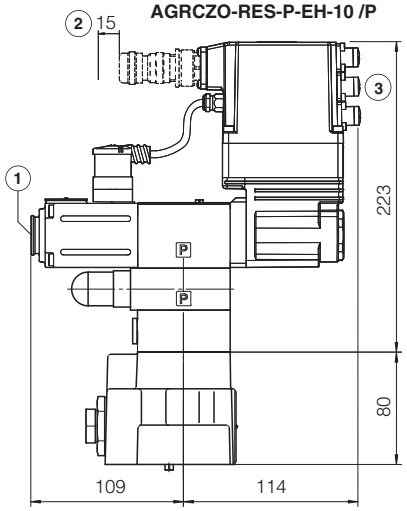




AGRCZO-REB-P-NP-10 /P
AGRCZO-RES-P-BC-10 /P
AGRCZO-RES-P-BP-10 /P



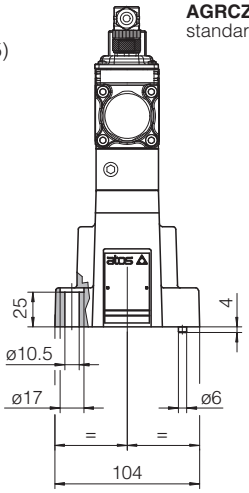
AGRCZO-RES-P-EH-10 /P



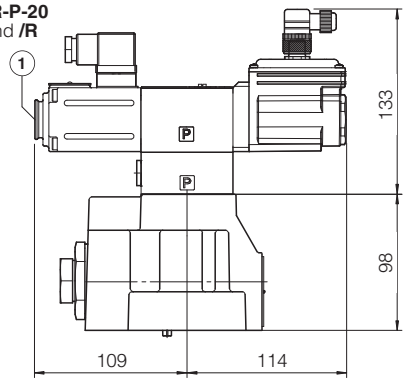
24 INSTALLATION DIMENSIONS FOR AGRCZO-20 [mm]

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00 (see table P005)

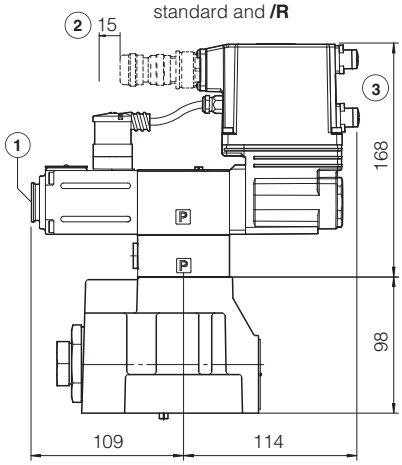
	Mass [kg]		
	R	**REB, RES**	**RES-EH**
AGRCZO-*-20	8,3	8,8	8,9
Option /P	+0,5		



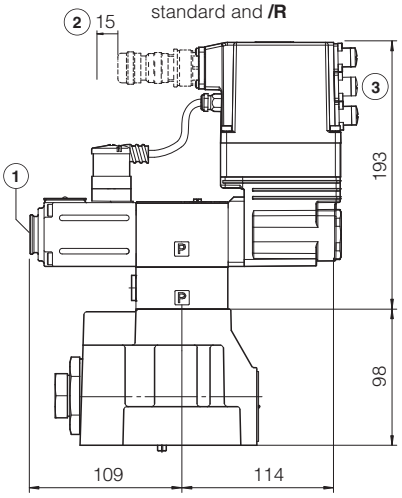
AGRCZO-R-P-20
standard and **/R**



AGRCZO-REB-P-NP-20
AGRCZO-RES-P-BC-20
AGRCZO-RES-P-BP-20
standard and **/R**



AGRCZO-RES-P-EH-20
standard and **/R**

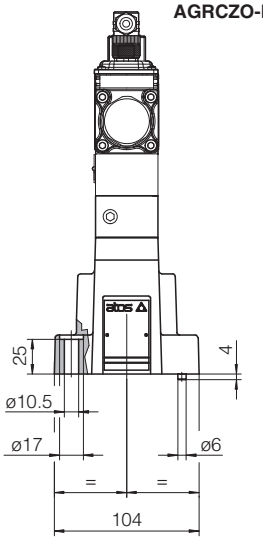


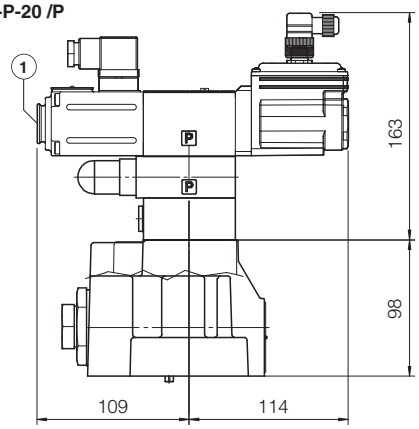
(1) = Air bleeding, see section 15

(2) = Space to remove the connectors

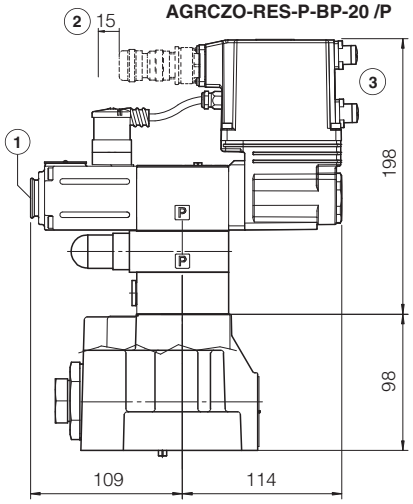
(3) = The dimensions of all connectors must be considered, see section 19.6 and 19.7

AGRCZO-R-P-20 /P

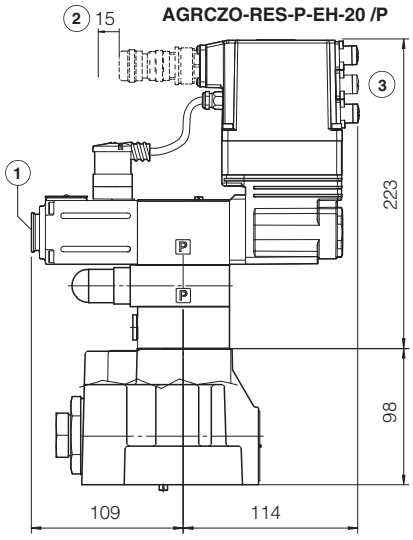




AGRCZO-REB-P-NP-20 /P
AGRCZO-RES-P-BC-20 /P
AGRCZO-RES-P-BP-20 /P

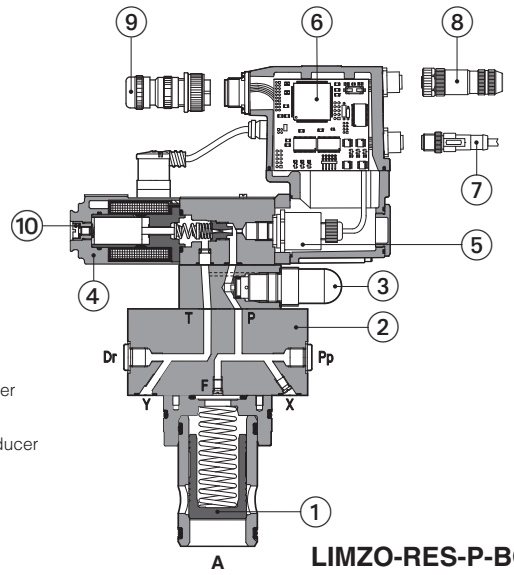


AGRCZO-RES-P-EH-20 /P



Digital proportional pressure cartridges high performance

piloted, with on-board pressure transducer - compensator, relief, reducing functions



① Poppet
② Cover
③ Mechanical pressure limiter
④ Proportional solenoid
⑤ On-board pressure transducer
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector
⑩ Screw for air blending

LIMZO-RES-P-BC-4

LICZO, LIMZO, LIRZO

2-way digital proportional cartridges with on-board pressure transducer, respectively performing: pressure compensator, relief and reducing closed loop functions.

R to be coupled with off-board drivers.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **16** ÷ **80** - ISO 7368
Max flow: up to **4500 l/min**
Max pressure: **350 bar**

1 **MODEL CODE OF COVERS**

LIMZO	-	RES	-	P	-	BC	-	4	/	315	/	*	/	*	/	*	*

LIMZO
Proportional pressure cartridges, piloted
LICZO = pressure compensator
LIMZO = pressure relief
LIRZO = pressure reducing

RES
R = for off-board driver, see section 5
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

BC
Fieldbus interfaces USB port always present **(3)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

4
Valve size ISO 7368:
1 = 16
2 = 25
3 = 32
4 = 40
5 = 50 (not for LIRZO)
6 = 63 (only for LIMZO)
8 = 80 (only for LIMZO)

315
Max regulated pressure:
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

***** (Hydraulic options)
Hydraulic options (4):
P =with on-board mechanical pressure limiter (standard for size 1, 2 and 3)

***** (Electronics options)
Electronics options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

***** (Dynamic response preset)
Dynamic response preset, see section 18 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

***** (Series number)
Series number

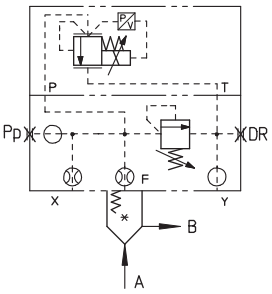
***** (Seals material)
Seals material, see section 12 :
- = NBR
PE = FKM
BT = HNBR

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) For possible combined options, see section 16

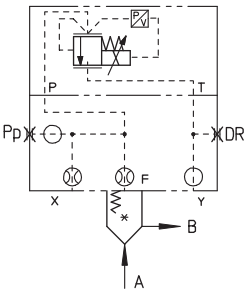
2 HYDRAULIC SYMBOLS

LICZO

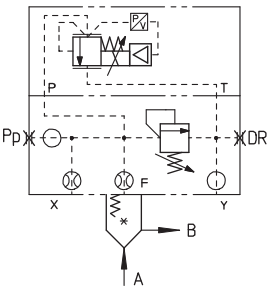
LICZO-R-1÷3
LICZO-R-4÷5 /P



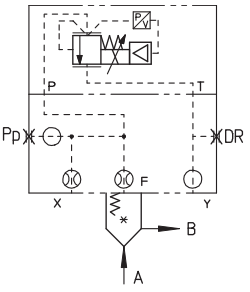
LICZO-R-4
LICZO-R-5



LICZO-REB(RES)-1÷3
LICZO-REB(RES)-4÷5 /P

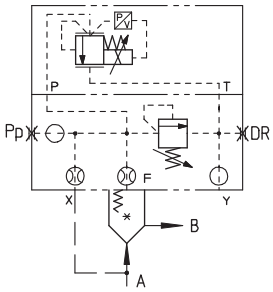


LICZO-REB(RES)-4÷5

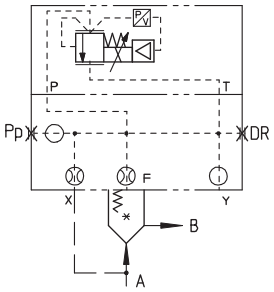


LIMZO

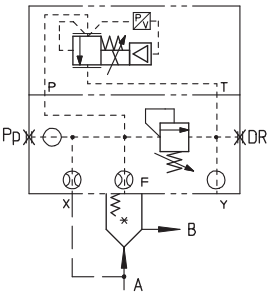
LIMZO-R-1÷3
LIMZO-R-4÷8 /P



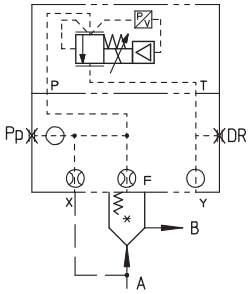
LIMZO-R-4÷8



LIMZO-REB(RES)-1÷3
LIMZO-REB(RES)-4÷8 /P

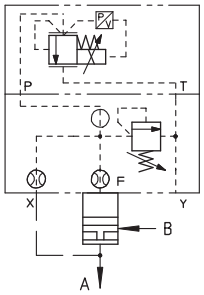


LIMZO-REB(RES)-4÷8

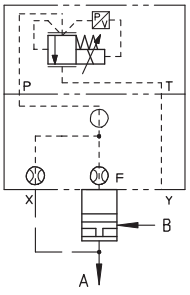


LIRZO

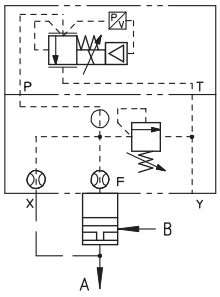
LIRZO-R-1÷3
LIRZO-R-4 /P



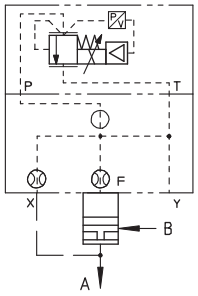
LIRZO-R-4



LIRZO-REB(RES)-1÷3
LIRZO-REB(RES)-4 /P



LIRZO-REB(RES)-4



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	*	/	*

Cartridge according to ISO 7368

Cartridge size ISO 7368:
16; **25**; **32**; **40**; **50**; **63**; **80**

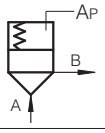
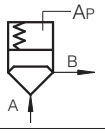
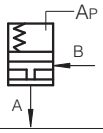
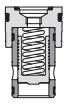
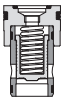
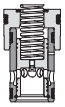
Type of poppet:
31 = for LIMZO and LICZO
36 = for LICZO
37 = for LIRZO

Series number

Spring cracking pressure:
2 = 1,5 bar for poppet 31
3 = 3 bar
4 = 4 bar
6 = 6 bar for poppet 31 and 36
7 = 7 bar for poppet 37

Seals material, see section 12 :
- = NBR
PE = FKM
BT = HNBR

4 TYPE OF POPPET

Type of poppet	31	36	37
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	**1:1**	**1:1**	**1:1**

5 OFF-BOARD ELECTRONIC DRIVER - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS

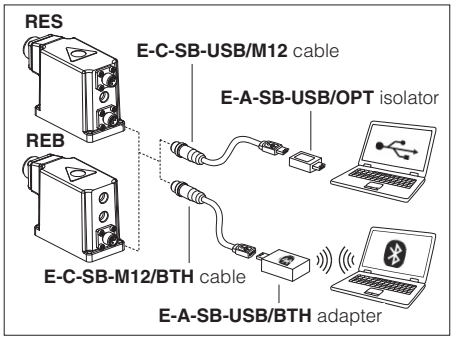
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

8 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**LICZO**					**LIMZO**							**LIRZO**			
valve size		**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**1**	**2**	**3**	**4**
Max flow	[l/min]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pres. at port A	[bar]	9	8,5	8	13	15	7	7	7	10,5	12	12	12	7			
Min regulated pres. at port A for /350	[bar]	11	10	10	13	16	10	10	9	12	13	13	16	12			
Max regulated pres. at port A	[bar]	100; 210; 315; 350					100; 210; 315; 350							100; 210; 315; 350			
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	80 ÷ 300					80 ÷ 350							80 ÷ 200			
Hysteresis	[% of the regulated max flow]	≤ 0,5															
Linearity	[% of the regulated max flow]	≤ 1,0															
Repeatability	[% of the regulated max flow]	≤ 0,2															
Thermal drift		zero point displacement < 1% at ΔT = 40°C															

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 5

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 18 .

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 22			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

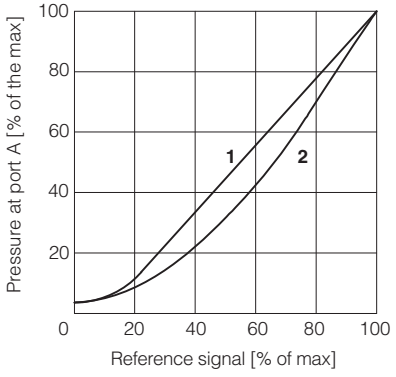
12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

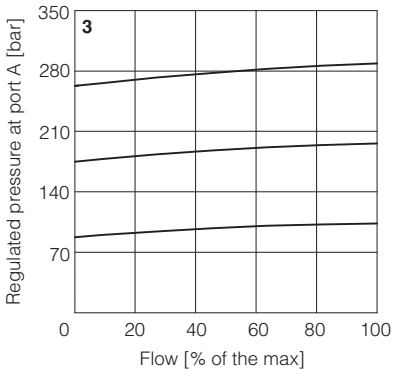
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams LIMZO
2 Regulation diagrams LICZO

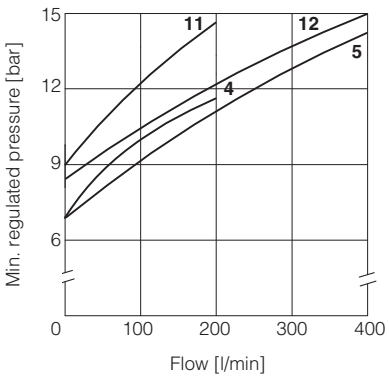
3 Pressure/flow diagrams LICZO, LIMZO

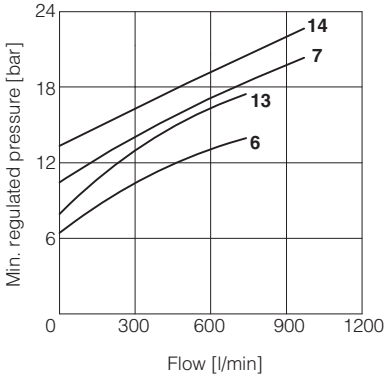


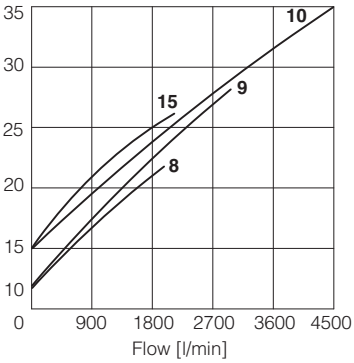


4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZO-*-1
5 = LIMZO-*-2
6 = LIMZO-*-3
7 = LIMZO-*-4
8 = LIMZO-*-5
9 = LIMZO-*-6
10 = LIMZO-*-8
11 = LICZO-*-1
12 = LICZO-*-2
13 = LICZO-*-3
14 = LICZO-*-4
15 = LICZO-*-5





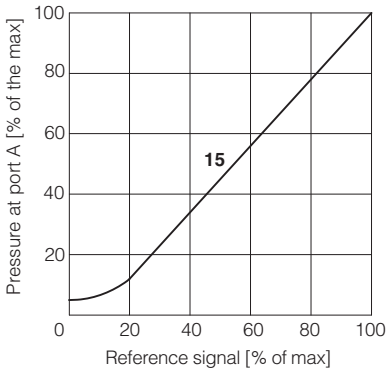


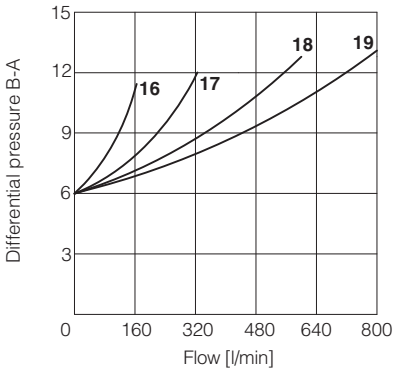
Regulation diagrams LIRZO

15 = LIRZO-A

16-19 Min. pressure/flow diagrams
with reference signal "null"

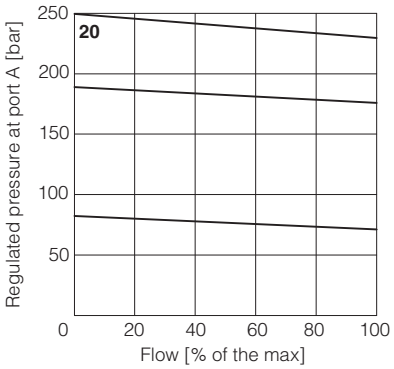
16 = LIRZO-*-1
17 = LIRZO-*-2
18 = LIRZO-*-3
19 = LIRZO-*-4





Pressure/flow diagrams

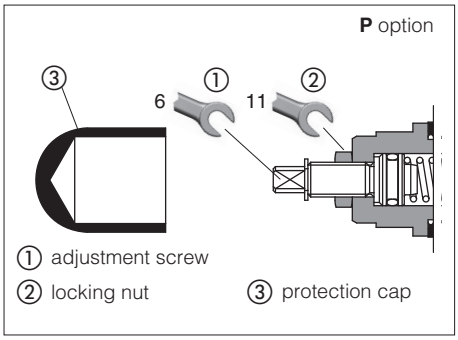
20 = LIRZO-A



14 HYDRAULIC OPTIONS

P = This option (standard for size 1, 2 and 3) provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



15 ELECTRONIC OPTIONS - only for **REB** and **RES**

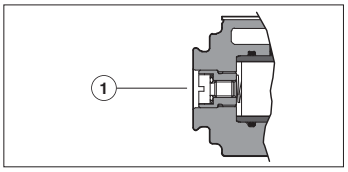
I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 20.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 20.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 20.2

16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible; **Electronics options**: /IQ, /IZ



17 AIR BLEEDING

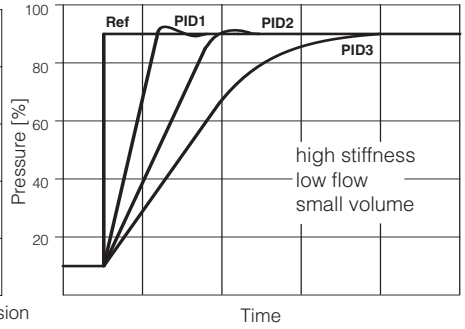
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

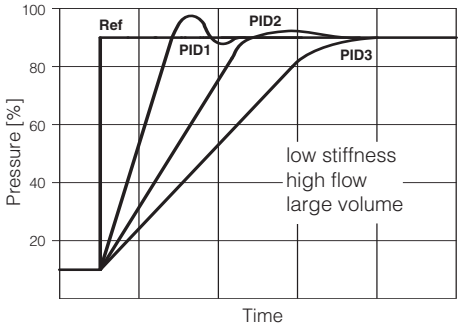
18 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	Dynamic response example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

19 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

20.1 Power supply (V+ and V0)
The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option
The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Pressure reference input signal (P_INPUT+)
The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

20.4 Pressure monitor output signal (P_MONITOR)
The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

20.5 Enable input signal (ENABLE) - not for standard
To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

20.6 Fault output signal (FAULT) - only for **/Z** option
Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

21 ELECTRONIC CONNECTIONS

21.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND / V0		Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

21.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

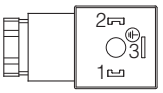
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

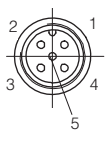
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

21.4 Solenoid connection - only for R

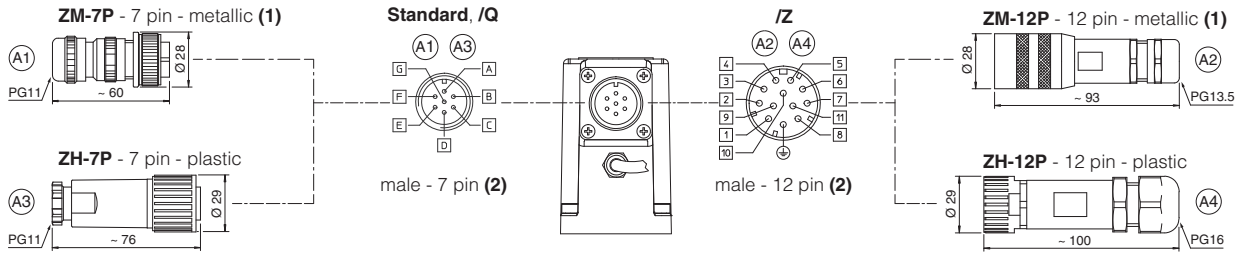
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

21.5 Pressure transducer connection - only for R

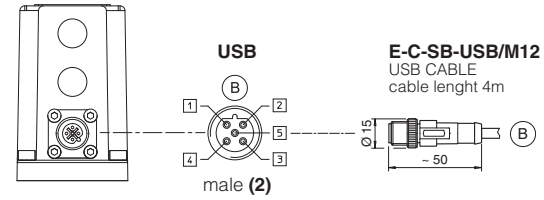
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

21.6 REB connections layout

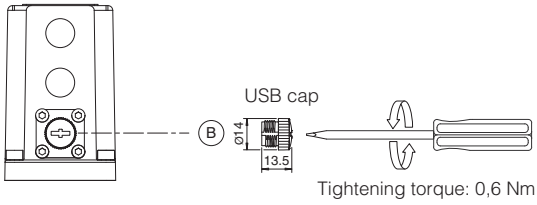
MAIN CONNECTORS



USB CONNECTOR



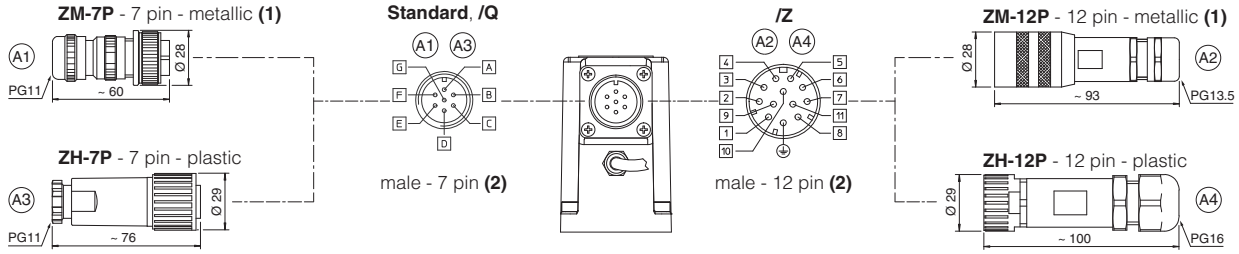
PLASTIC PROTECTION CAPS - supplied with the valves



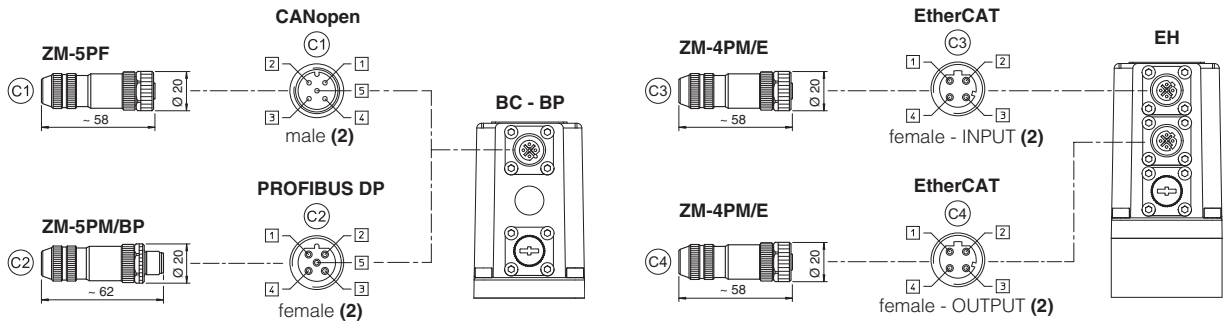
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

21.7 RES connections layout

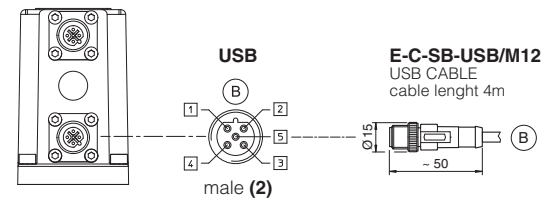
MAIN CONNECTORS



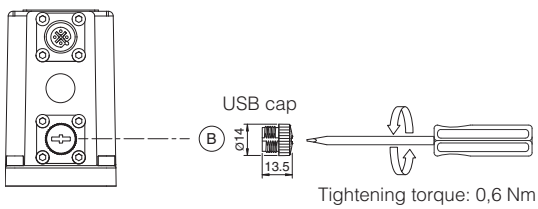
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

22.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

22.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

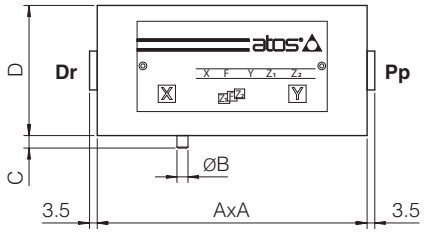
(2) Internally terminated

23 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZO LICZO LIRZO	**1** = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO LICZO	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO	**6** = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

24 COVERS DIMENSIONS [mm]

Size	AxA	øB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4"
5 = 50	140x140	6	4	70	G 1/4"
6 = 63	180x180	6	4	80	G 3/8"
8 = 80	ø250	8	6	80	G 3/8"



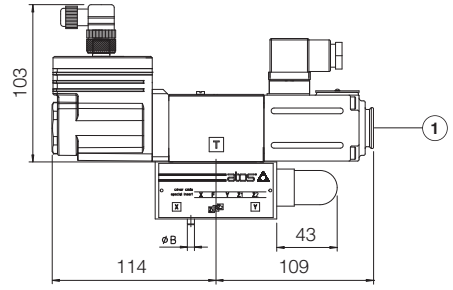
Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

25 COVERS INSTALLATION DIMENSIONS [mm]

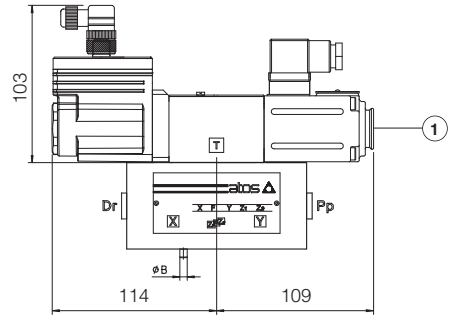
Version **R** for off-board driver

Mass [kg]			
	LICZO, LIMZO, LIRZO		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	3,8	-	0,2
2 = 25	4,3	-	0,5
3 = 32	5,6	-	0,9
4 = 40	11,0	12,0	1,7
5 = 50	14,5	15,5	2,9
6 = 63	24,0	25,0	6,7
8 = 80	32,6	33,6	13,1

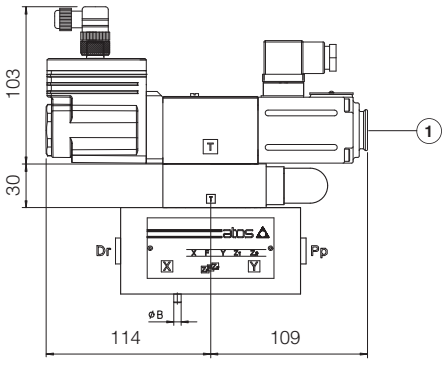
LICZO-R-1 LIMZO-R-1 LIRZO-R-1
LICZO-R-2 LIMZO-R-2 LIRZO-R-2
LICZO-R-3 LIMZO-R-3 LIRZO-R-3



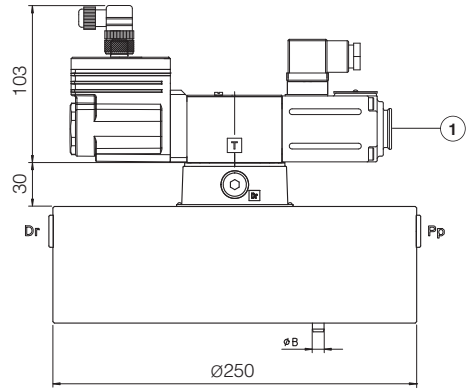
LICZO-R-4 LIMZO-R-4 LIRZO-R-4
LICZO-R-5 LIMZO-R-5
LIMZO-R-6



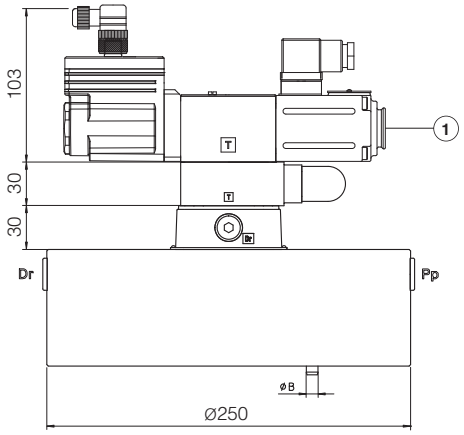
LICZO-R-4/P LIMZO-R-4/P LIRZO-R-4/P
LICZO-R-5/P LIMZO-R-5/P
LIMZO-R-6/P



LIMZO-R-8



LIMZO-R-8/P



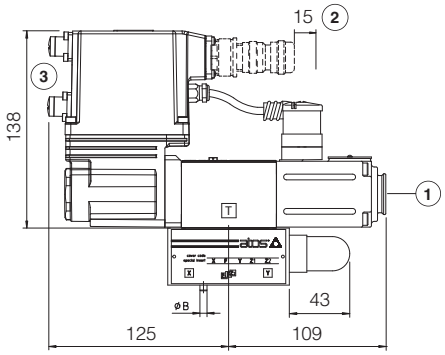
(1) = Air bleeding, see section 17

Note: for mounting surface and cavity dimensions, see tech. table P006

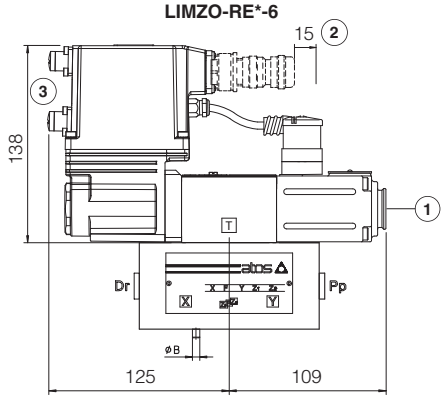
Versions **REB** and **RES** for on-board driver

Mass [kg]			
	LICZO, LIMZO, LIRZO		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,3	-	0,2
2 = 25	4,8	-	0,5
3 = 32	6,1	-	0,9
4 = 40	11,5	12,5	1,7
5 = 50	15,0	16,0	2,9
6 = 63	24,5	25,5	6,7
8 = 80	33,1	34,1	13,1

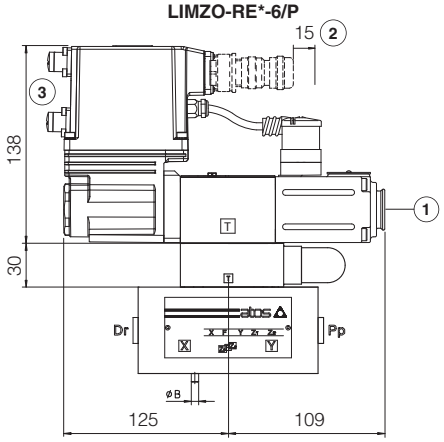
LICZO-RE*-1 LIMZO-RE*-1 LIRZO-RE*-1
LICZO-RE*-2 LIMZO-RE*-2 LIRZO-RE*-2
LICZO-RE*-3 LIMZO-RE*-3 LIRZO-RE*-3



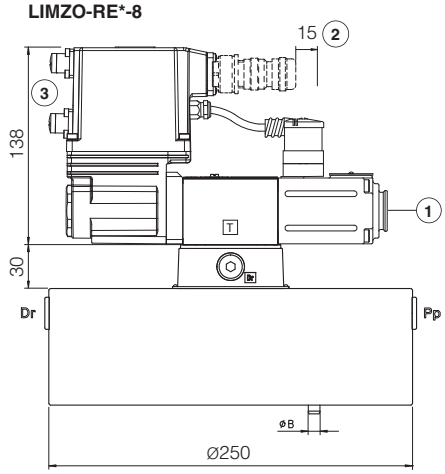
LICZO-RE*-4 LIMZO-RE*-4 LIRZO-RE*-4
LICZO-RE*-5 LIMZO-RE*-5
LIMZO-RE*-6



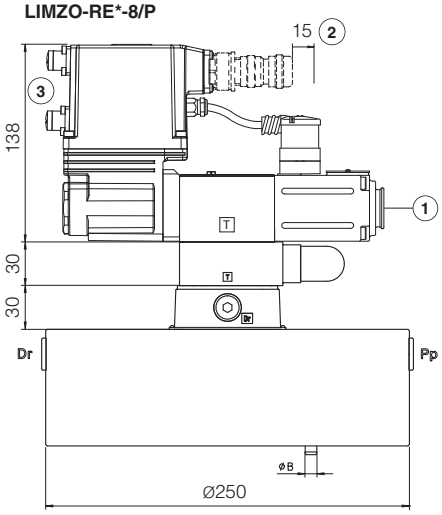
LICZO-RE*-4/P LIMZO-RE*-4/P LIRZO-RE*-4/P
LICZO-RE*-5/P LIMZO-RE*-5/P
LIMZO-RE*-6/P



LIMZO-RE*-8



LIMZO-RE*-8/P



(1) = Air bleeding, see section 17

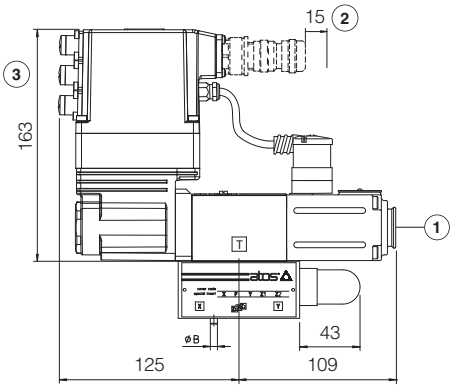
(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 21.6 and 21.7

Note: for mounting surface and cavity dimensions, see tech. table P006

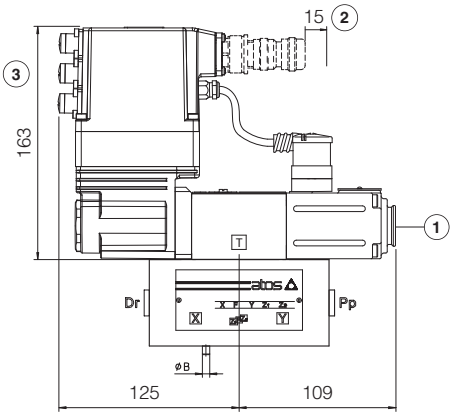
Version **RES-EH** for on-board driver

LICZO-RES-EH-1 LIMZO-RES-EH-1 LIRZO-RES-EH-1
LICZO-RES-EH-2 LIMZO-RES-EH-2 LIRZO-RES-EH-2
LICZO-RES-EH-3 LIMZO-RES-EH-3 LIRZO-RES-EH-3

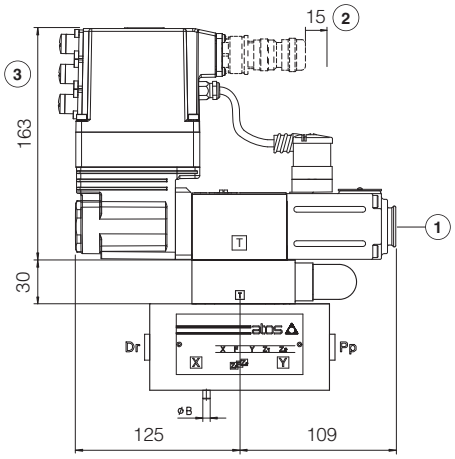


Mass [kg]			
	LICZO, LIMZO, LIRZO		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,4	-	0,2
2 = 25	4,9	-	0,5
3 = 32	6,2	-	0,9
4 = 40	11,6	12,6	1,7
5 = 50	15,1	16,1	2,9
6 = 63	24,6	25,6	6,7
8 = 80	33,2	34,2	13,1

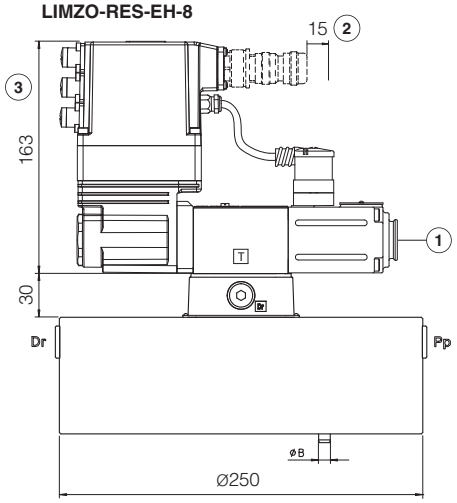
LICZO-RES-EH-4 LIMZO-RES-EH-4 LIRZO-RES-EH-4
LICZO-RES-EH-5 LIMZO-RES-EH-5
LIMZO-RES-EH-6



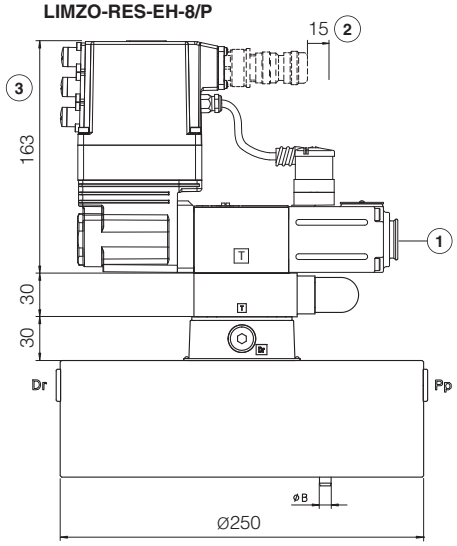
LICZO-RES-EH-4/P LIMZO-RES-EH-4/P LIRZO-RES-EH-4/P
LICZO-RES-EH-5/P LIMZO-RES-EH-5/P
LIMZO-RE*-6/P



LIMZO-RES-EH-8



LIMZO-RES-EH-8/P



(1) = Air bleeding, see section 17
(2) = Space to remove the connectors
(3) = The dimensions of all connectors must be considered, see section 21.6 and 21.7

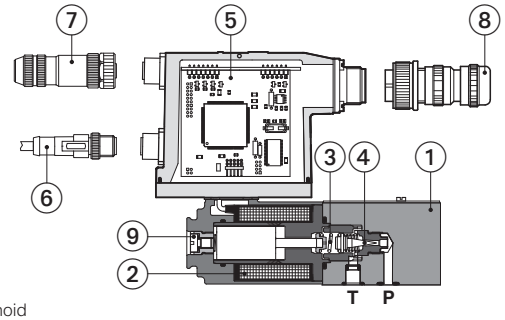
Note: for mounting surface and cavity dimensions, see tech. table P006

26 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P006**	Mounting surfaces and cavities for cartridge valves
GS203	E-BM-RES digital driver	**QB420**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF420**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Digital proportional relief valves

direct, without transducer



RZMO-AES-BC-010

① Valve body
② Proportional solenoid
③ Spring
④ Poppet
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air bleeding

RZMO-A , RZMO-AEB, RZMO-AES

Poppet type, direct, digital proportional relief valves for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **4 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO	-	AEB	-	NP	-	010	/	210	/	*	/	*	*	/	*

Proportional pressure relief valve, direct

A = for off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Configuration:
010 = regulation on port P, discharge in T (direct operated version)

Max regulated pressure (5):
50 = 50 bar **210** = 210 bar **350**= 350 bar
100 = 100 bar **315** = 315 bar

Electronic options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Coil voltage, only for **A** - see section 14:
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

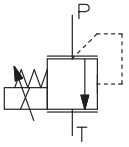
Series number

Seals material, see section 10:
- = NBR
PE = FKM
BT = HNBR

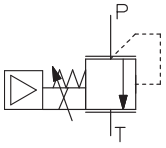
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Possible combined options: IQ, IZ
(5) Special execution with max regulated pressure **500 bar** available on request

2 HYDRAULIC SYMBOLS

RZMO-A



RZMO-AEB RZMO-AES



3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

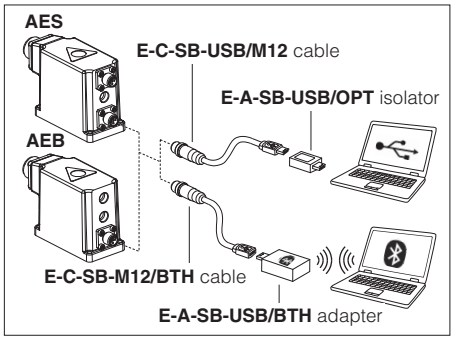
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZMO-*-010**
Max regulated pressure	[bar]	50; 100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 11
Max flow	[l/min]	4
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 70
Hysteresis		≤ 1,5 [% of max pressure]
Linearity		≤ 3,0 [% of max pressure]
Repeatability		≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard		option /6	option /18
Max. solenoid current	2,6 A		3,25 A	1,5 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω		2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

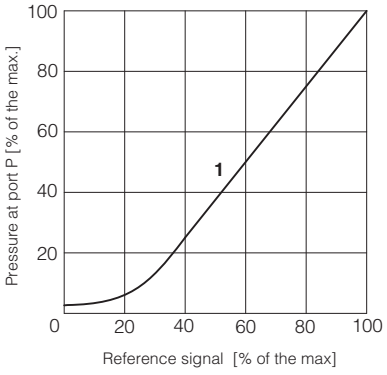
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

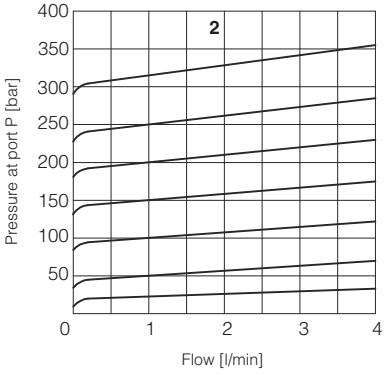
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog	
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5			
Hydraulic fluid	**Suitable seals type**		**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR		HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM		HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR		HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

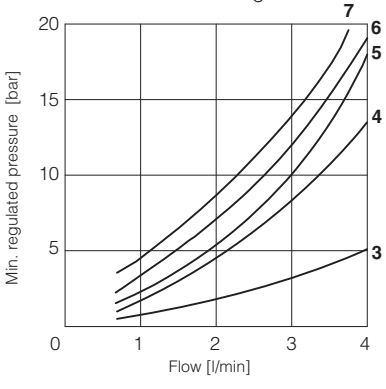
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-6 Min. pressure/flow diagrams
with zero reference signal



3 = RZMO/50 **4 =** RZMO/100
5 = RZMO/210 **6 =** RZMO/315
7 = RZMO/350

Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

12 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

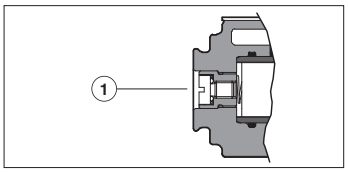
14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND / V0		Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

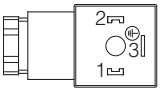
(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

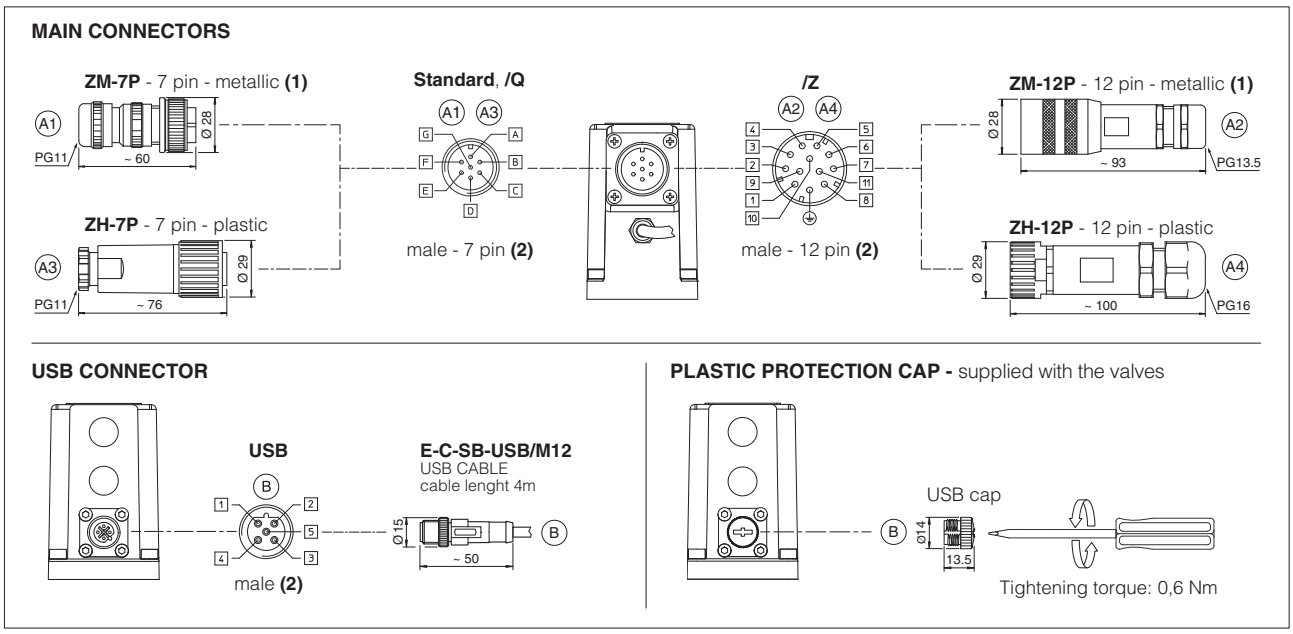
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

17.4 Solenoid connection - only for A

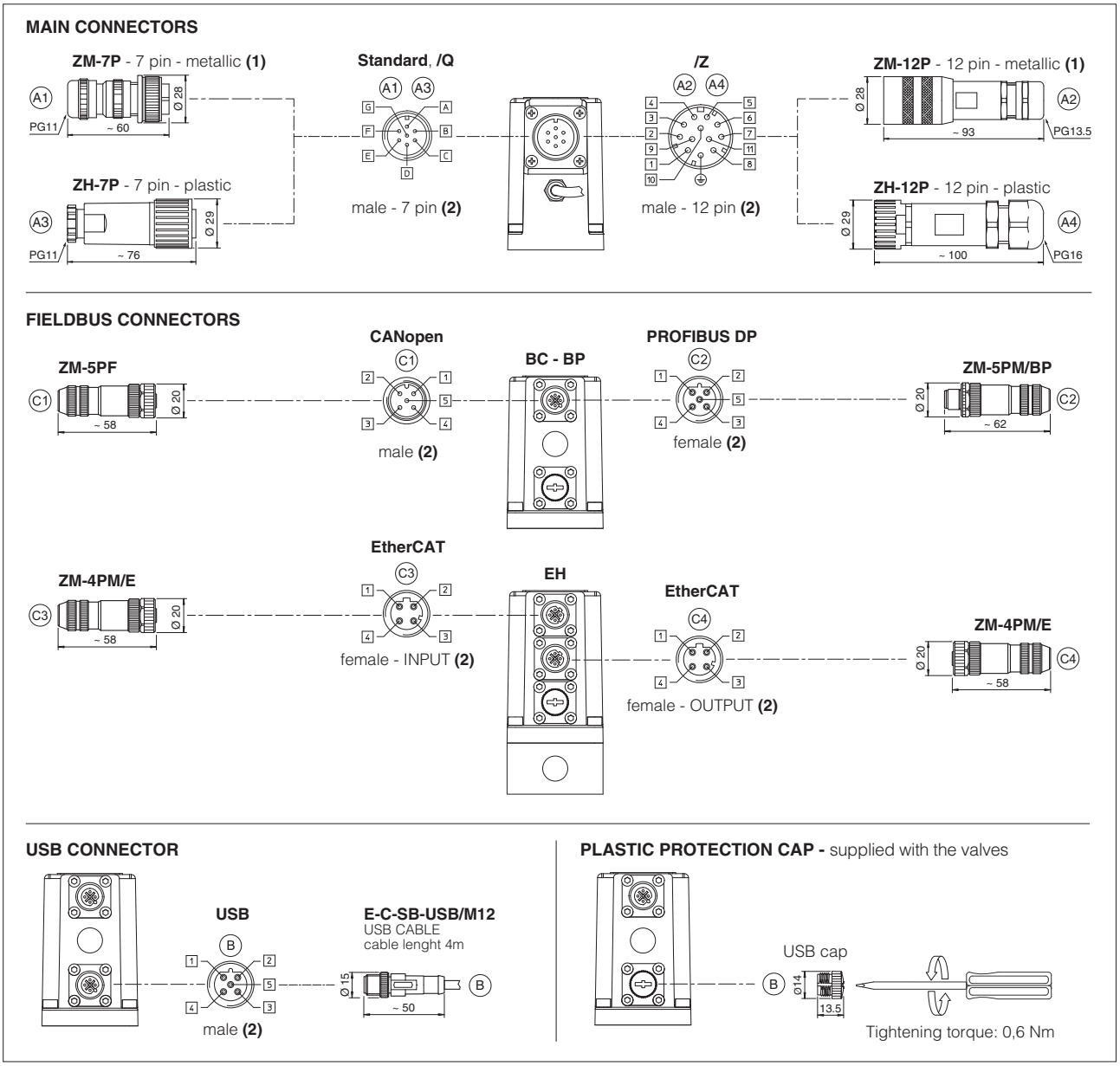
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

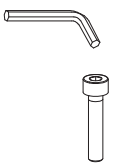
18.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 FASTENING BOLTS AND SEALS



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals:

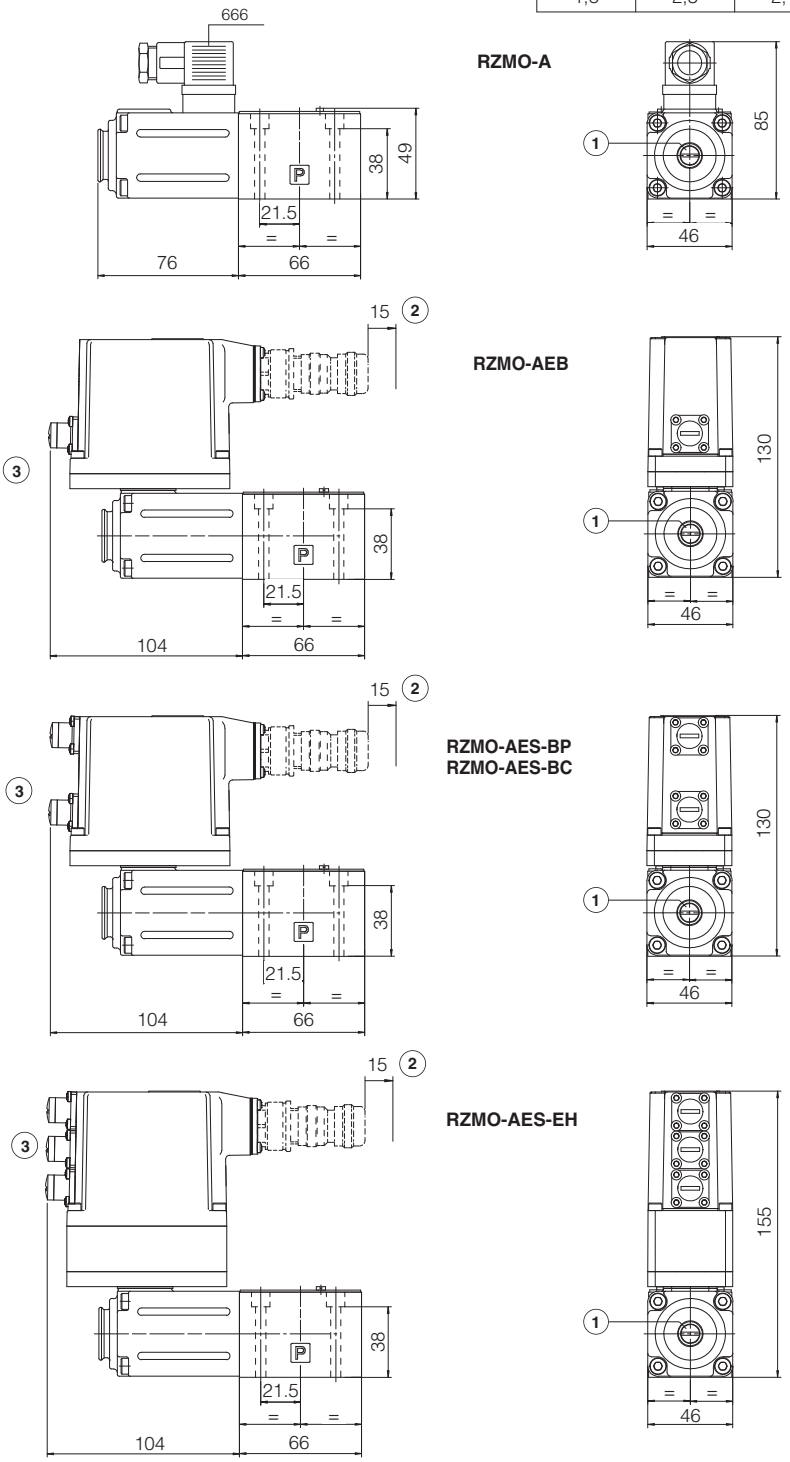
2 OR 108

Diameter of ports P, T: Ø 5 mm

20 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
1,8	2,3	2,4



(1) = Air bleeding, see section 15

(2) = Space to remove the connectors

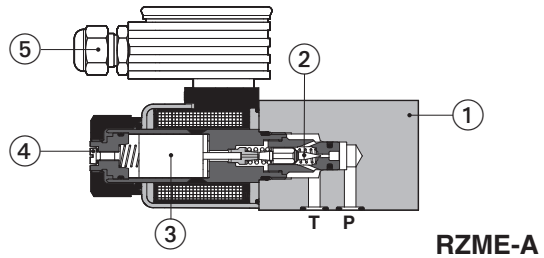
(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

21 RELATED DOCUMENTATION

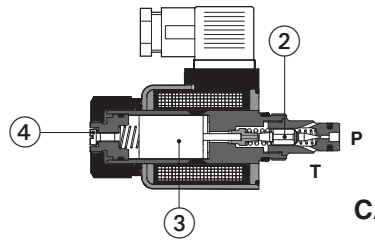
FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB200	Quickstart for AEB valves commissioning
QF200	Quickstart for AES valves commissioning

Proportional relief valves

direct, without transducer



RZME-A



CART RZME-A

① Valve body
② Poppet
③ Proportional solenoid
④ Screw for air bleeding
⑤ E-MI-AS-IR digital driver (to be ordered separately)

RZME-A, CART RZME-A

Poppet type, direct, proportional pressure relief valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

They are available in following executions:

RZME: subplate mounting, ISO size 06
CART RZME: M20 cartridge execution

The solenoids are certified according to North American standard **cURus**.

Size: **06** - ISO 4401 (RZME); **M20** (CART RZME)
Max flow: **4 l/min**
Max pressure: **350 bar**

For cavity CART RZME see section 16

1 MODEL CODE

RZME	-	A	-	010	/	315	-	*	/	*	*	/	*

RZME = Proportional pressure relief valve, direct
RZME = subplate mounting
CART RZME = cartridge execution

A = for off-board driver, see section 3

Configuration:
010 = reduced pressure on port A, discharge in T

Max regulated pressure:
32 = 32 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Coil with special connectors, see section 12 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

Coil voltage, see section 10 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers **(1)**

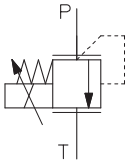
Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Select valve's coil voltage **/18** in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

2 HYDRAULIC SYMBOL

RZME-A
CART RZME-A



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F **(1)**		E-MI-AS-IR **(1)**		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

(1) For **CART RZME** the electronic driver may interfere with the manifold surface. Please check the installation dimensions at section 16

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Valve model	**RZME-A-010**
Max regulated pressure	50; 100; 210; 315; 350;
Min. regulated pressure [bar]	see min. pressure / flow diagrams at section 9
Max. pressure at port P [bar]	350
Max. pressure at port T [bar]	210
Max. flow [l/min]	4
Response time 0-100% step signal **(1)** [ms] (depending on installation)	≤ 70
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3
Repeatability [% of the max pressure]	≤ 2

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	**cURus** North American Standard		

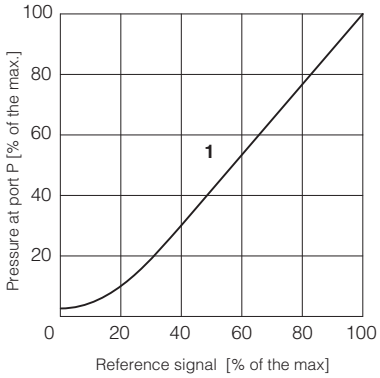
8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

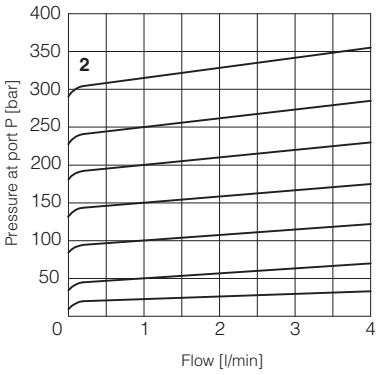
9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation

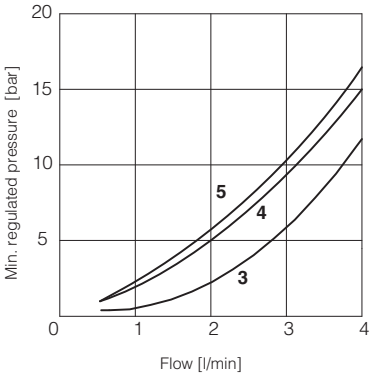


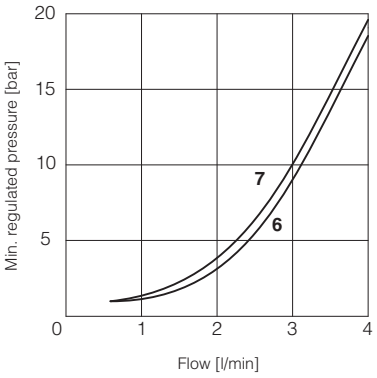
2 = Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-7 = Min. pressure/flow diagrams
with zero reference signal

3 = pressure range: 50
4 = pressure range: 100
5 = pressure range: 210
6 = pressure range: 315
7 = pressure range: 350





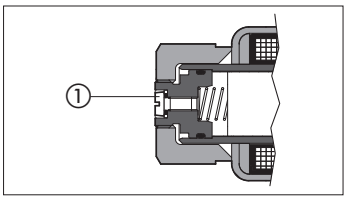
10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

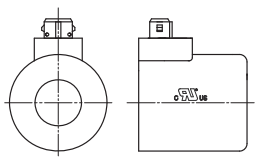
11 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

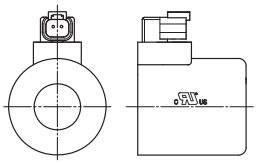


12 COILS WITH SPECIAL CONNECTORS

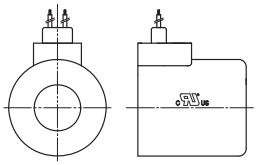
J option
Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



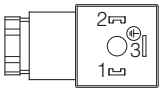
K option
Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67



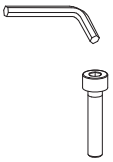
S option
Coil type COZES
Lead Wire connection
Cable lenght = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

14 FASTENING BOLTS AND SEALS FOR RZME



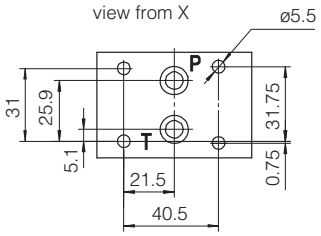
Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm

Seals:
2 OR 108
Diameter of ports P, T: Ø 5 mm

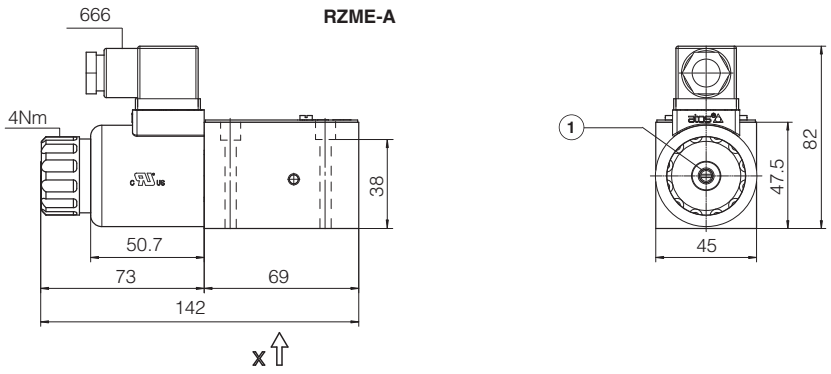
15 INSTALLATION DIMENSIONS FOR RZME [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

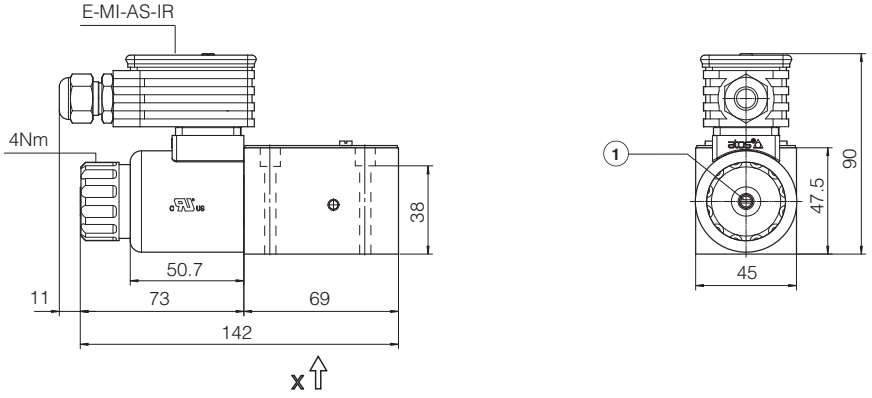
Mass [kg]	
RZME	1,5
RZME with E-MI-AS-IR	2,0



RZME-A



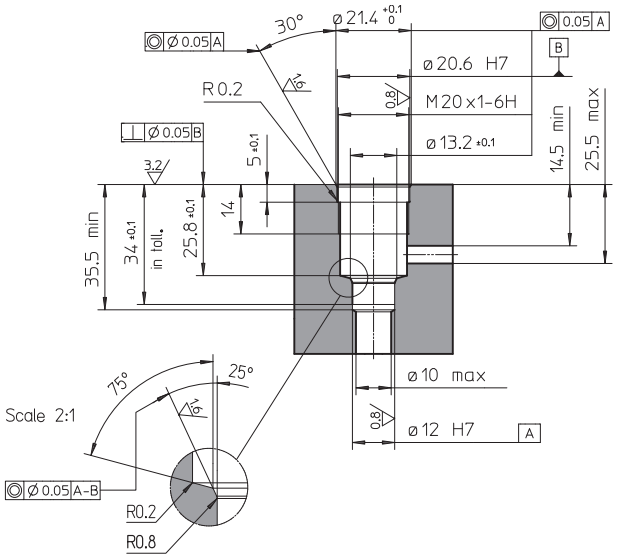
RZME-A
(with digital driver E-MI-AS-IR)



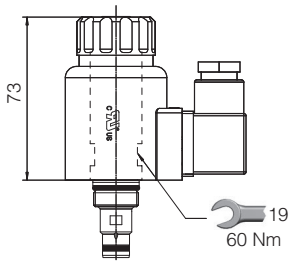
(1) = Air bleeding, see section 11

16 INSTALLATION DIMENSIONS FOR CART RZME [mm]

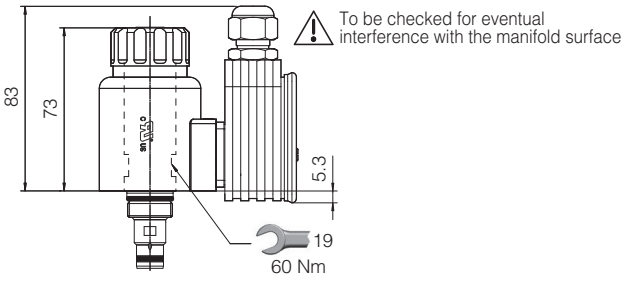
Cavity dimensions for **CART RZME-A**

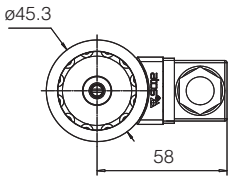


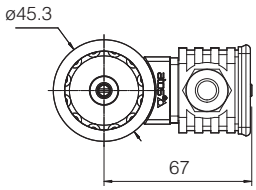
CART RZME-A



CART RZME-A
(with E-MI-AS-IR digital driver)







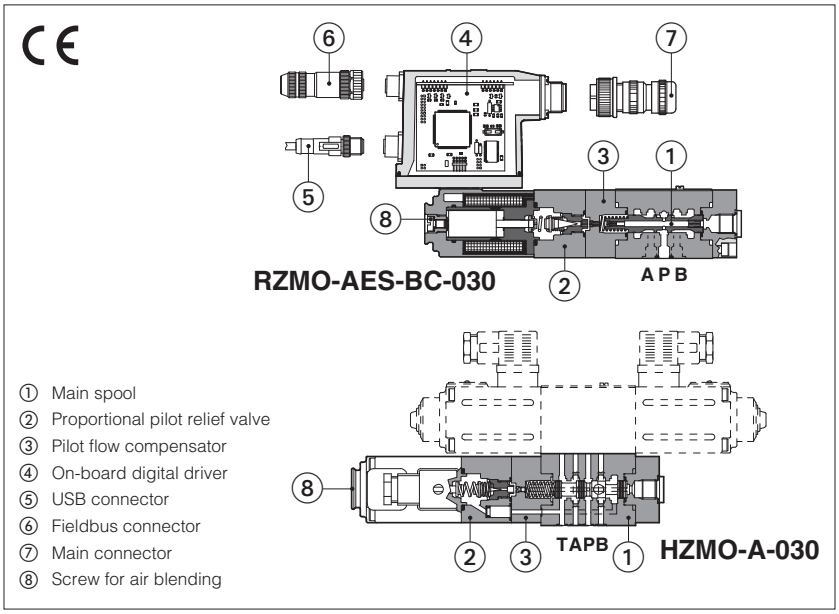
Mass [kg]	
CART RZME	0,6
CART RZME with E-MI-AS-IR	1,1

17 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS050**	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		

Digital proportional relief valves

piloted, without transducer, subplate or modular mounting



① Main spool
② Proportional pilot relief valve
③ Pilot flow compensator
④ On-board digital driver
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector
⑧ Screw for air blending

RZMO-A , RZMO-AEB, RZMO-AES
HZMO-A

Spool type piloted digital proportional reducing valves for pressure open loop controls, available in subplate or modular mounting.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **40 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO	- AEB	- NP	- 030	/ 210	/ *	/ *	* / *

RZMO: Proportional pressure relief valve, piloted
RZMO = subplate
HZMO = modular

A = for off-board driver, see section 3

Only for **RMZO**:
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Configuration:
030 = regulation on port P, discharge in T (pilot operated version)

Max regulated pressure:
50 = 50 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Electronic options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Coil voltage, only for **A** - see section 14:
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

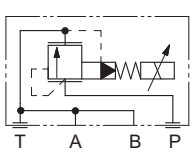
Series number

Seals material, see section 10:
- = NBR
PE = FKM
BT = HNBR

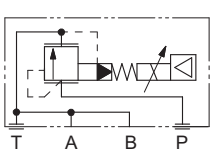
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

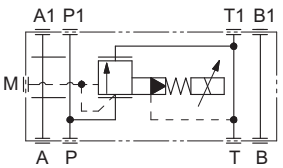
RZMO-A



RZMO-AEB RZMO-AES



HZMO-A



3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

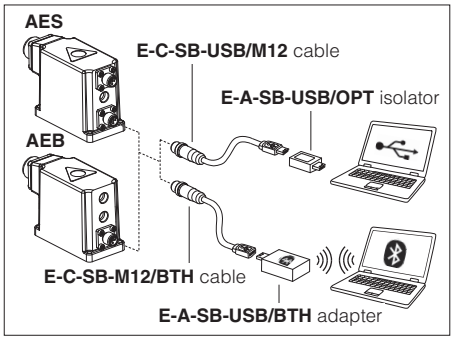
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZMO-*-030, HZMO-A-30**
Max regulated pressure	[bar]	50; 100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 11
Min ÷ Max flow	[l/min]	2,5 ÷ 40
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 60
Hysteresis		≤ 2 [% of max pressure]
Linearity		≤ 3 [% of max pressure]
Repeatability		≤ 2 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard		option /6	option /18
Max. solenoid current	2,6 A		3,25 A	1,5 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω		2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

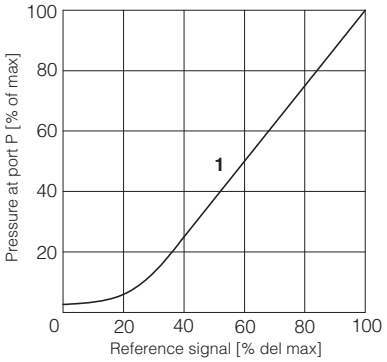
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

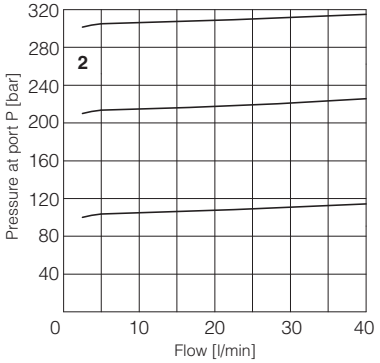
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

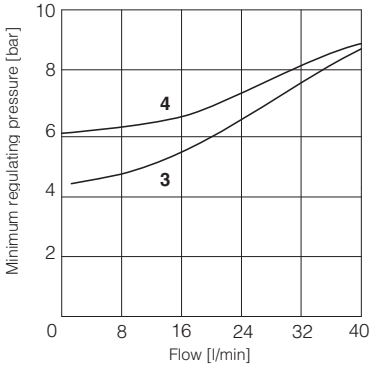
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = All the models (except /350)
4 = All the models (only /350)

Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

12 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

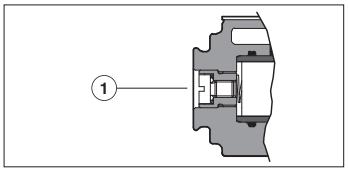
14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND V0		Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

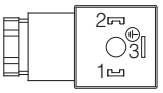
(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

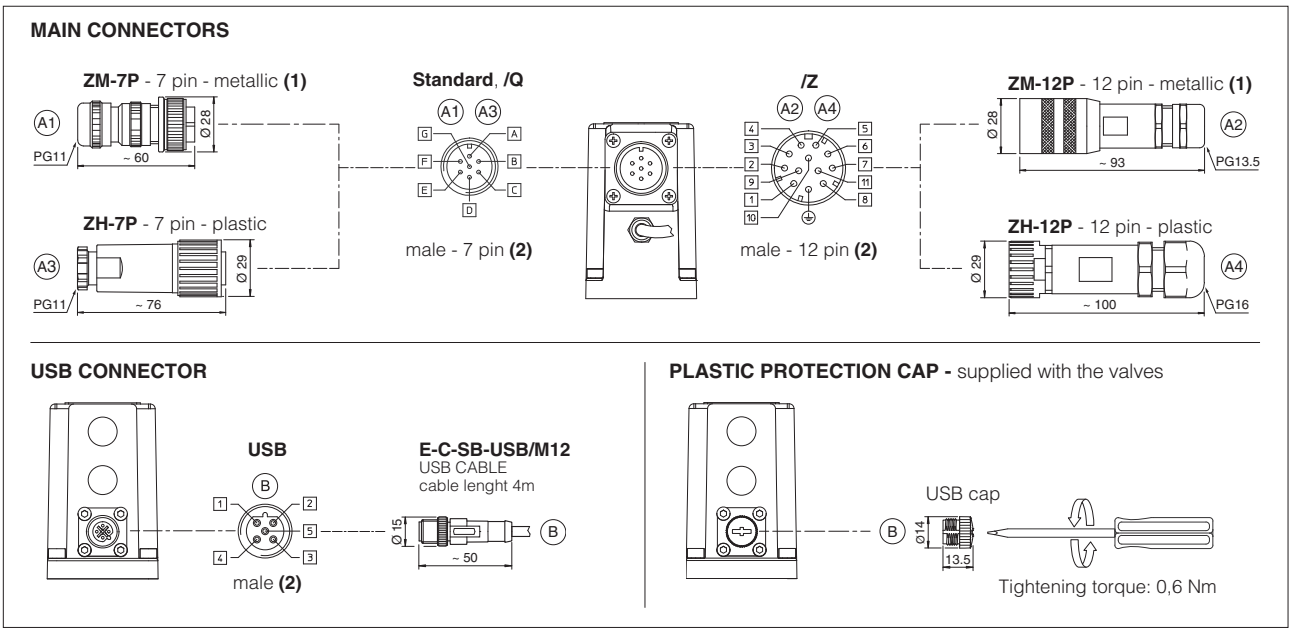
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

17.4 Solenoid connection - only for A

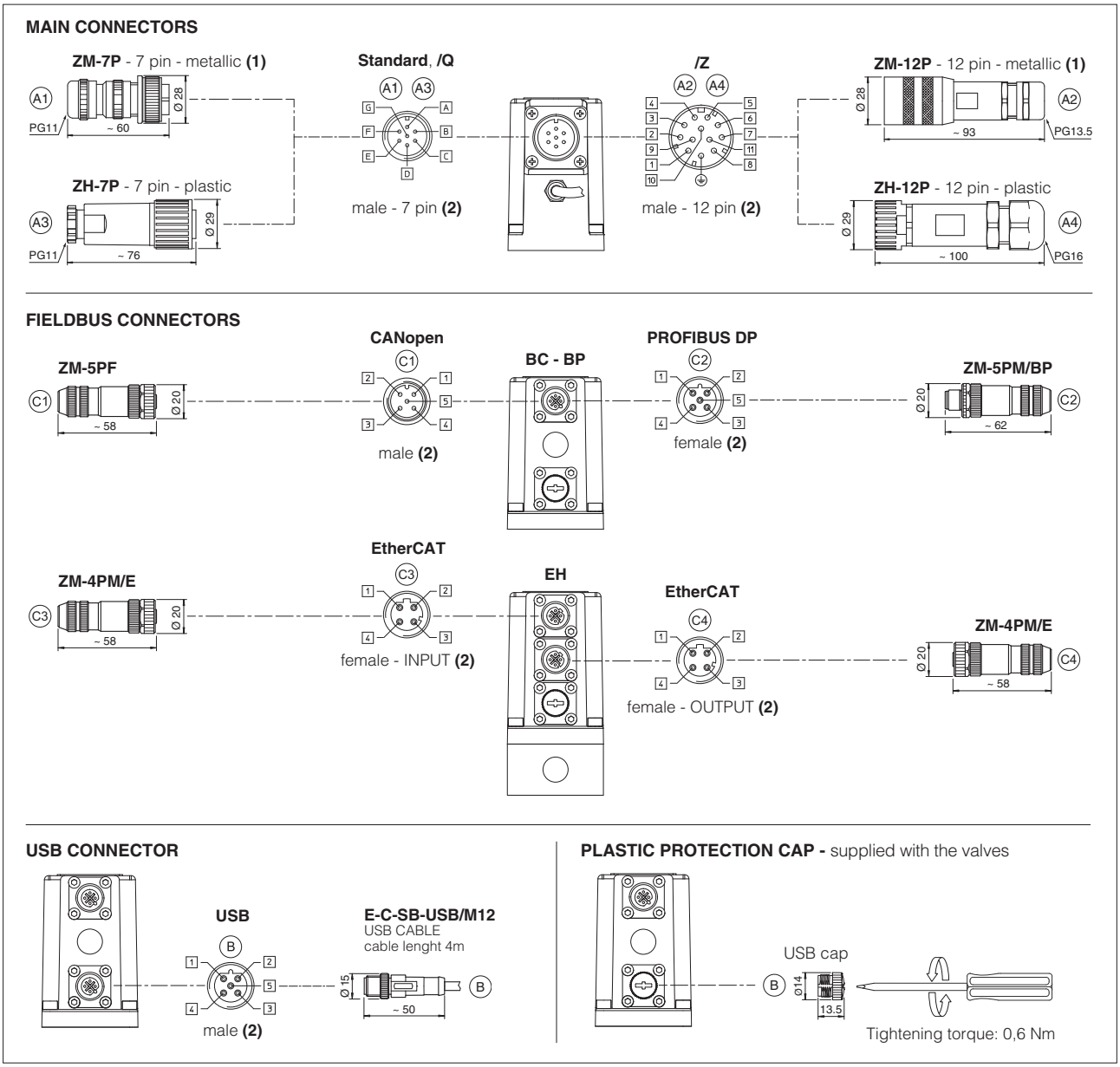
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

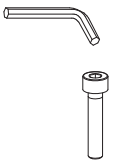
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	**QB200**	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	**QF200**	Quickstart for AES valves commissioning

20 FASTENING BOLTS AND SEALS

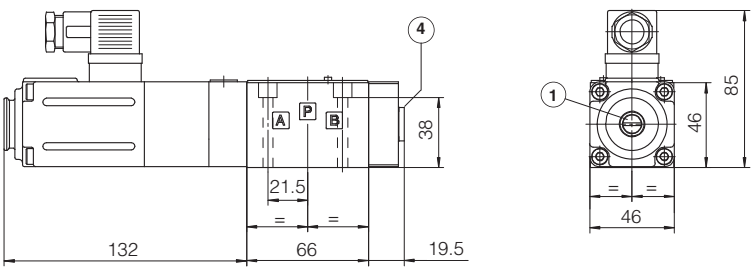
	RZMO	HZMO
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** Not available
	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm Ports A, B connected to port T	**Seals:** 4 OR 108 Diameter of ports P, T, A, B: Ø 6,5 mm

RZMO

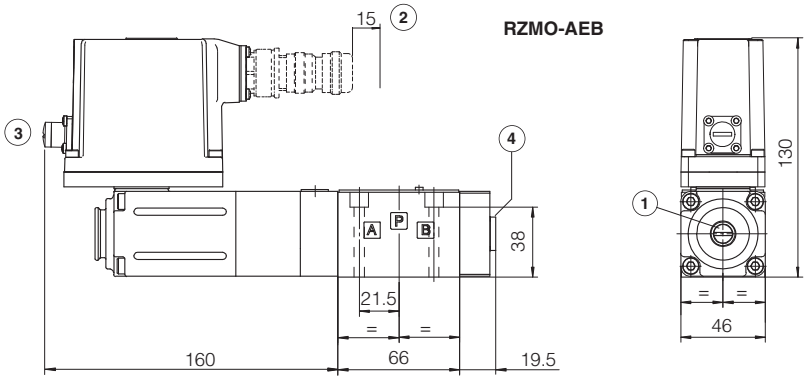
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
2,8	3,3	3,4

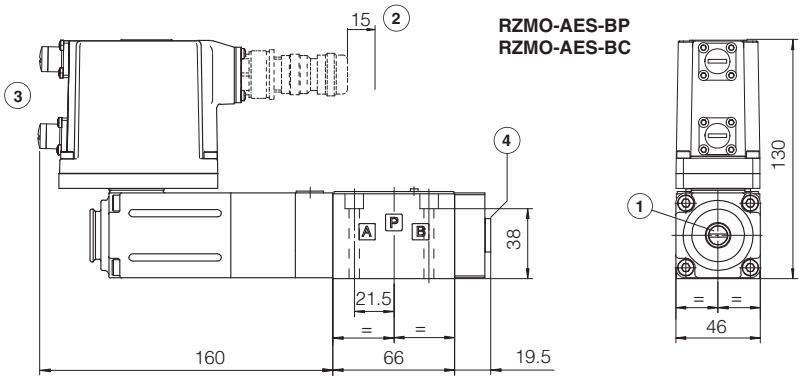
RZMO-A



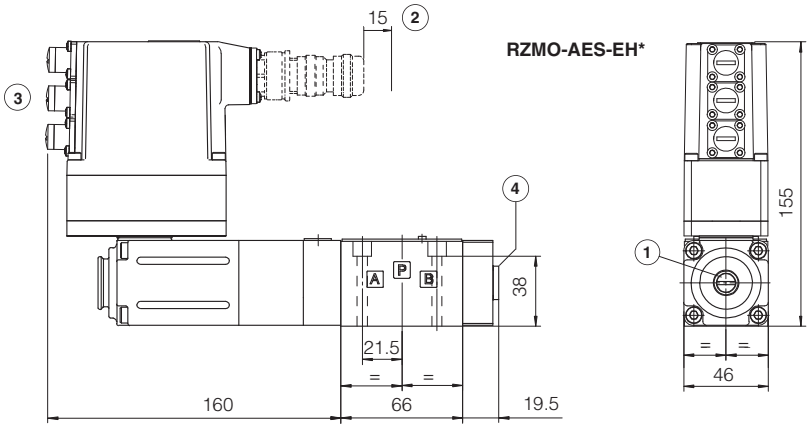
RZMO-AEB



RZMO-AES-BP
RZMO-AES-BC



RZMO-AES-EH*

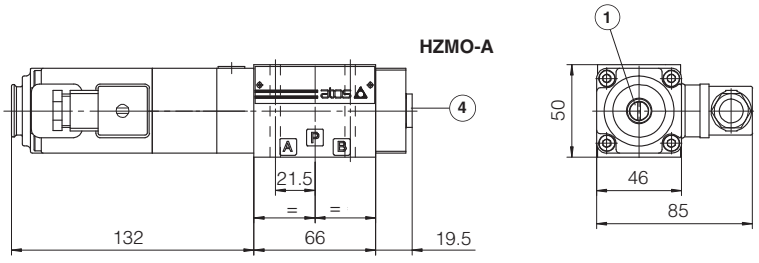


HZMO

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Mass [kg]
A
2,8

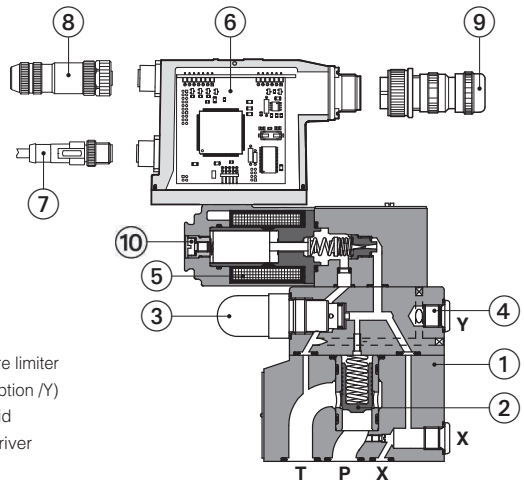
HZMO-A



(1) = Air bleeding, see section 15
(2) = Space to remove the connectors
(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6
(4) = Pressure gauge port = G1/4”

Digital proportional relief valves

piloted, without transducer



① Main valve body
② Main poppet
③ Mechanical pressure limiter
④ Drain port G1/4" (option /Y)
⑤ Proportional solenoid
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector
⑩ Screw for air bleeding

AGMZO-AES-BC-10

AGMZO-A,
AGMZO-AEB, AGMZO-AES

Poppet type, piloted, digital proportional relief valves for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10**, **20**, **32** - ISO 6264
Max flow: **200**, **400**, **600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGMZO	- AES	- BC	- 10	/ 315	/ *	/ *	* /	*

AGMZO: Proportional pressure relief valve, piloted

AES:
A = for off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

BC:
Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

10:
Valve size ISO 6264: **10, 20, 32**

315:
Max regulated pressure:
50 = 50 bar **100** = 100 bar **210** = 210 bar **315** = 315 bar **350** = 350 bar

*****:
Hydraulic options (4):
E = external pilot
Y = external drain (only pipe connection G ¼")
Electronics options, only for **AEB** and **AES (4)**:
I = current reference input 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

*****:
Coil voltage, only for **A** - see section 14 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers

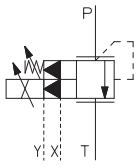
*****:
Series number

*****:
Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

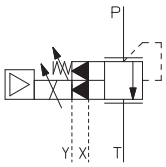
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS

AGMZO-A



AGMZO-AEB AGMZO-AES



3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

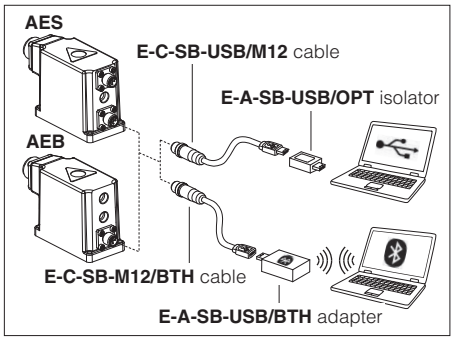
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**AGMZO-*-10**	**AGMZO-*-20**	**AGMZO-*-32**
Max regulated pressure	[bar]	50; 100; 210; 315; 350		
Max pressure at port P	[bar]	350		
Max pressure at port T	[bar]	210		
Min regulated pressure	[bar]	see min. pressure / flow diagrams at section 11		
Max flow	[l/min]	200	400	600
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 120	≤ 135	≤ 150
Hysteresis		≤ 0,5 [% of max pressure]		
Linearity		≤ 1,0 [% of max pressure]		
Repeatability		≤ 0,2 [% of max pressure]		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard		option /6	option /18
Max. solenoid current	2,6 A		3,25 A	1,5 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω		2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

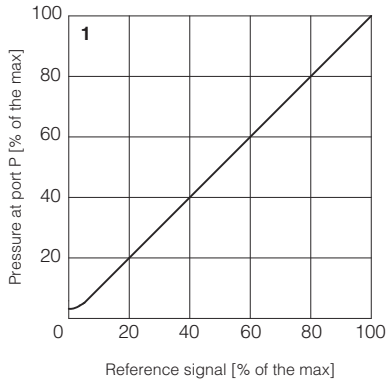
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

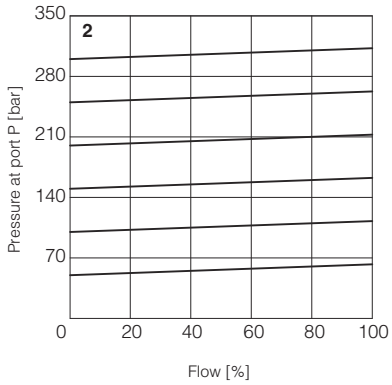
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

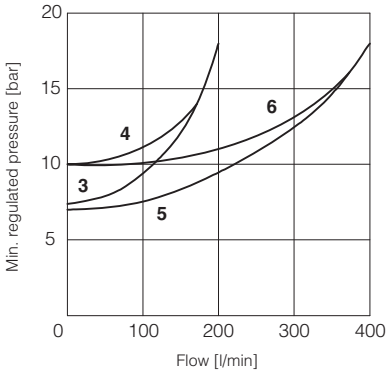


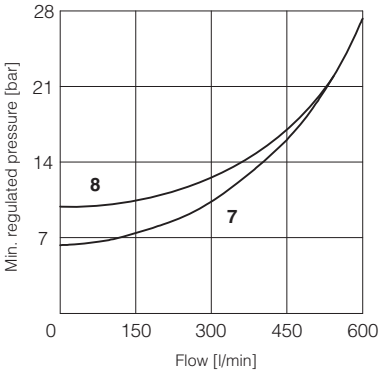
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



3-8 = Min. pressure/flow diagrams
with zero reference signal

3 = AGMZO-*-10/50, 100, 210, 315
4 = AGMZO-*-10/350
5 = AGMZO-*-20/50, 100, 210, 315
6 = AGMZO-*-20/350
7 = AGMZO-*-32/50, 100, 210, 315
8 = AGMZO-*-32/350

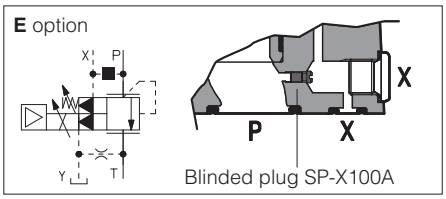


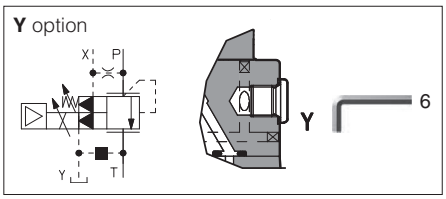


12 HYDRAULIC OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").

Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.





13 ELECTRONICS OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 18.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 18.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 18.2

14 POSSIBLE COMBINED OPTIONS

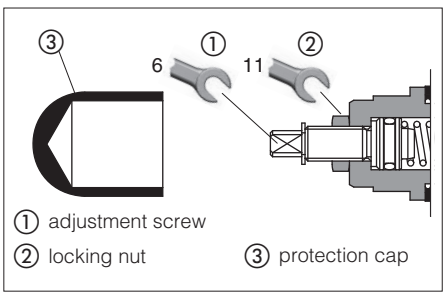
Hydraulic options: all combination possible

Electronics options: /IQ, /IZ

15 MECHANICAL PRESSURE LIMITER

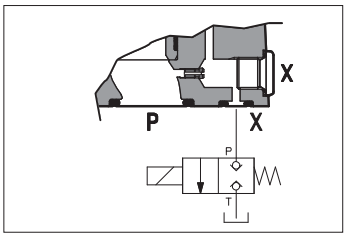
The AGMZO are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



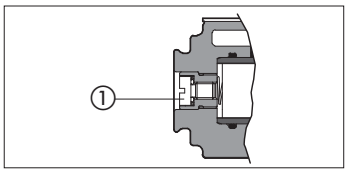
16 REMOTE PRESSURE UNLOADING

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).
This function can be used in emergency to unload the system pressure by-passing the proportional control.



17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

19 ELECTRONIC CONNECTIONS

19.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND V0		Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

19.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

19.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

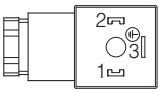
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

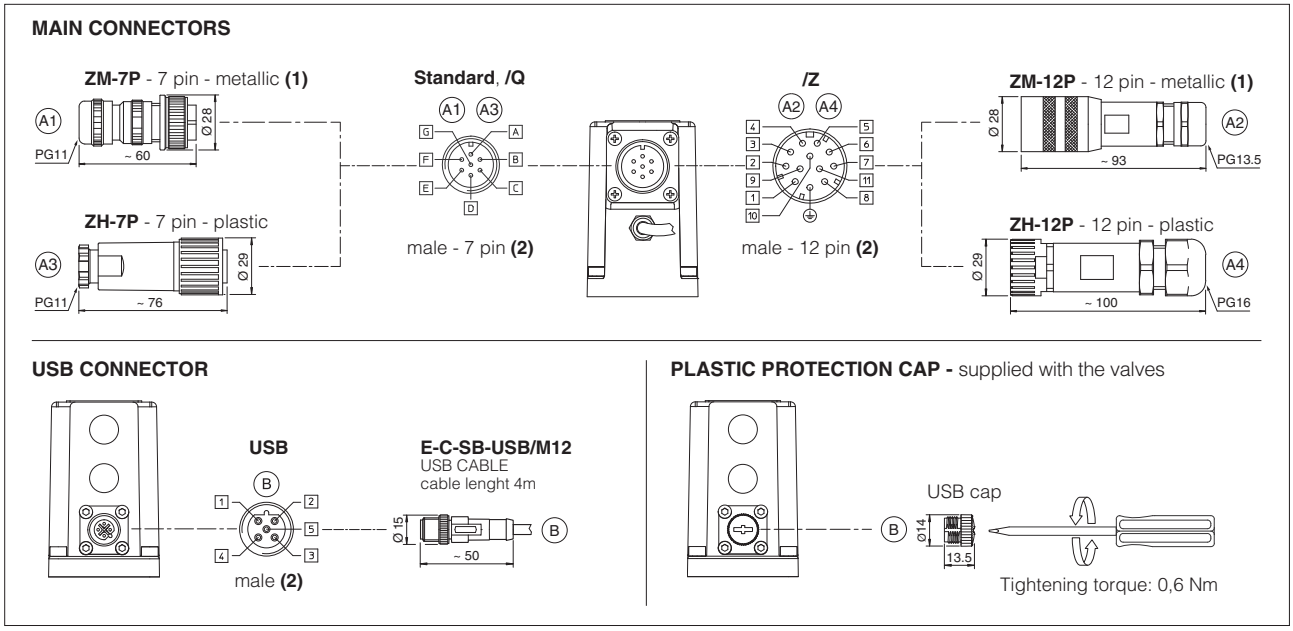
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

19.4 Solenoid connection - only for A

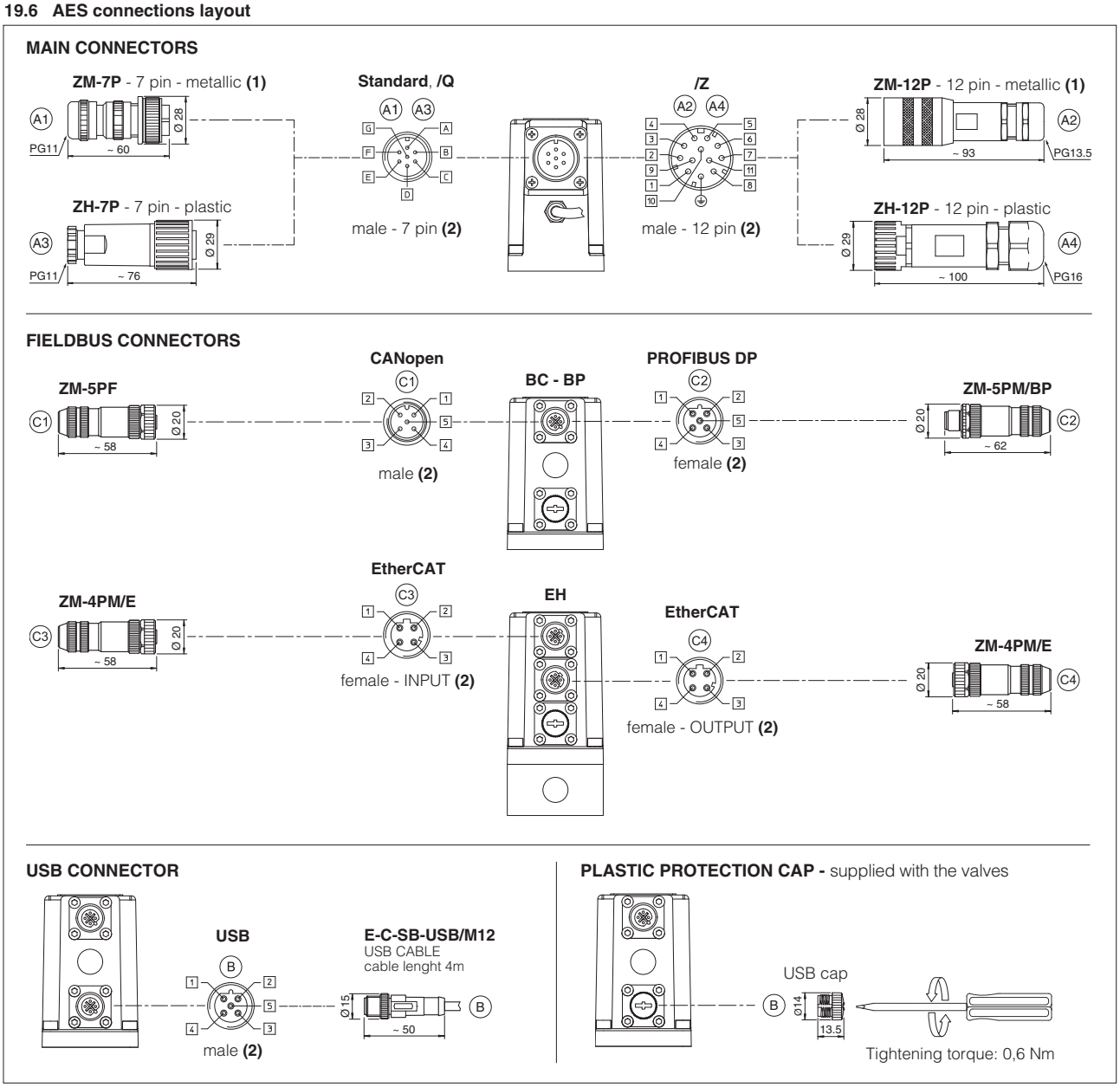
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

19.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

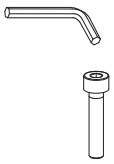
20.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

21 FASTENING BOLTS AND SEALS

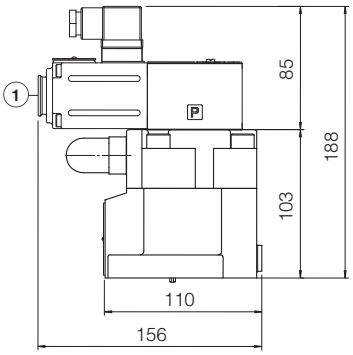
	AGMZO-*-10	**AGMZO-*-20**	**AGMZO-*-32**
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**Seals:** 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

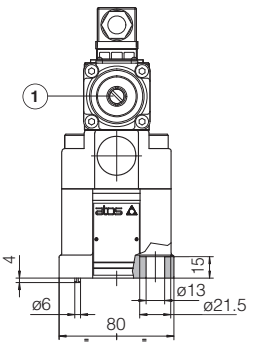
SIZE 10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

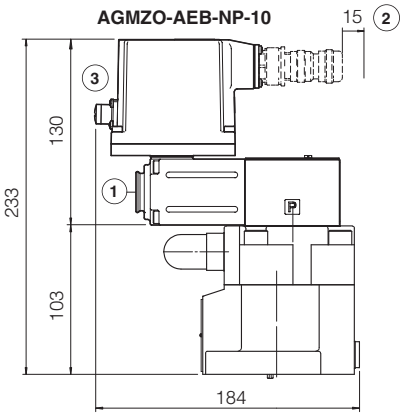
	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGMZO-*-10	5,4	5,9	6,0

AGMZO-A-10

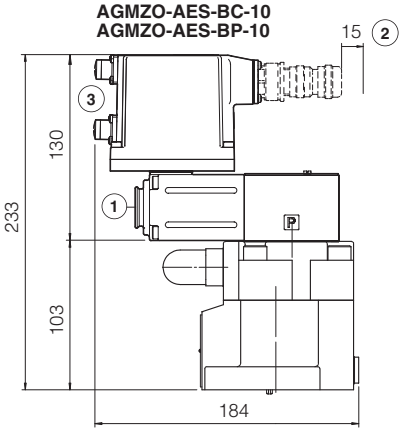




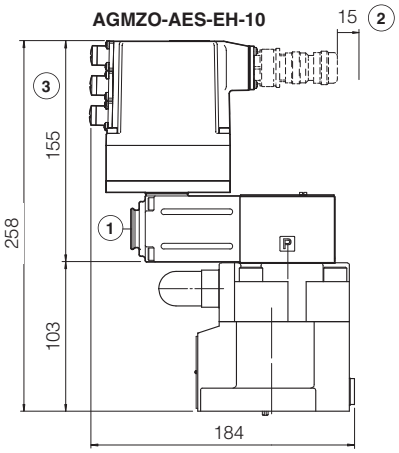
AGMZO-AEB-NP-10



AGMZO-AES-BC-10
AGMZO-AES-BP-10



AGMZO-AES-EH-10

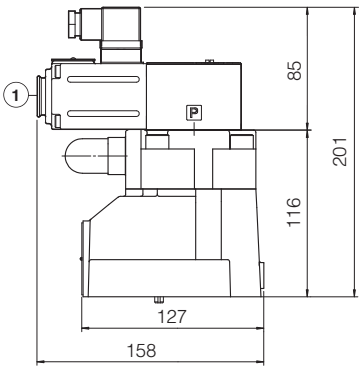


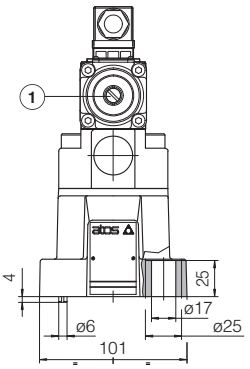
SIZE 20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

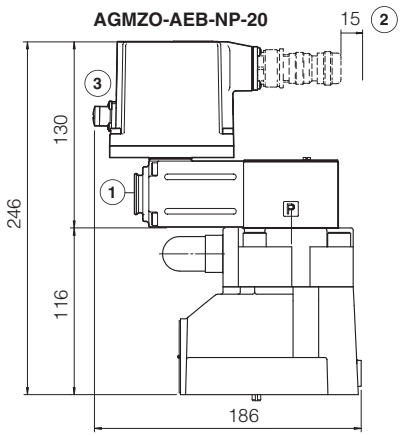
	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGMZO-*-20	6,6	7,1	7,2

AGMZO-A-20

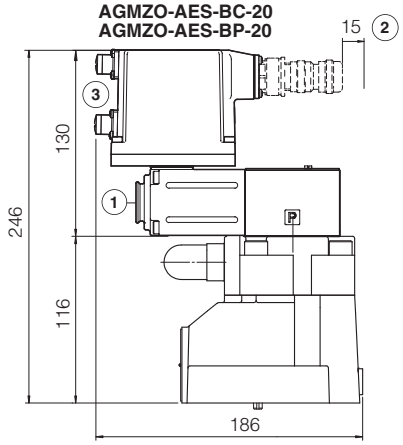




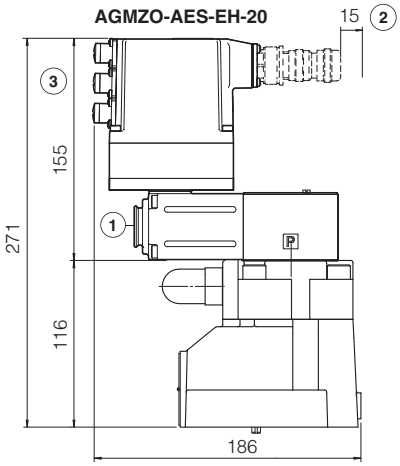
AGMZO-AEB-NP-20



AGMZO-AES-BC-20
AGMZO-AES-BP-20



AGMZO-AES-EH-20



(1) = Air bleeding, see section 17

(2) = Space to remove the connectors

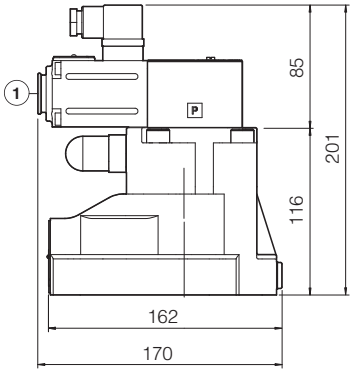
(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

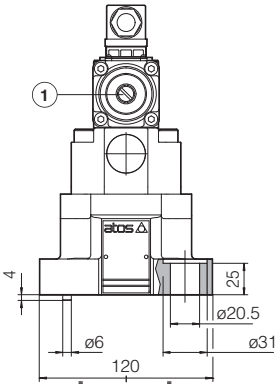
SIZE 32

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)
(with M20 fixing holes instead of standard M18)

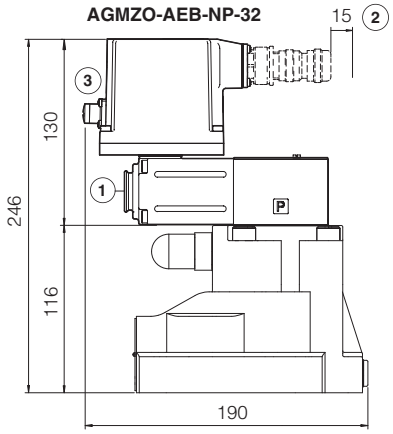
	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGMZO-*-32	8,0	8,5	8,6

AGMZO-A-32

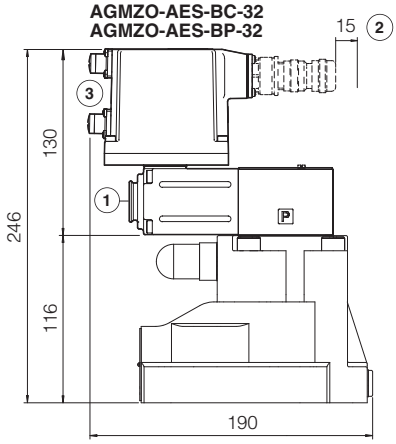




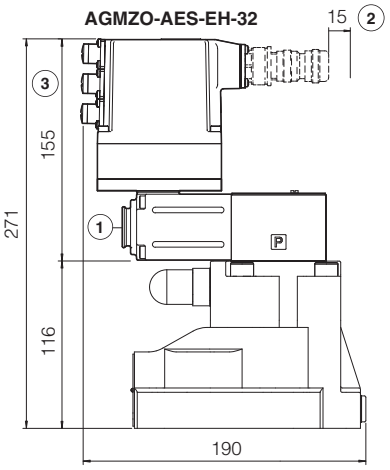
AGMZO-AEB-NP-32



AGMZO-AES-BC-32
AGMZO-AES-BP-32



AGMZO-AES-EH-32



(1) = Air bleeding, see section 17

(2) = Space to remove the connectors

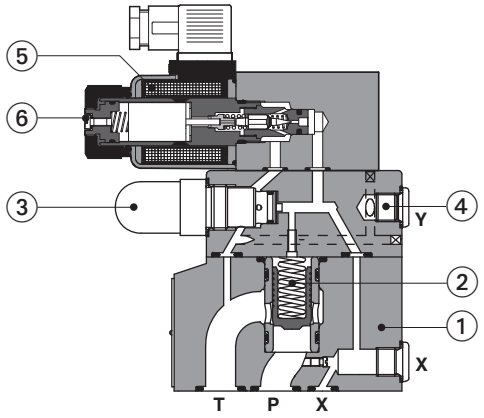
(3) = The dimensions of all connectors must be considered, see section 19.5 and 19.6

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	**QB200**	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	**QF200**	Quickstart for AES valves commissioning

Proportional relief valves

piloted, without transducer



① Valve main body
② Main poppet
③ Mechanical pressure limiter
④ Drain port G 1/4" (option /Y)
⑤ Proportional solenoid
⑥ Screw for air bleeding

AGMZE-A-10

AGMZE-A

Poppet type, piloted, proportional pressure relief valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

The solenoids are certified according to North American standard **cURus**.

Size: **10**, **20**, **32** - ISO 6264
Max flow: **200**, **400**, **600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGMZE	-	A	-	10	/	315	/	*	-	*	/	*	*	/	*

AGMZE: Proportional pressure relief valve, piloted

A = for off-board driver, see section 3

Valve size ISO 6264: **10, 20, 32**

Max regulated pressure:
50 = 50 bar **210** = 210 bar **350** = 350 bar
100 = 100 bar **315** = 315 bar

Hydraulic options (1):
E = external pilot
Y = external drain (only pipe connection G 1/4")

Coil with special connectors, see section 16 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

Coil voltage, see section 12 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers **(2)**

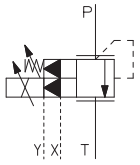
Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /EY
(2) Select valve's coil voltage **/18** in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

2 HYDRAULIC SYMBOL

AGMZE-A



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position		
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100		
MTTFd valves according to EN ISO 13849	75 years, see technical table P007		
Ambient temperature range	**Standard** = -20°C ÷ +70°C	**/PE** option = -20°C ÷ +70°C	**/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C	**/PE** option = -20°C ÷ +80°C	**/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

6 HYDRAULIC CHARACTERISTICS

Valve model		**AGMZE-A-10**	**AGMZE-A-20**	**AGMZE-A-32**
Max regulated pressure	[bar]	50; 100; 210; 315; 350		
Max pressure at port P	[bar]	350		
Max pressure at port T	[bar]	210		
Min regulated pressure	[bar]	see min. pressure / flow diagrams at section 11		
Max flow	[l/min]	200	400	600
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 120	≤ 135	≤ 150
Hysteresis		≤ 0,5 [% of max pressure]		
Linearity		≤ 1,0 [% of max pressure]		
Repeatability		≤ 0,2 [% of max pressure]		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

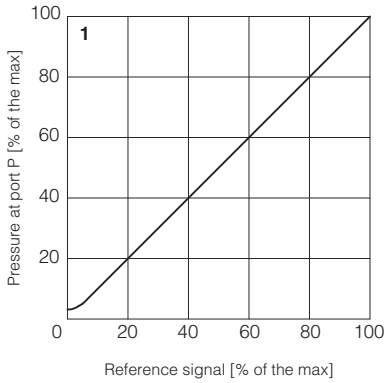
Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	**cURus** North American Standard		

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

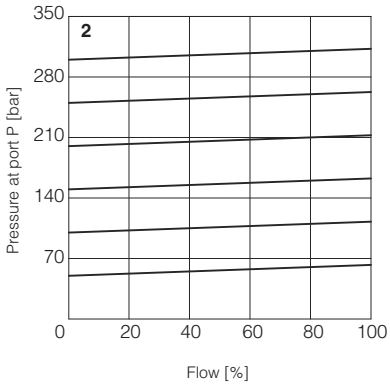
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

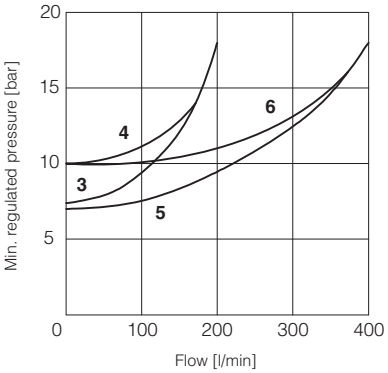


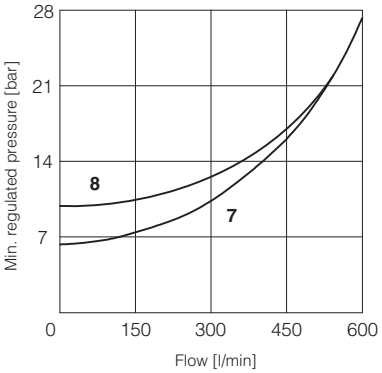
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



3-8 = Min. pressure/flow diagrams
with zero reference signal

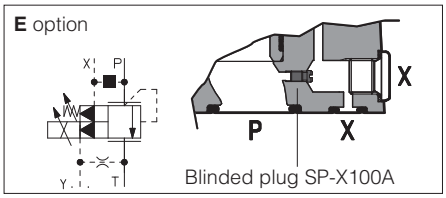
3 = AGMZE-A-10/50, 100, 210, 315
4 = AGMZE-A-10/350
5 = AGMZE-A-20/50, 100, 210, 315
6 = AGMZE-A-20/350
7 = AGMZE-A-32/50, 100, 210, 315
8 = AGMZE-A-32/350



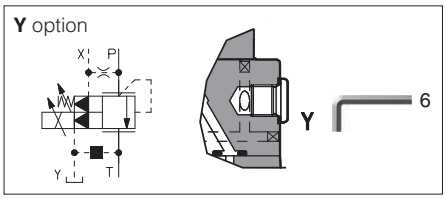


10 HYDRAULIC OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").



Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.



11 POSSIBLE COMBINED OPTIONS

/EY

12 COIL VOLTAGE OPTIONS

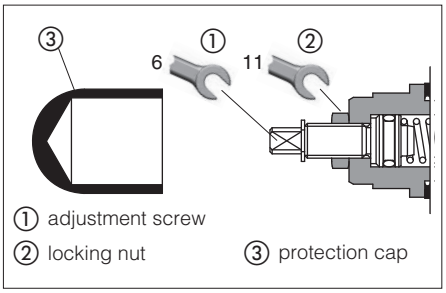
6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

13 MECHANICAL PRESSURE LIMITER

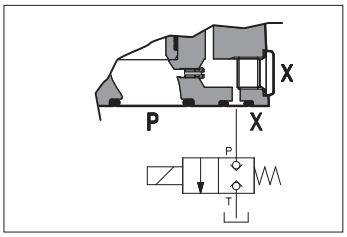
The AGMZE are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



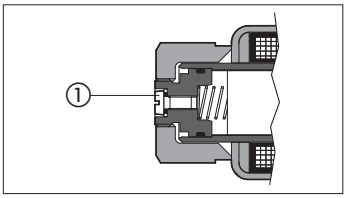
14 REMOTE PRESSURE UNLOADING

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).
This function can be used in emergency to unload the system pressure by-passing the proportional control.



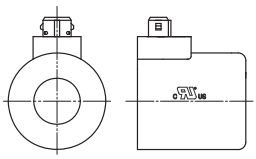
15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

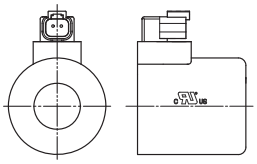


16 COILS WITH SPECIAL CONNECTORS

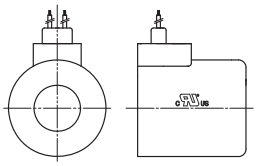
J option
Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



K option
Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67



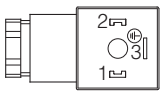
S option
Coil type COZES
Lead Wire connection
Cable lenght = 180 mm



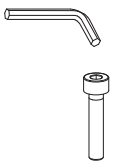
17 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION
1	**COIL**	Power supply
2	**COIL**	Power supply
3	**GND**	Ground

Connector code 666



18 FASTENING BOLTS AND SEALS

	AGMZE-A-10	AGMZE-A-20	AGMZE-A-32
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**Seals:** 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

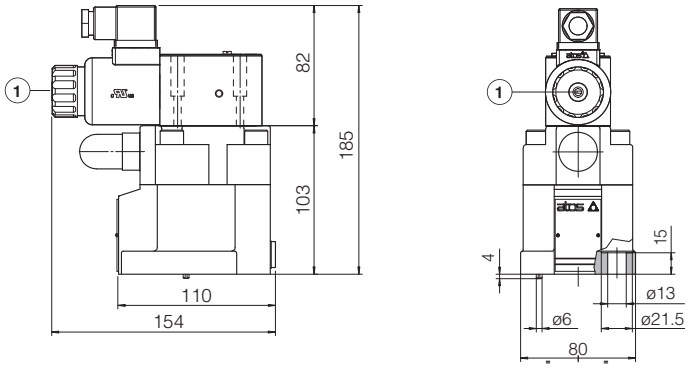
19 INSTALLATION DIMENSIONS [mm]

SIZE 10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

Mass [kg]	
AGMZE-A-10	5,4

AGMZE-A-10

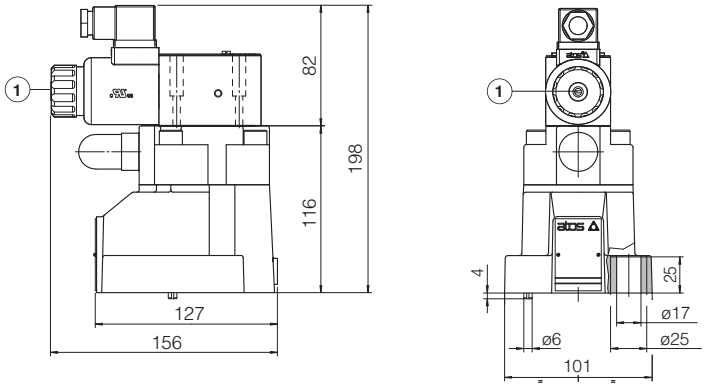


SIZE 20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

Mass [kg]	
AGMZE-A-20	6,6

AGMZE-A-20

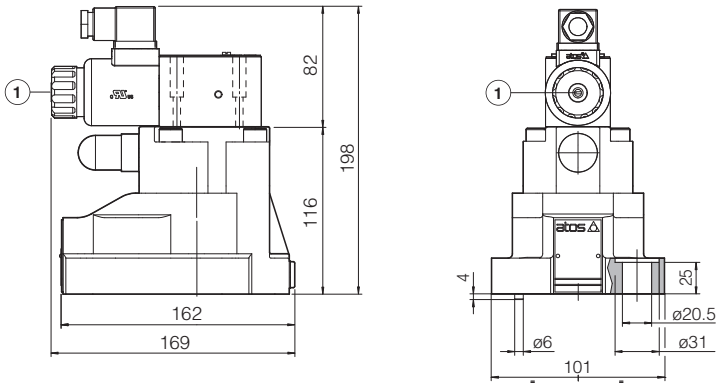


SIZE 32

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)
(with M20 fixing holes instead of standard M18)

Mass [kg]	
AGMZE-A-32	8

AGMZE-A-32



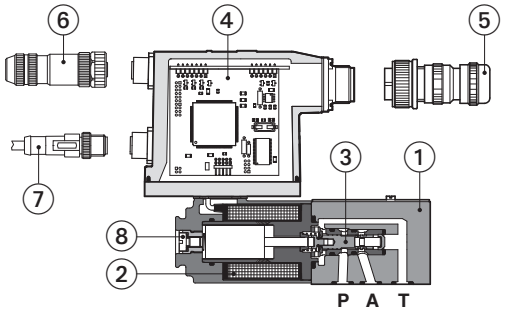
(1) = Air bleeding, see section 15

20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Digital proportional reducing valves

direct, without transducer



RZGO-AES-BC-010

① Valve body
② Proportional solenoid
③ Spool
④ On-board digital driver
⑤ Main connector
⑥ Fieldbus connector
⑦ USB connector
⑧ Screw for air blending

RZGO-A , RZGO-AEB, RZGO-AES

Spool type, direct. digital proportional reducing valves for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **12 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZGO	-	AEB	-	NP	-	010	/	210	/	*	/	*	*	/	*

RZGO: Proportional pressure reducing valve, direct

AEB: **A** = for off-board driver, see section 3; **AEB** = basic on-board digital driver **(1)**; **AES** = full on-board digital driver **(2)**

NP: **Fieldbus interfaces,** USB port always present **(3)**: **NP** = Not present; **BP** = PROFIBUS DP; **BC** = CANopen; **EH** = EtherCAT

010: **Configuration:** **010** = regulation on port A, discharge in T (direct operated version)

210: **Max regulated pressure:** **32** = 32 bar; **100** = 100 bar; **210**= 210 bar

*****: **Electronic options,** only for **AEB** and **AES (4)**: **I** = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC); **Q** = enable signal; **Z** = double power supply, enable, fault and monitor signals -12 pin connector

*****: **Coil voltage,** only for **A** - see section 14: **-** = standard coil for 24VDC Atos drivers; **6** = optional coil for 12VDC Atos drivers; **18** = optional coil for low current drivers

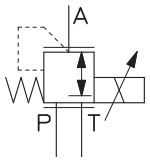
*****: Series number

*****: **Seals material,** see section 10: **-** = NBR; **PE** = FKM; **BT** = HNBR

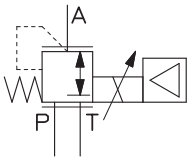
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZGO-A



RZGO-AEB RZGO-AES



3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

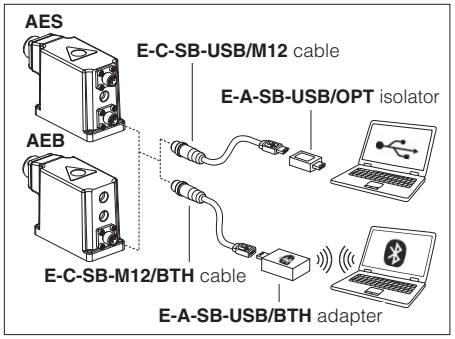
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZGO-*-010**
Max regulated pressure	[bar]	32; 100; 210
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure **(1)**	[bar]	0,8
Max flow	[l/min]	12
Response time 0-100% step signal (depending on installation) **(2)**	[ms]	≤ 45
Hysteresis		≤ 1,5 [% of max pressure]
Linearity		≤ 3,0 [% of max pressure]
Repeatability		≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,4 A 1,8 A for /32 - max pressure 32 bar	3 A 2,25 A for /32 - max pressure 32 bar	1 A 0,8 A for /32 - max pressure 32 bar	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

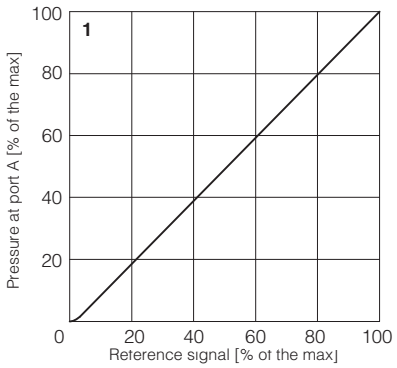
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

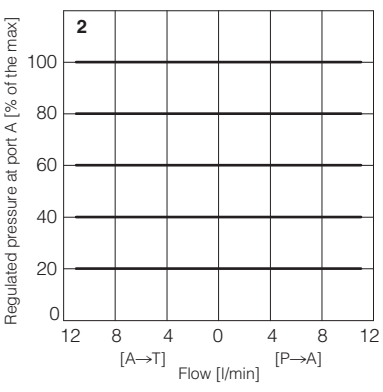
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

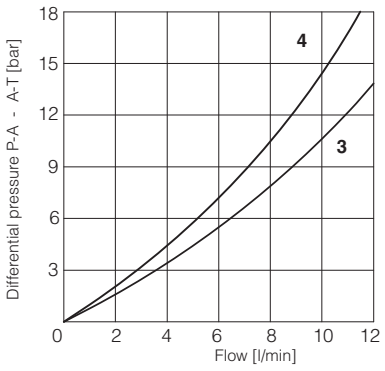
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = Pressure drops vs. flow P→A
4 = Pressure drops vs. flow A→T

12 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

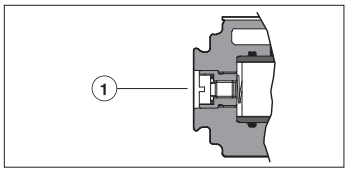
14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND | V0		Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

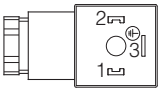
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

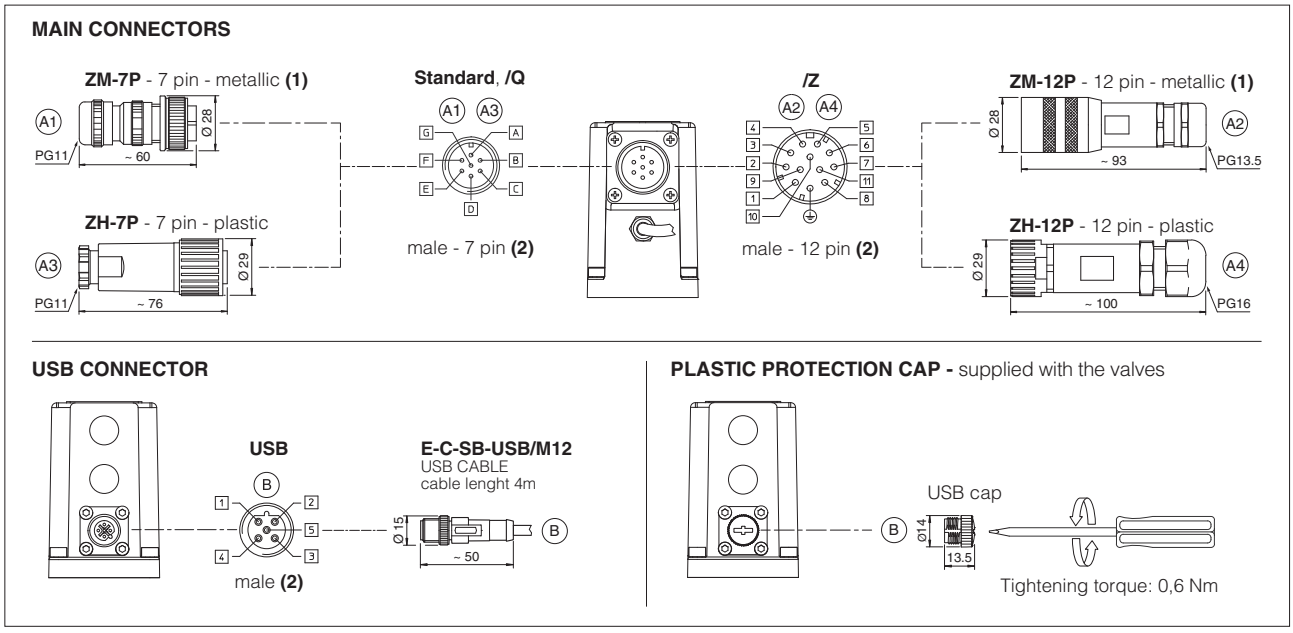
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

17.4 Solenoid connection - only for A

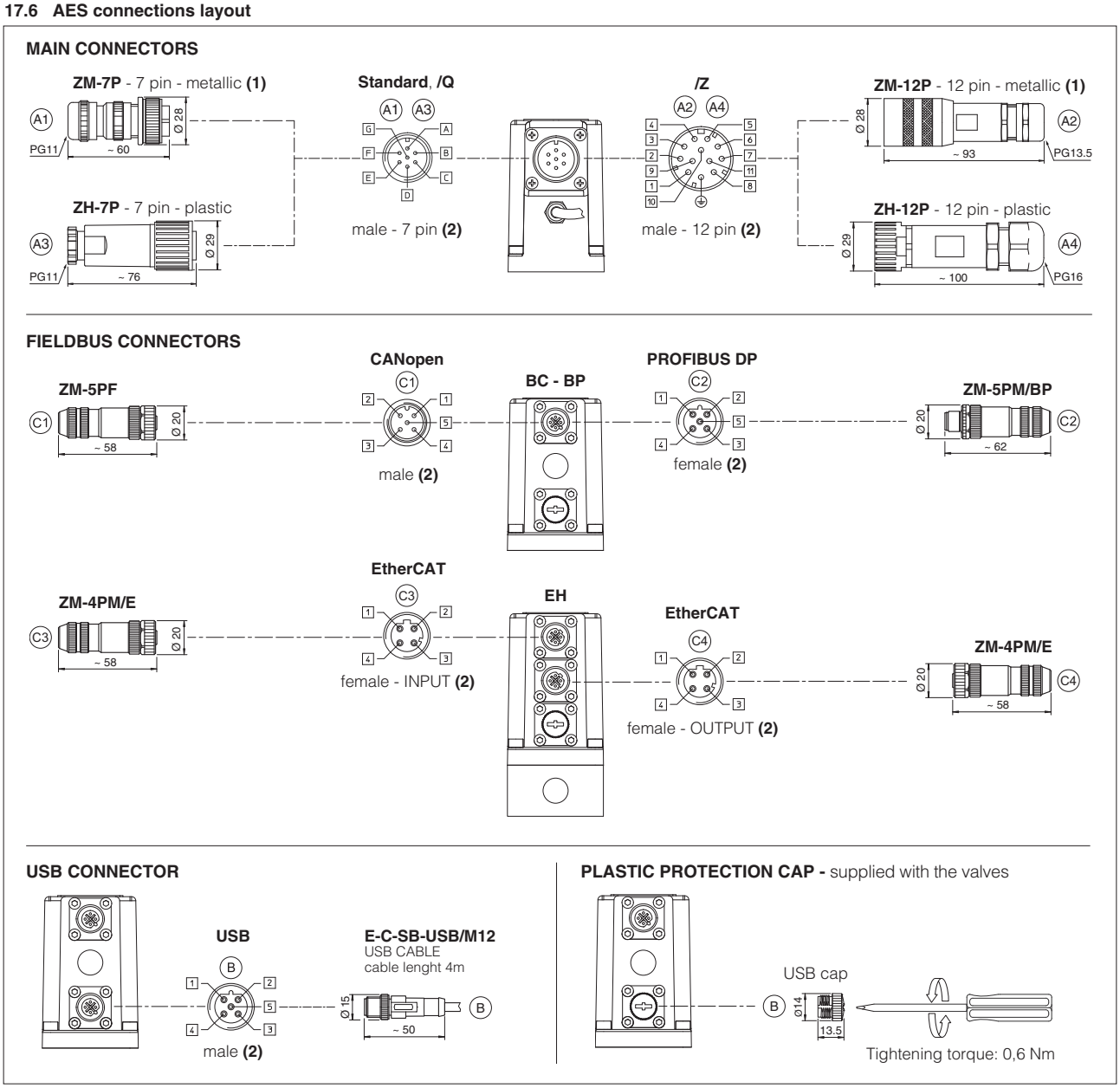
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

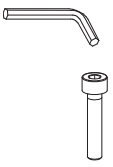
18.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 FASTENING BOLTS AND SEALS



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals:

4 OR 108

Diameter of ports P, A, T: Ø 5 mm

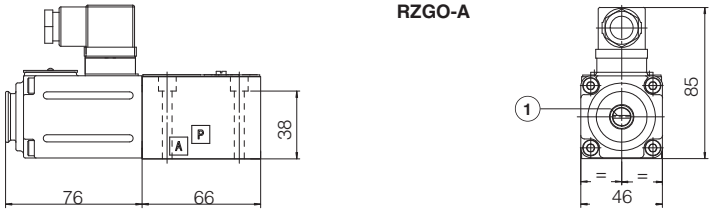
Port B not used

20 INSTALLATION DIMENSIONS [mm]

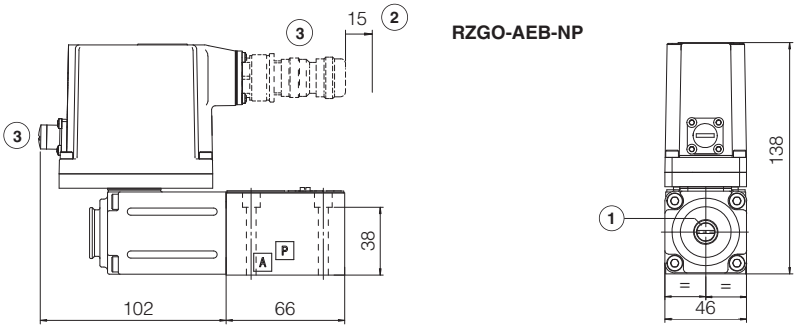
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
1,8	2,3	2,4

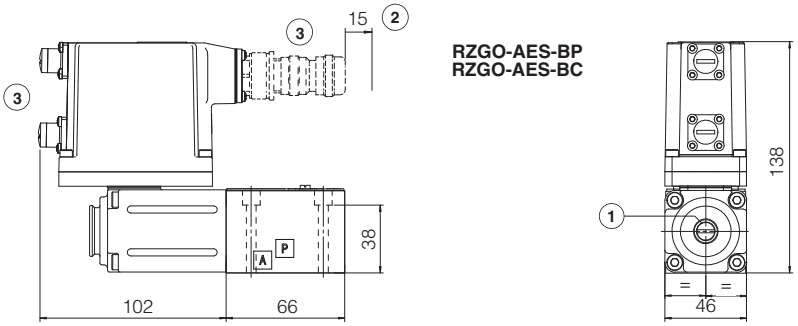
RZGO-A



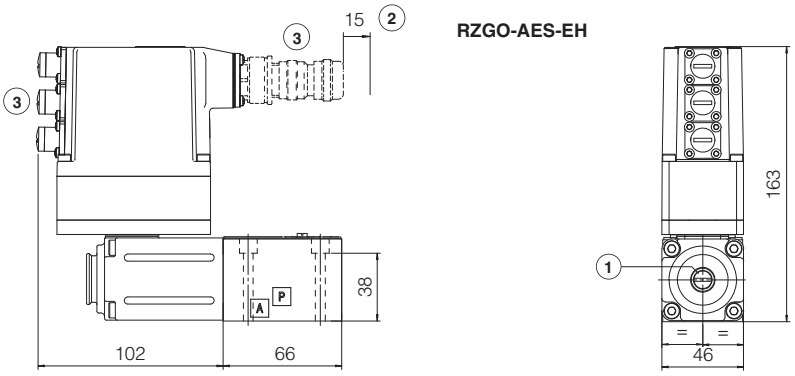
RZGO-AEB-NP



RZGO-AES-BP
RZGO-AES-BC



RZGO-AES-EH



(1) = Air bleeding, see section 15

(2) = Space to remove the connectors

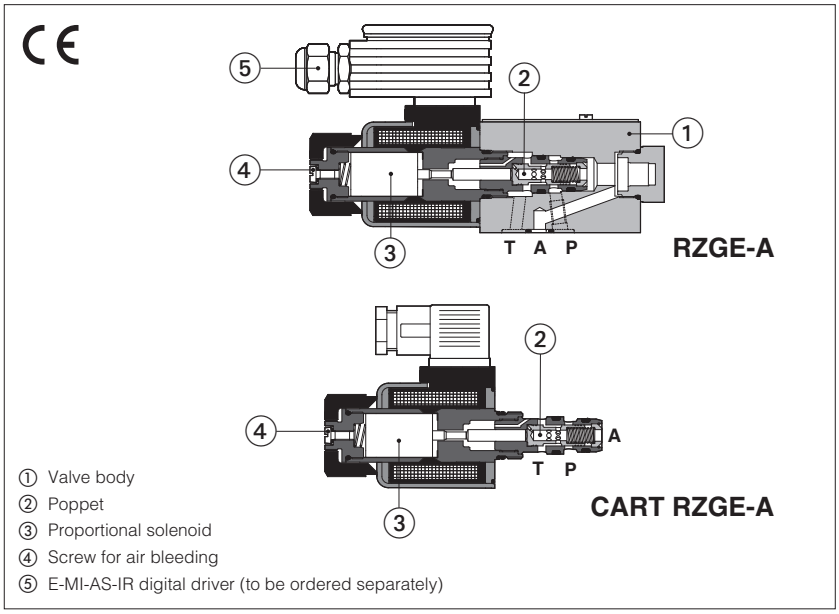
(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

21 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB200	Quickstart for AEB valves commissioning
QF200	Quickstart for AES valves commissioning

Proportional reducing valves

direct, without transducer



① Valve body
② Poppet
③ Proportional solenoid
④ Screw for air bleeding
⑤ E-MI-AS-IR digital driver (to be ordered separately)

RZGE-A, CART RZGE-A

Poppet type, direct, proportional pressure reducing valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

They are available in following executions:

RZGE: subplate mounting, ISO size 06
CART RZGE: M20 cartridge execution

The solenoids are certified according to North American standard **cURus**.

Size: **06** - ISO 4401 (RZGE); **M20** (CART RZGE)
Max flow: **12 l/min**
Max pressure: **350 bar**

For cavity CART RZGE see section 16

1 MODEL CODE

RZGE	-	A	-	010	/	210	-	*	/	*	*	/	*

RZGE
Proportional pressure reducing valve, direct
RZGE = subplate mounting
CART RZGE = cartridge execution

A = for off-board driver, see section 3

Configuration:
010 = reduced pressure on port A

Max regulated pressure:
32 = 32 bar
100 = 100 bar
210 = 210 bar

Coil with special connectors, see section 12 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

Coil voltage, see section 10 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers **(1)**

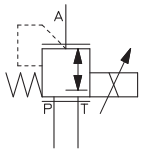
Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Select valve's coil voltage **/18** in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

2 HYDRAULIC SYMBOL

RZGE-A
CART RZGE-A



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F **(1)**		E-MI-AS-IR **(1)**		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

(1) For **CART RZGE** the electronic driver may interfere with the manifold surface.
Please check the installation dimensions at section 16

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position		
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100		
MTTFd valves according to EN ISO 13849	150 years, see technical table P007		
Ambient temperature range	**Standard** = -20°C ÷ +70°C	**/PE** option = -20°C ÷ +70°C	**/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C	**/PE** option = -20°C ÷ +80°C	**/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

6 HYDRAULIC CHARACTERISTICS

Valve model		**RZGE-A-010**
Max regulated pressure		32; 100; 210
Min. regulated pressure	[bar]	0,8 (or actual value at T port)
Max. pressure at port P	[bar]	315
Max. pressure at port T	[bar]	210
Max. flow	[l/min]	12
Response time 0-100% step signal **(1)** (depending on installation)	[ms]	≤ 70
Hysteresis	[% of the max pressure]	≤ 1,5
Linearity	[% of the max pressure]	≤ 3
Repeatability	[% of the max pressure]	≤ 2

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	**cURus** North American Standard		

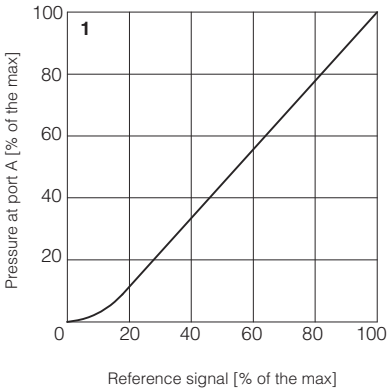
8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

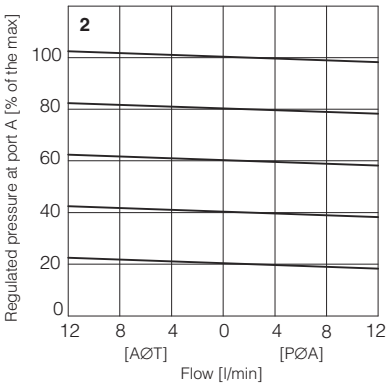
9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation

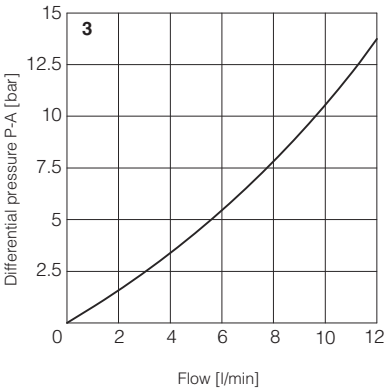


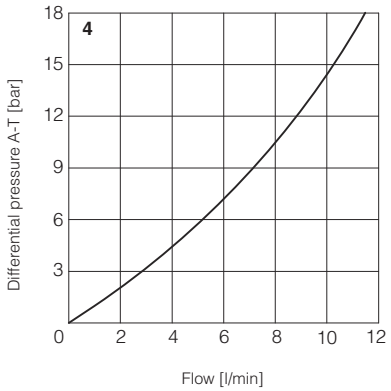
2 = Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 = Min. pressure/flow diagrams
with zero reference signal

3 = Pressure drops vs. flow P-A
4 = Pressure drops vs. flow A-T





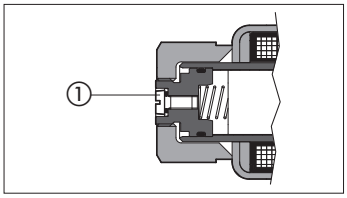
10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

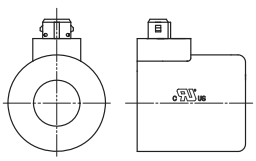
11 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

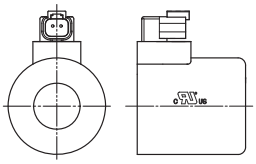


12 COILS WITH SPECIAL CONNECTORS

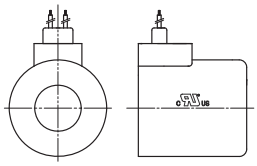
J option
Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



K option
Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67



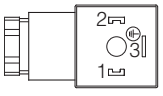
S option
Coil type COZES
Lead Wire connection
Cable lenght = 180 mm



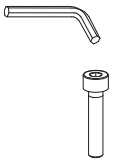
13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION
1	**COIL**	Power supply
2	**COIL**	Power supply
3	**GND**	Ground

Connector code 666



14 FASTENING BOLTS AND SEALS FOR RZGE



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals:

3 OR 108

Diameter of ports P, T, A: Ø 5 mm

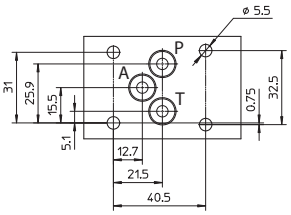
Port B not used

15 INSTALLATION DIMENSIONS FOR RZGE [mm]

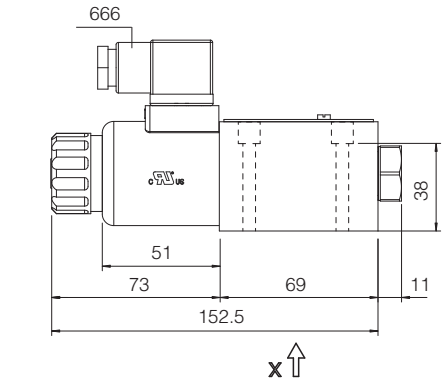
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without port B)

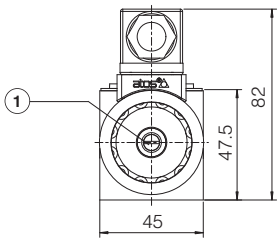
Mass [kg]	
RZGE	1,5
RZGE with E-MI-AS-IR	2,0

view from X

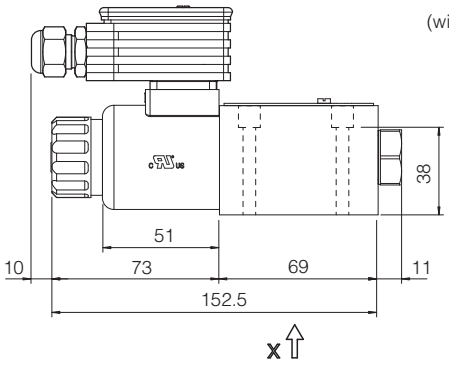


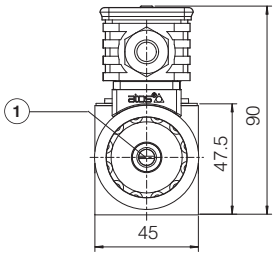
RZGE-A





RZGE-A
(with E-MI-AS-IRdigital driver)

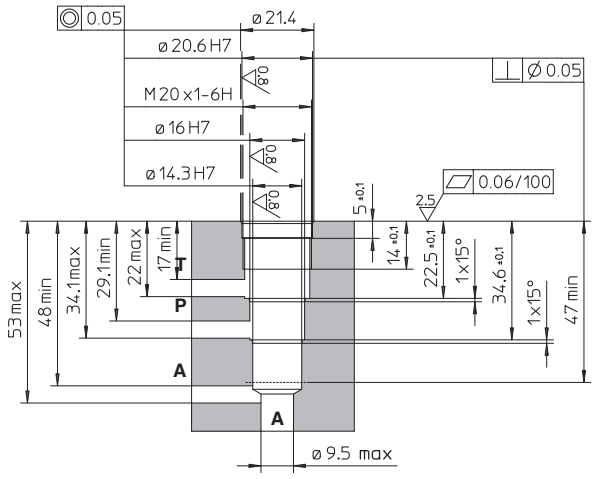




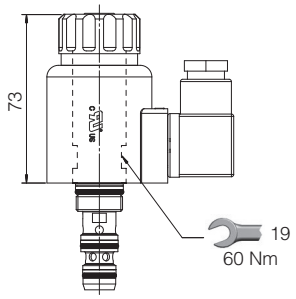
(1) = Air bleeding, see section 11

16 INSTALLATION DIMENSIONS FOR CART RZGE [mm]

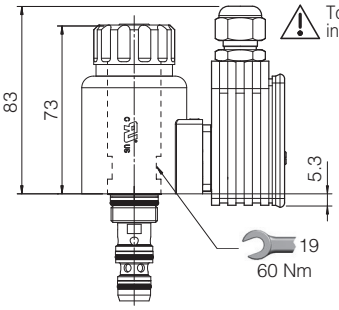
Cavity dimensions for **CART RZGE-A**



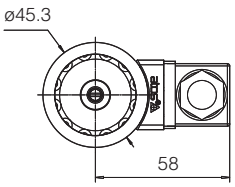
CART RZGE-A

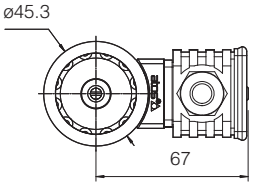


CART RZGE-A
(with E-MI-AS-IR digital driver)



To be checked for eventual interference with the manifold surface





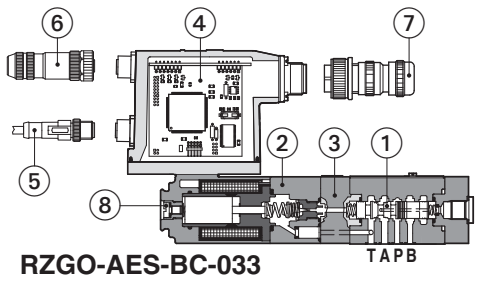
Mass [kg]	
CART RZGE	0,6
CART RZGE with E-MI-AS-IR	1,1

17 RELATED DOCUMENTATION

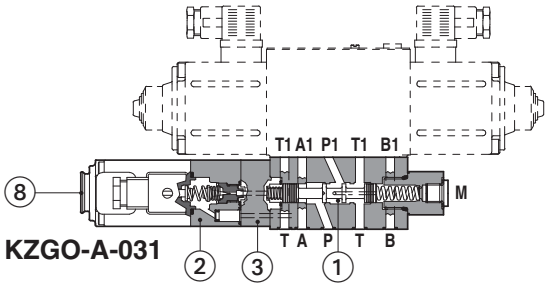
FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Digital proportional reducing valves

piloted, without transducer, subplate or modular mounting



RZGO-AES-BC-033



KZGO-A-031

① Main spool
② Proportional pilot relief valve
③ Pilot flow compensator
④ On-board digital driver
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector
⑧ Screw for air blending

RZGO-A , RZGO-AEB, RZGO-AES
HZGO-A , KZGO-A

Spool type, piloted, digital proportional reducing valves for pressure open loop controls, available in subplate size 06 or modular mounting size 06 and 10

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

RZGO, HZGO:	**KZGO**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **40 l/min**	Max flow: **100 l/min**
Max pressure: **350 bar**	Max pressure: **350 bar**

1 MODEL CODE

RZGO	-	AEB	-	NP	-	033	/	210	/	*	/	*	*	/	*

RZGO = Proportional pressure reducing valve, piloted
RZGO = subplate, size 06
HZGO = modular, size 06
KZGO = subplate, size 10

A = for off-board driver, see section 3

Only for **RZGO**:
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Configuration:
031 = regulation on port P1, discharge in T (only for HZGO, KZGO)
033 = regulation on port A, discharge in T (only for RZGO)

Max regulated pressure:
50 = 50 bar (not for KZGO)
100 = 100 bar
210 = 210 bar
315 = 315 bar
350= 350 bar

Electronic options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

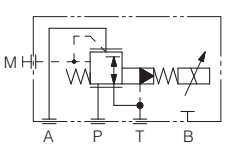
Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

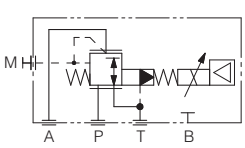
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

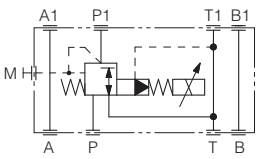
RZGO-A-033



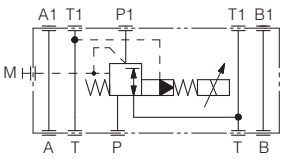
RZGO-AES-033



HZGO-A-031



KZGO-A-031



3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

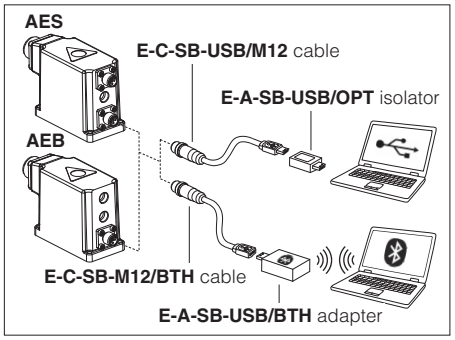
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZGO, HZGO**	**KZGO**
Max regulated pressure	[bar]	50; 100; 210; 315; 350	100; 210; 315; 350
Max pressure at port P	[bar]	350	
Max pressure at port T	[bar]	210	
Min regulated pressure **(1)**	[bar]	1,0; 3,0 (only for /350)	
Min flow	[l/min]	2,5	3
Max flow	[l/min]	40	100
Response time 0-100% step signal (depending on installation) **(2)**	[ms]	≤ 50	≤ 80
Hysteresis		≤ 2 [% of max pressure]	
Linearity		≤ 3 [% of max pressure]	
Repeatability		≤ 2 [% of max pressure]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard		option /6	option /18
Max. solenoid current	2,6 A		3,25 A	1,5 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω		2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

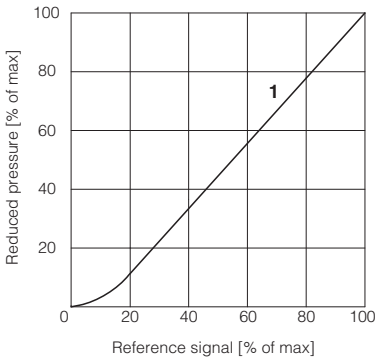
11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

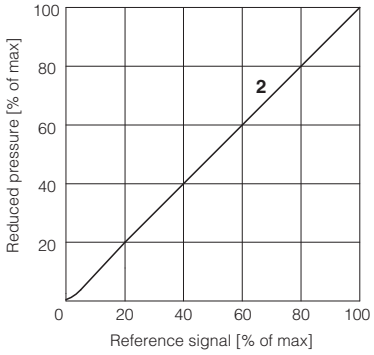
11.1 Regulation diagrams

with flow rate Q = 10 l/min

1 = RZGO, HZGO
2 = KZGO

Note: the presence of counter pressure at port T can affect the effective pressure regulation

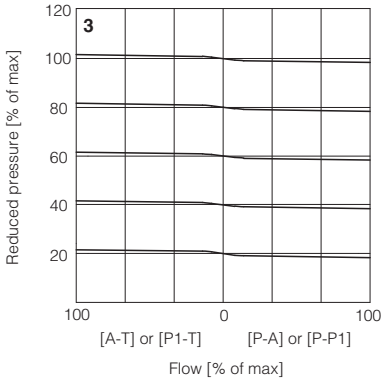




11.2 Pressure/flow diagrams

with reference pressure set with Q = 10 l/min

3 = RZGO, KZGO



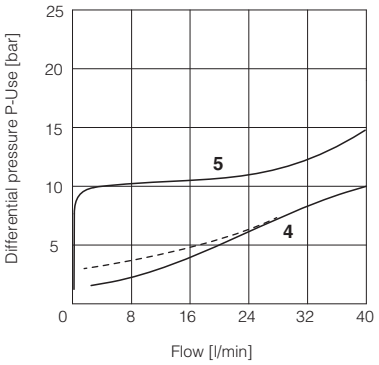
11.3 Pressure drop/flow diagram

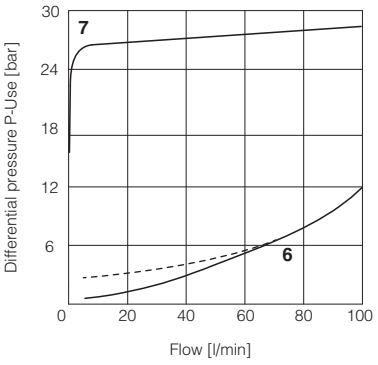
RZGO, HZGO

4 = A-T or P1-T (dotted line /350)
5 = P-P1 or P-A

KZGO

6 = P1-T (dotted line /350)
7 = P-P1





12 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

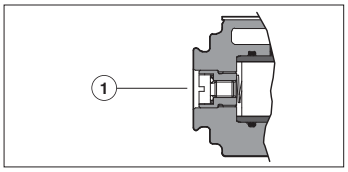
14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND V0		Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

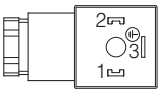
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

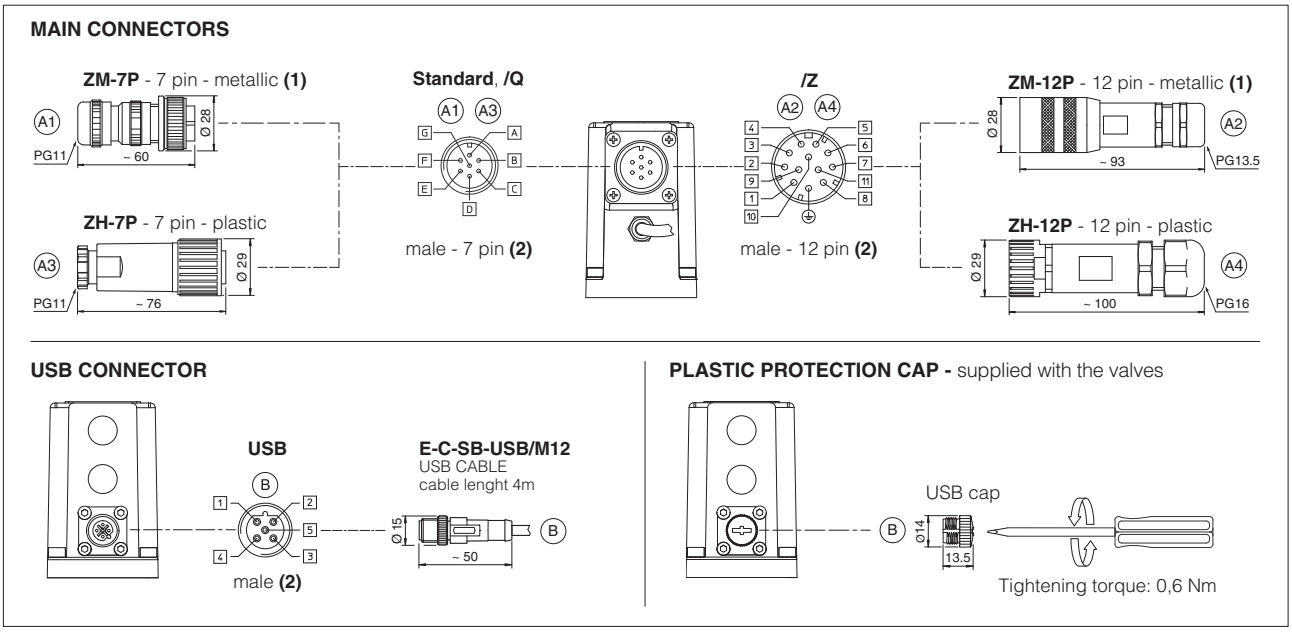
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

17.4 Solenoid connection - only for A

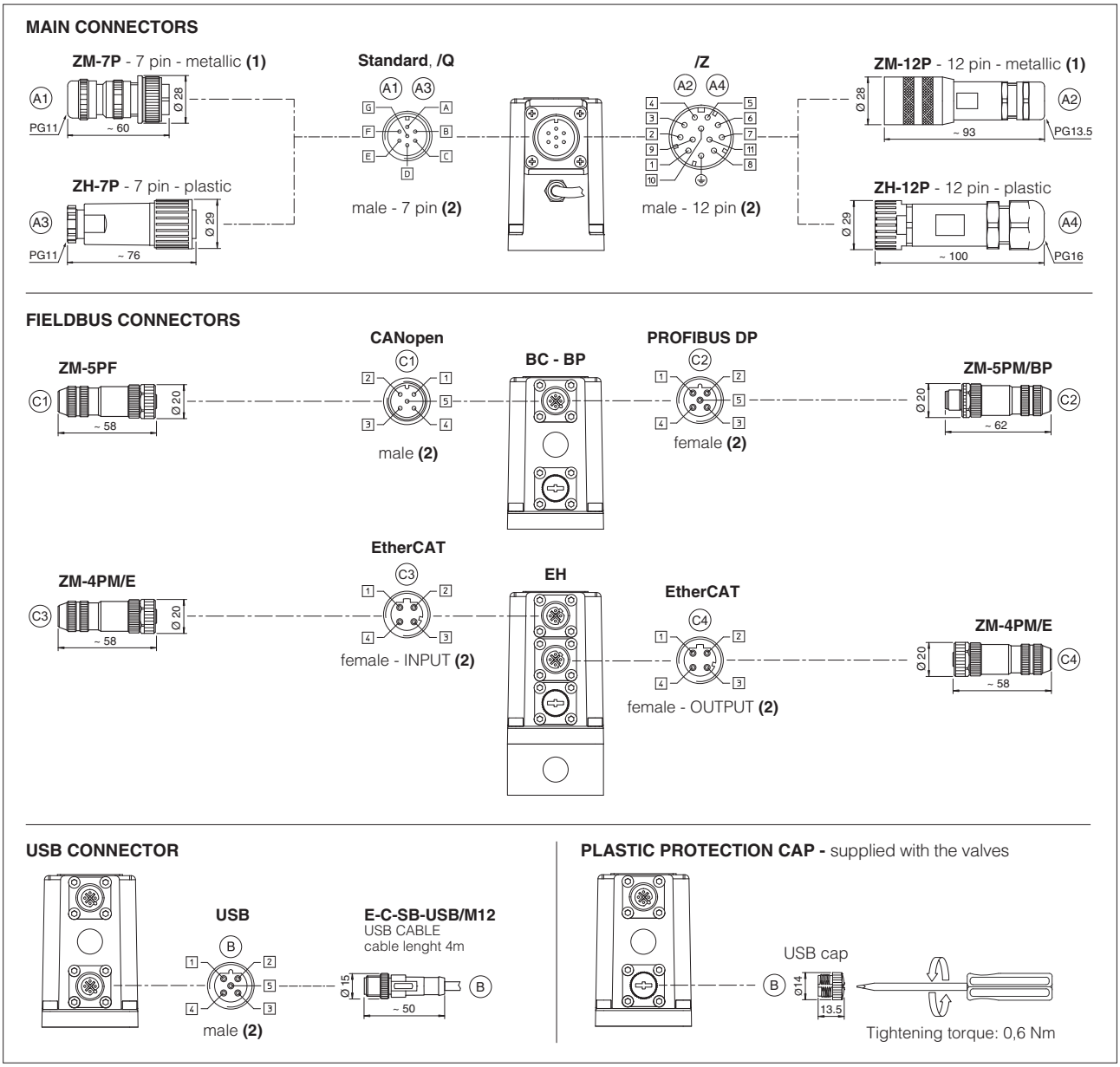
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

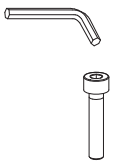
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	**QB200**	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	**QF200**	Quickstart for AES valves commissioning

20 FASTENING BOLTS AND SEALS

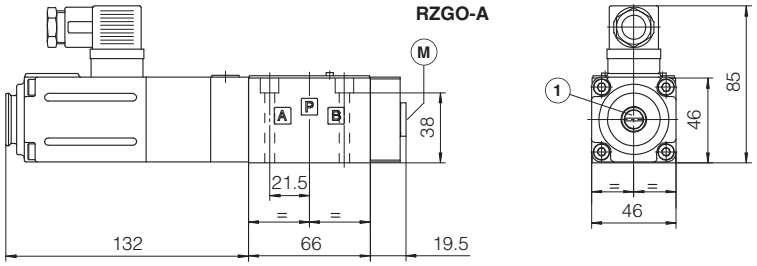
	RZGO	HZGO	KZGO
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** M5 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** M6 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm Port B not used	**Seals:** 4 OR 108 Diameter of ports P, A, B, T: Ø 6,5 mm	**Seals:** 5 OR 2050; 1 OR 108 Diameter of ports P, A, B, T: Ø 10,5 mm (max)

RZMO

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

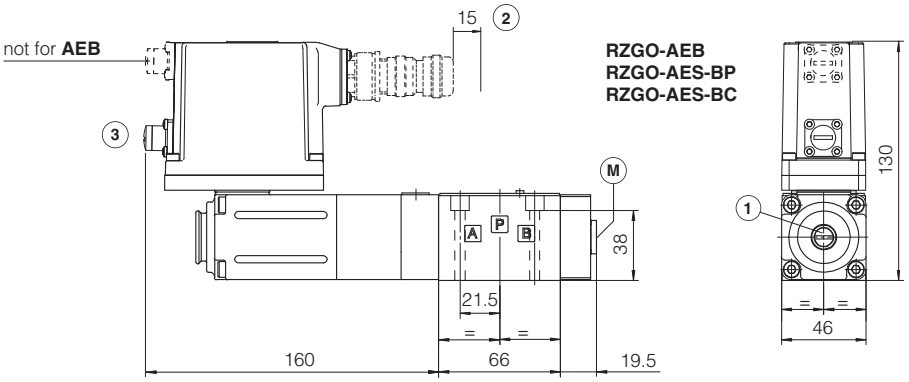
Mass [kg]		
A	**AEB, AES**	**AES-EH**
2,8	3,3	3,4

RZGO-A

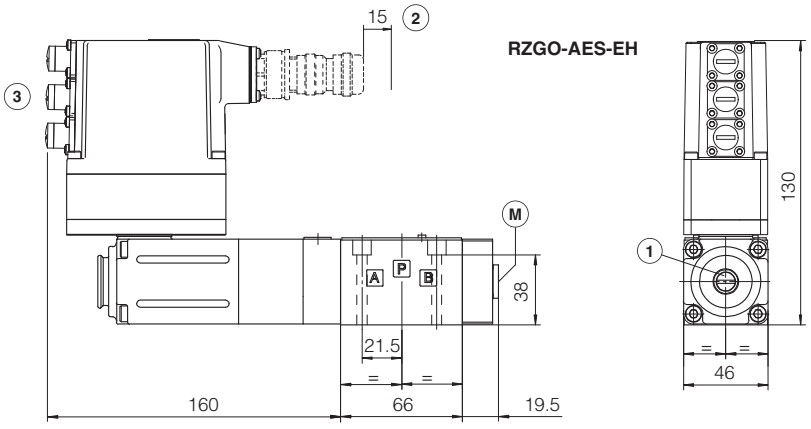


not for **AEB**

RZGO-AEB
RZGO-AES-BP
RZGO-AES-BC



RZGO-AES-EH

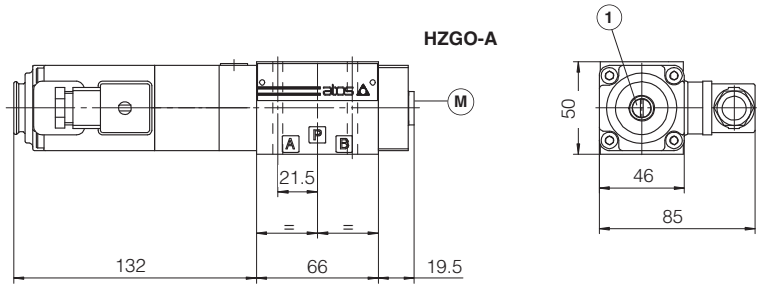


HZGO

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Mass [kg]
A
2,8

HZGO-A

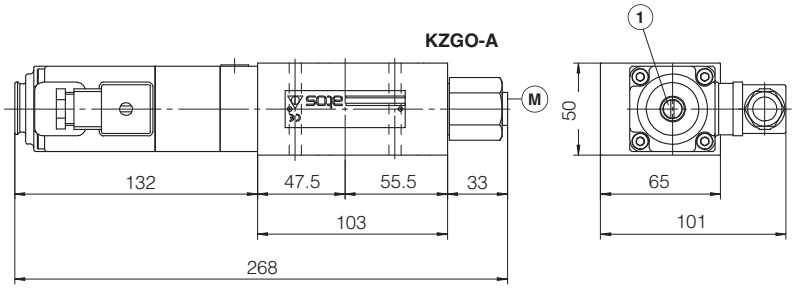


KZGO

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
(see table P005)

Mass [kg]
A
3,8

KZGO-A



(1) = Air bleeding, see section 15

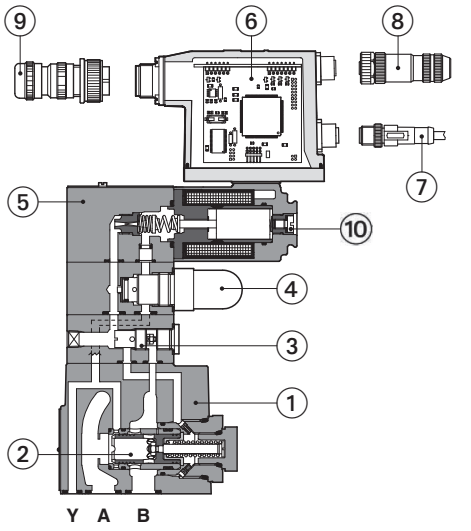
(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

(M) = Pressure gauge connection port = G1/4"

Digital proportional reducing valves

piloted, without transducer



① Valve body
② Main spool
③ Pilot flow compensator
④ On-board pressure limiter
⑤ Pilot relief valve
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector
⑩ Screw for air bleeding

AGRCZO-AES-BC-10

AGRCZO-A,
AGRCZO-AEB, AGRCZO-AES

Digital proportional reducing valves, piloted, for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** and **20** - ISO 5781
Max flow: **160** and **300 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGRCZO	-	AES	-	BC	-	10	/	315	/	*	/	*	*	/	*

Proportional pressure reducing valve, piloted

A = for off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Valve size ISO 5781: **10, 20**

Max regulated pressure:
50 = 50 bar **100** = 100 bar **210** = 210 bar **315** = 315 bar **350** = 350 bar

Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

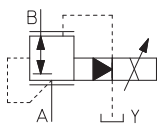
Hydraulic options (4):
P = with integral mechanical pressure limiter
R = with integral check valve for free reverse flow

Electronics options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

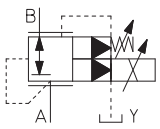
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS

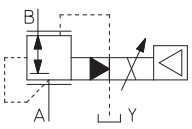
AGRCZO-A



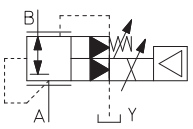
AGRCZO-A-*/P



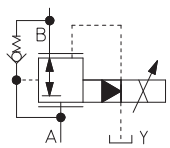
AGRCZO-AEB
AGRCZO-AES



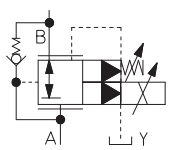
AGRCZO-AEB-*/P
AGRCZO-AES-*/P



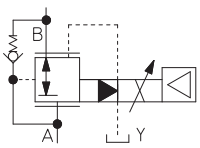
AGRCZO-A-*/R



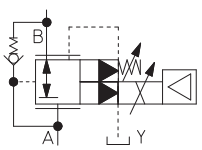
AGRCZO-A-*/PR



AGRCZO-AEB-*/R
AGRCZO-AES-*/R



AGRCZO-AEB-*/PR
AGRCZO-AES-*/PR



3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

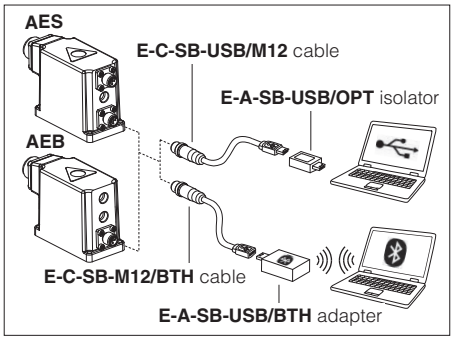
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**AGRCZO-*-10**	**AGRCZO-*-20**
Max regulated pressure	[bar]	50; 100; 210; 315; 350	
Min regulated pressure **(1)**	[bar]	1; 3 (only for /350)	
Max pressure at port A or B	[bar]	350	
Max pressure at port Y	[bar]	pilot drain always external, to be directly connected to tank at zero pressure	
Max flow	[l/min]	160	300
Response time 0-100% step signal (depending on installation) **(2)**	[ms]	≤ 45	≤ 50
Hysteresis		≤ 2,0 [% of max pressure]	
Linearity		≤ 3,0 [% of max pressure]	
Repeatability		≤ 2,0 [% of max pressure]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard		option /6	option /18
Max. solenoid current	2,6 A		3,25 A	1,5 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω		2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

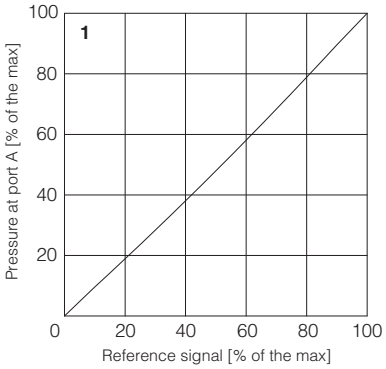
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

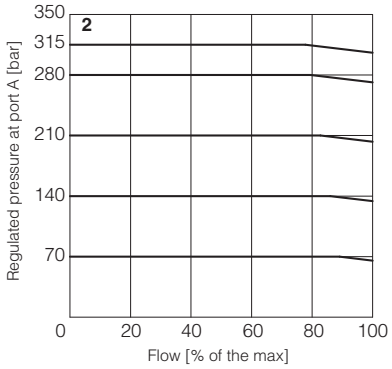
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams
with flow rate Q = 10 l/min



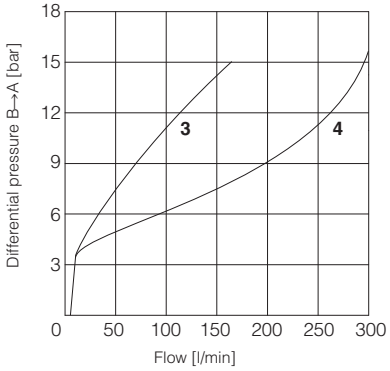
2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min

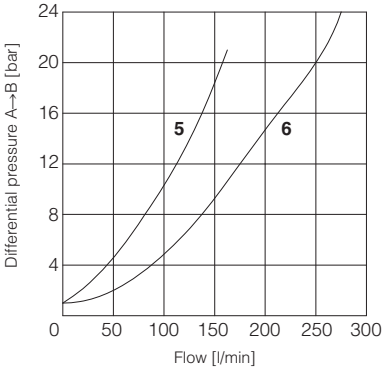


3-6 Pressure drop/flow diagrams
with zero reference signal

Differential pressure B→A
3 = AGRCZO-*-10
4 = AGRCZO-*-20

Differential pressure A→B (through check valve)
5 = AGRCZO-*-10/*/R
6 = AGRCZO-*-20/*/R

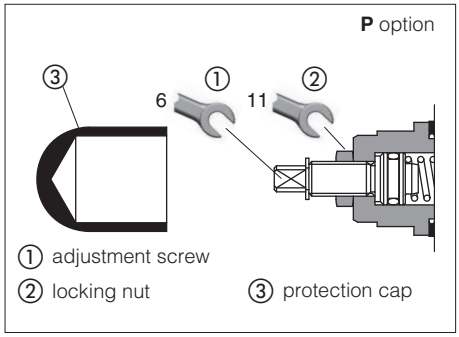




12 HYDRAULIC OPTIONS

P = This option provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

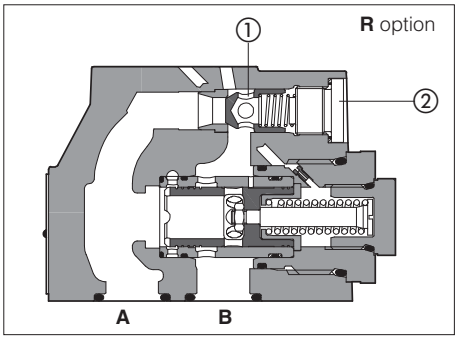
- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



R = This option provides a integral check valve for free reverse flow A→B

① Check valve - cracking pressure = 0,5 bar

② Plug



13 ELECTRONICS OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

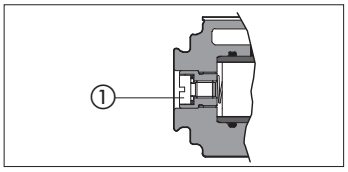
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

14 POSSIBLE COMBINED OPTIONS

for **A**: /PR

for **AEB** and **AES**: /IP, /IQ, /IR, /IZ, /PQ, /PR, /PZ, /QR, /RZ, /IPQ, /IPR, /IPZ, /IQR, /IRZ, /PQR, /PRZ, /IPQR, /IPRZ

15 AIR BLEEDING



At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND | V0		Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

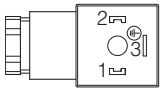
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

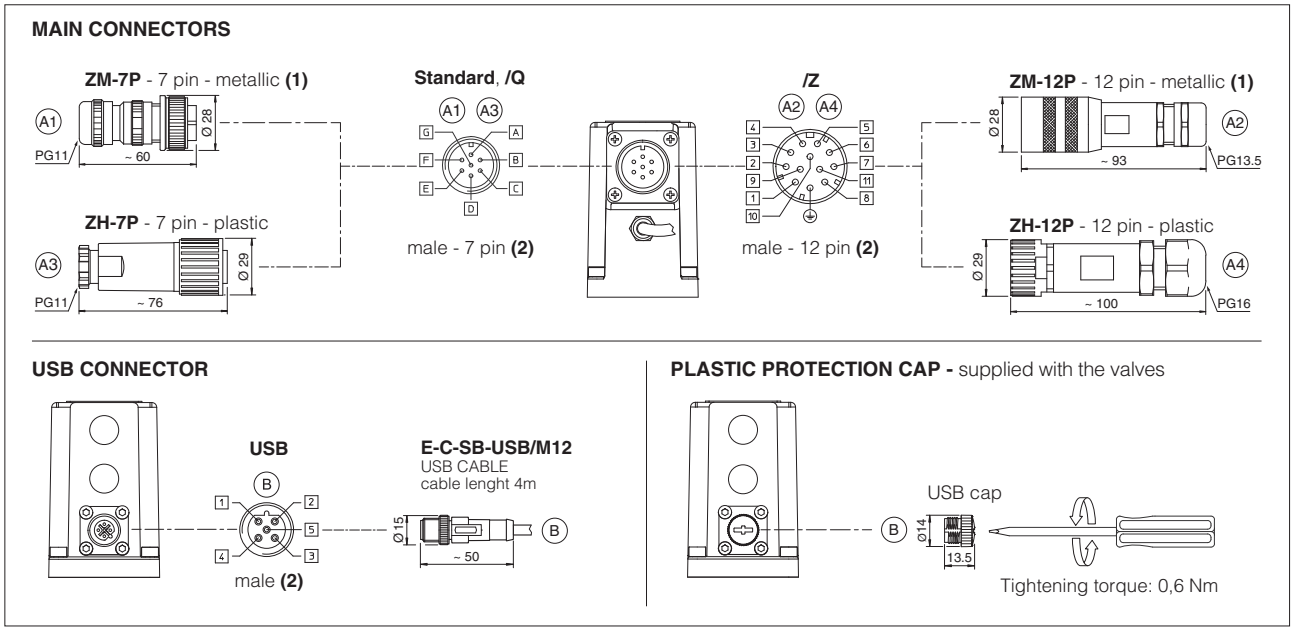
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

17.4 Solenoid connection - only for A

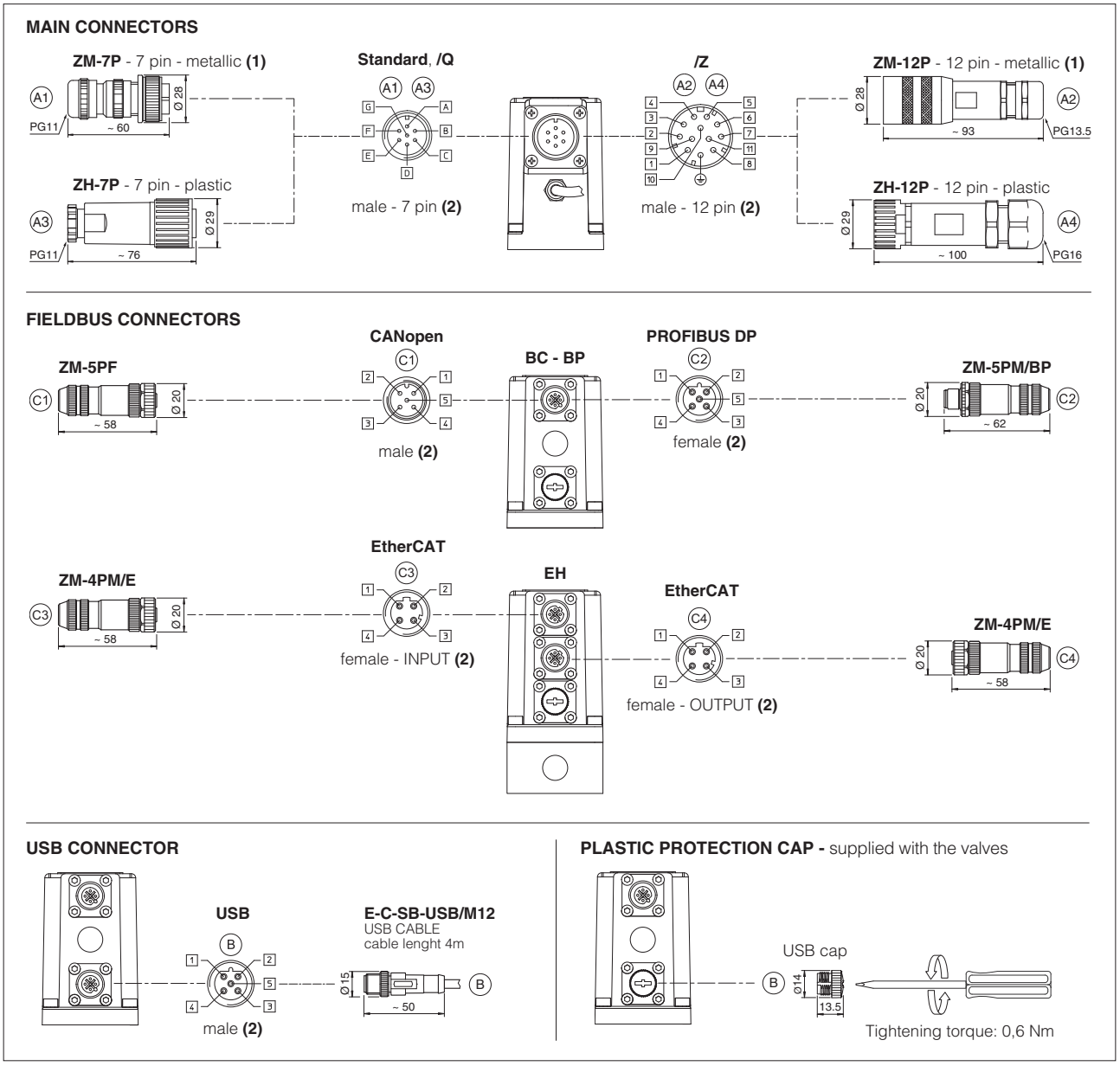
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

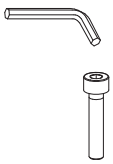
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	**QB200**	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	**QF200**	Quickstart for AES valves commissioning

20 FASTENING BOLTS AND SEALS

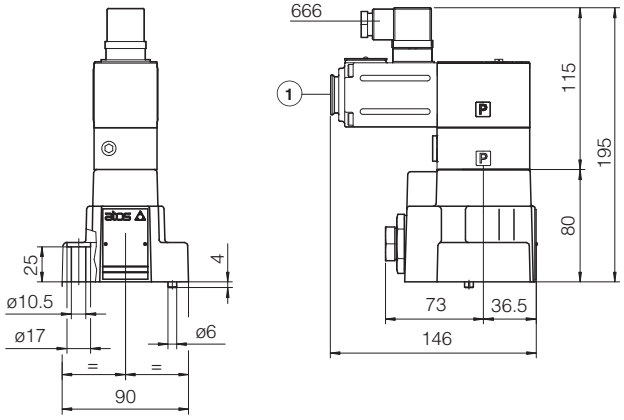
	AGRCZO-*-10	AGRCZO-*-20
	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm
	**Seals:** 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm

21 INSTALLATION DIMENSIONS FOR AGRCZO-10 [mm]

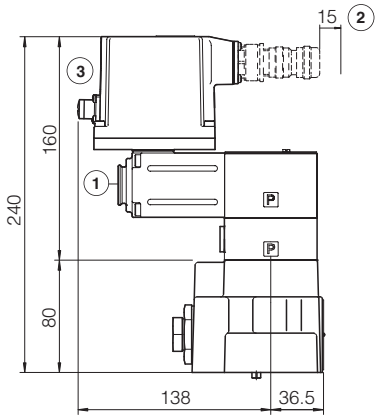
ISO 5781: 2000
Mounting surface: 5781-06-07-0-00 (see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGRCZO-*-10	5,0	5,6	5,7
Option /P	+0,5		

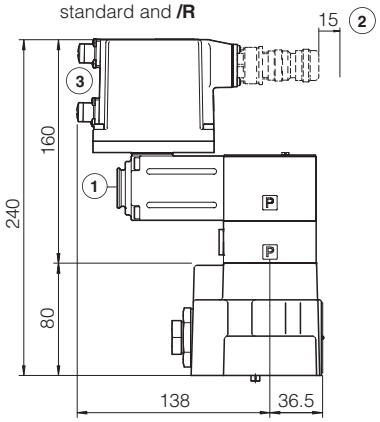
AGRCZO-A-10
standard and **/R**



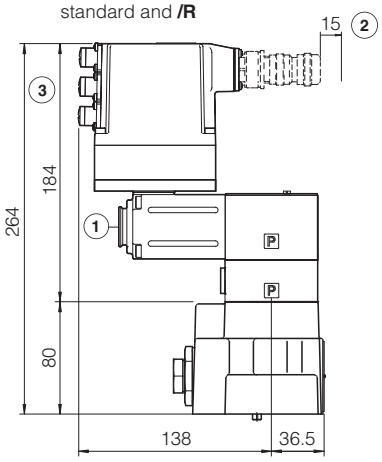
AGRCZO-AEB-NP-10
standard and **/R**



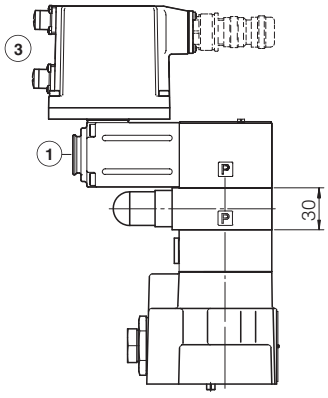
AGRCZO-AES-BC-10
AGRCZO-AES-BP-10
standard and **/R**



AGRCZO-AES-EH-10
standard and **/R**



Option /P



(1) = Air bleeding, see section 15

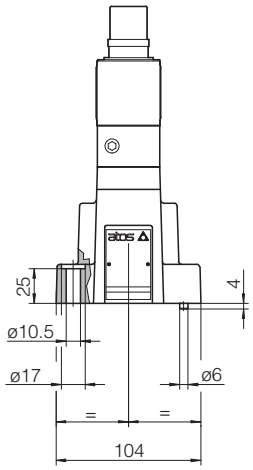
(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

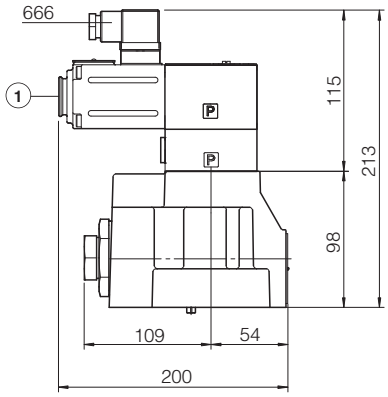
22 INSTALLATION DIMENSIONS FOR AGRCZO-20 [mm]

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00 (see table P005)

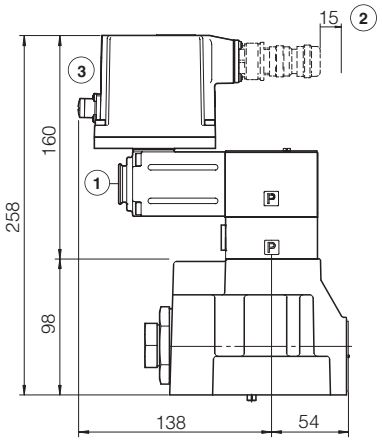
	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGRCZO-*-20	7,5	8,1	8,2
Option /P	+0,5		



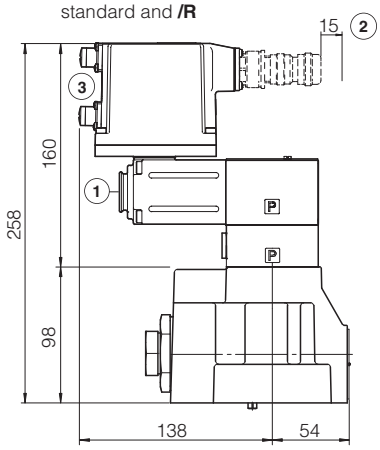
AGRCZO-A-20
standard and **/R**



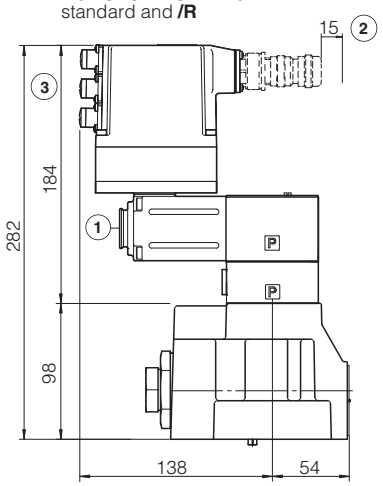
AGRCZO-AEB-NP-20
standard and **/R**



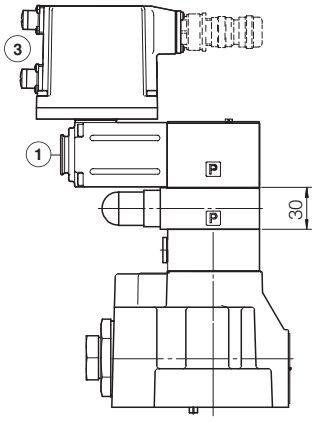
AGRCZO-AES-BC-20
AGRCZO-AES-BP-20
standard and **/R**



AGRCZO-AES-EH-20
standard and **/R**



Option /P



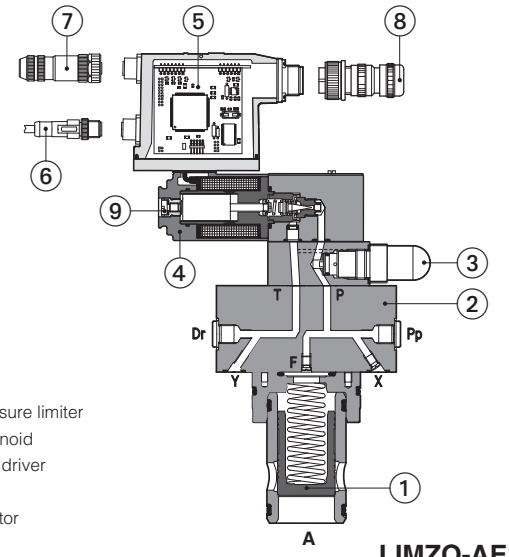
(1) = Air bleeding, see section 15

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Digital proportional pressure cartridges

piloted, without transducer - compensator, relief, reducing functions



① Poppet
② Cover
③ Mechanical pressure limiter
④ Proportional solenoid
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

LIMZO-AES-BC-4

LICZO, LIMZO, LIRZO

2-way digital proportional cartridges respectively performing: pressure compensator, relief and reducing open loop functions.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **16** ÷ **80** - ISO 7368
Max flow: up to **4500 l/min**
Max pressure: **350 bar**

1 **MODEL CODE OF COVERS**

LIMZO	-	**AES**	-	**BC**	-	**4**	/	**315**	/	*	/	*	/	*	*

LIMZO
Proportional pressure cartridges, piloted
LICZO = pressure compensator
LIMZO = pressure relief
LIRZO = pressure reducing

A = for off-board driver, see section 5
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces USB port always present **(3)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 7368:
1 = 16
2 = 25
3 = 32
4 = 40
5 = 50 (not for LIRZO)
6 = 63 (only for LIMZO)
8 = 80 (only for LIMZO)

Max regulated pressure:
50 = 50 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Hydraulic options (4):
P =with integral mechanical pressure limiter (standard for size 1, 2 and 3)

Electronics options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 V)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

Coil voltage, only for **A** - see section 17 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

Series number

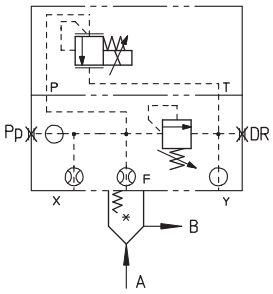
Seals material, see section 12 :
- = NBR
PE = FKM
BT = HNBR

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) For possible combined options, see section 16

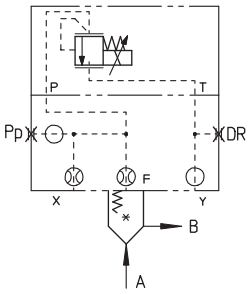
2 HYDRAULIC SYMBOLS

LICZO

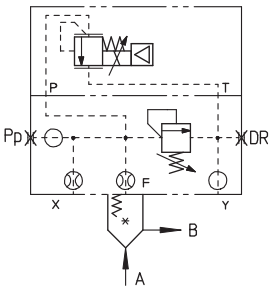
LICZO-A-1÷3
LICZO-A-4÷5 /P



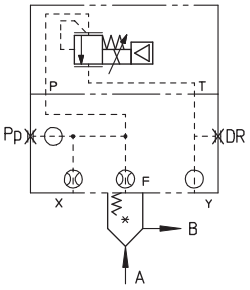
LICZO-A-4
LICZO-A-5



LICZO-AEB(AES)-1÷3
LICZO-AEB(AES)-4÷5 /P

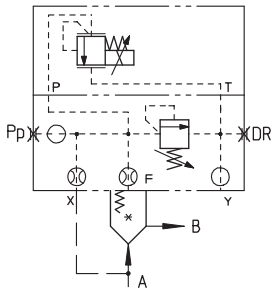


LICZO-AEB(AES)-4÷5

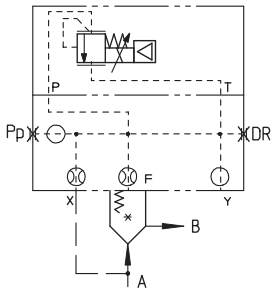


LIMZO

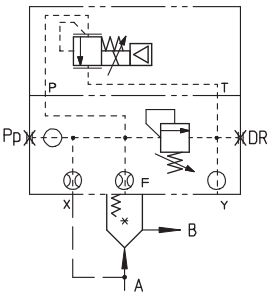
LIMZO-A-1÷3
LIMZO-A-4÷8 /P



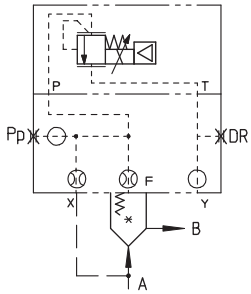
LIMZO-A-4÷8



LIMZO-AEB(AES)-1÷3
LIMZO-AEB(AES)-4÷8 /P

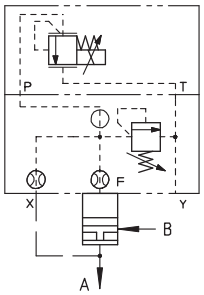


LIMZO-AEB(AES)-4÷8

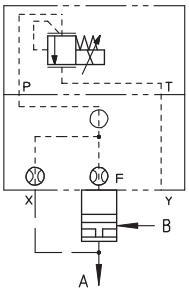


LIRZO

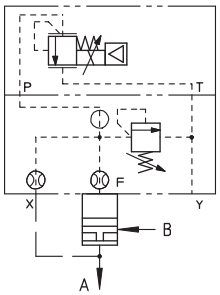
LIRZO-A-1÷3
LIRZO-A-4 /P



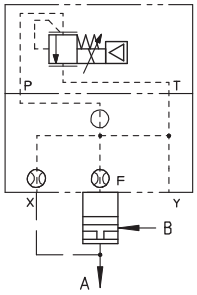
LIRZO-A-4



LIRZO-AEB(AES)-1÷3
LIRZO-AEB(AES)-4 /P



LIRZO-AEB(AES)-4



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	*	/	*

Cartridge according to ISO 7368

Cartridge size ISO 7368:
16; **25**; **32**; **40**; **50**; **63**; **80**

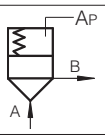
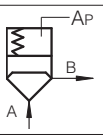
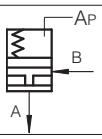
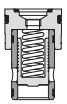
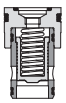
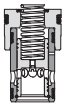
Type of poppet:
31 = for LIMZO and LICZO
36 = for LICZO
37 = for LIRZO

Series number

Spring cracking pressure:
2 = 1,5 bar for poppet 31
3 = 3 bar
4 = 4 bar
6 = 6 bar for poppet 31 and 36
7 = 7 bar for poppet 37

Seals material, see section 12 :
- = NBR
PE = FKM
BT = HNBR

4 TYPE OF POPPET

Type of poppet	31	36	37
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	**1:1**	**1:1**	**1:1**

5 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS

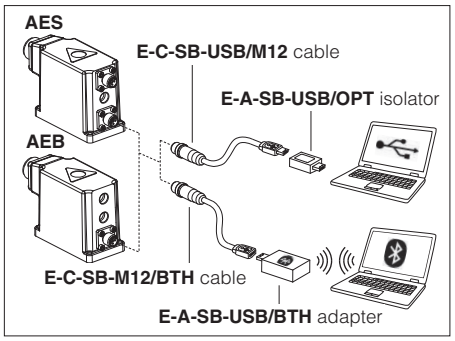
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

8 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		LICZO					LIMZO							LIRZO			
valve size		**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**1**	**2**	**3**	**4**
Max flow	[l/min]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pres. at port A	[bar]	9	8,5	8	13	15	7	7	7	10,5	12	12	**(2)**	7			
Min regulated pres. at port A for /350	[bar]	11	10	10	13	16	10	10	9	12	13	13	16	12			
Max regulated pres. at port A	[bar]	50; 100; 210; 315; 350					50; 100; 210; 315; 350							50; 100; 210; 315; 350			
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	100 ÷ 400					100 ÷ 450							100 ÷ 350			
Hysteresis	[% of the regulated max flow]	≤ 2					≤ 1,5							≤ 2			
Linearity	[% of the regulated max flow]	≤ 3					≤ 3							≤ 3			
Repeatability	[% of the regulated max flow]	≤ 2					≤ 2							≤ 2			

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 5

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.
(2) Consult our techincal office.

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard		option /6	option /18
Max. solenoid current	2,6 A		3,25 A	1,5 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω		2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 21			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

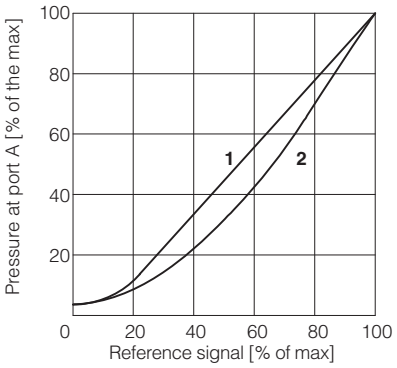
12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

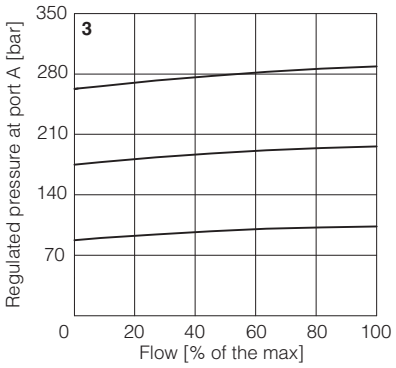
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams LIMZO
2 Regulation diagrams LICZO

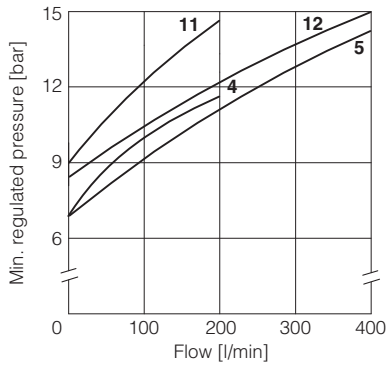
3 Pressure/flow diagrams LICZO, LIMZO

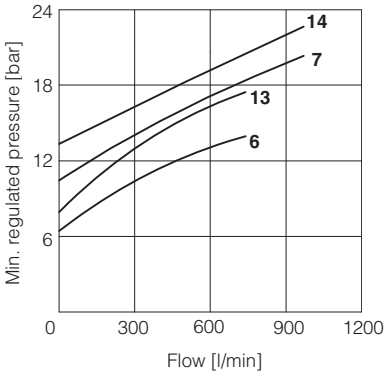


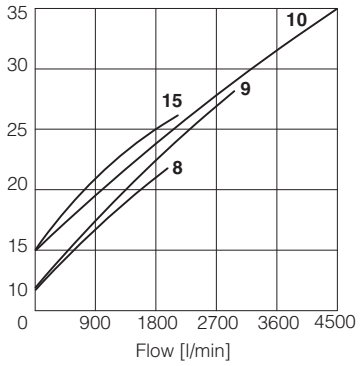


4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZO-*-1
5 = LIMZO-*-2
6 = LIMZO-*-3
7 = LIMZO-*-4
8 = LIMZO-*-5
9 = LIMZO-*-6
10 = LIMZO-*-8
11 = LICZO-*-1
12 = LICZO-*-2
13 = LICZO-*-3
14 = LICZO-*-4
15 = LICZO-*-5





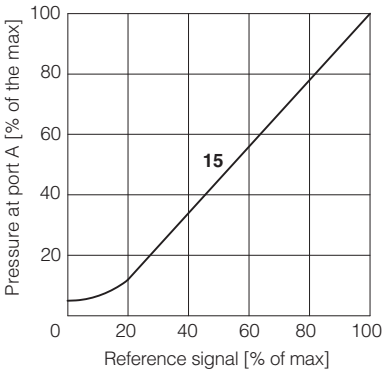


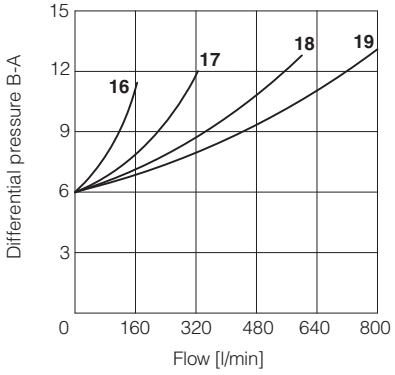
Regulation diagrams LIRZO

15 = LIRZO-A

16-19 Min. pressure/flow diagrams
with reference signal "null"

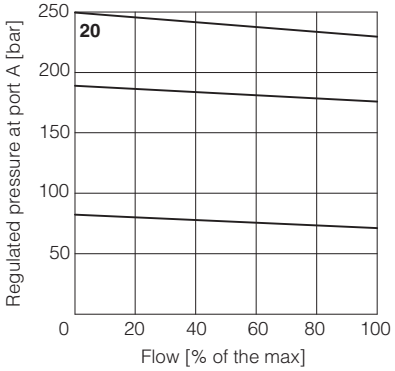
16 = LIRZO-*-1
17 = LIRZO-*-2
18 = LIRZO-*-3
19 = LIRZO-*-4





Pressure/flow diagrams

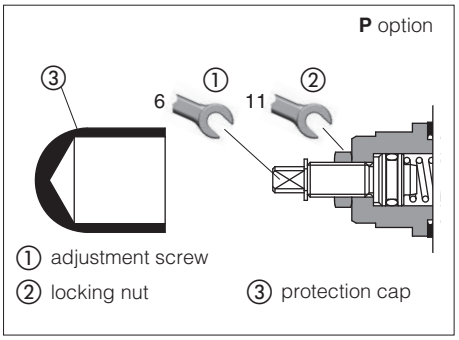
20 = LIRZO-A



14 HYDRAULIC OPTIONS

P = This option (standard for size 1, 2 and 3) provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



15 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 19.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 19.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 19.2

16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ

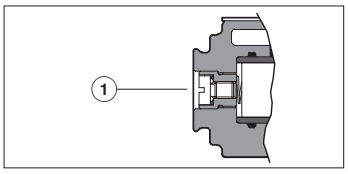
17 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

18 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



19 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

19.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

19.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND V0		Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

20.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

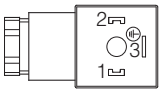
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

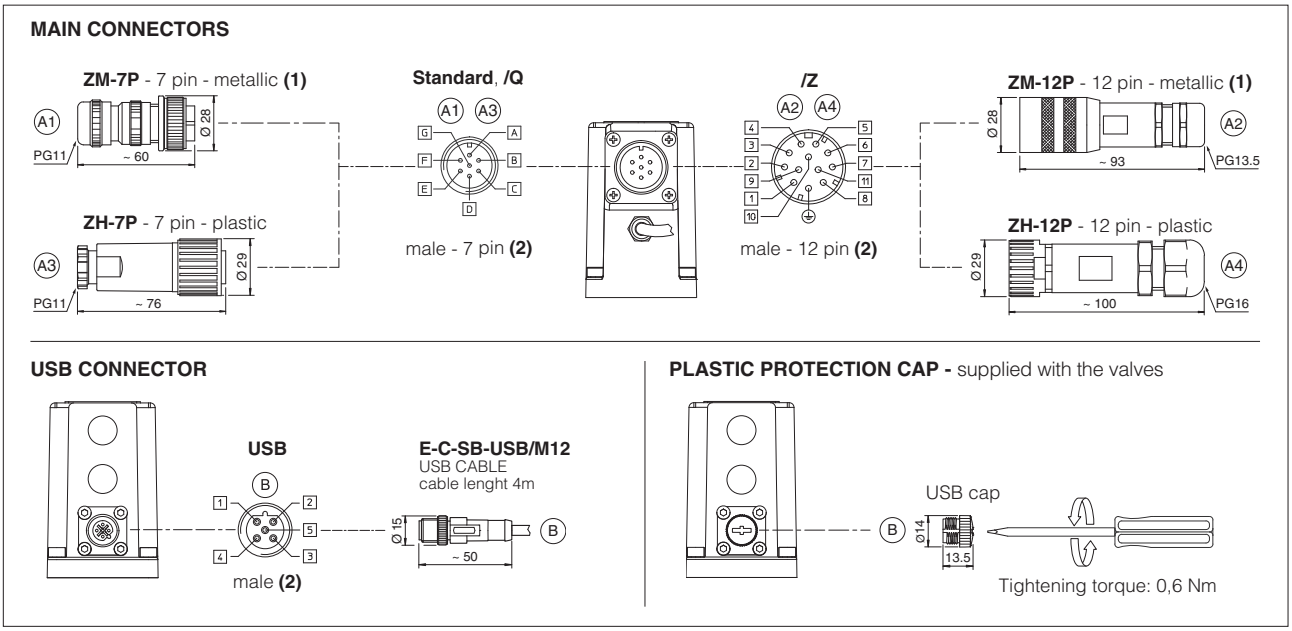
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

20.4 Solenoid connection - only for A

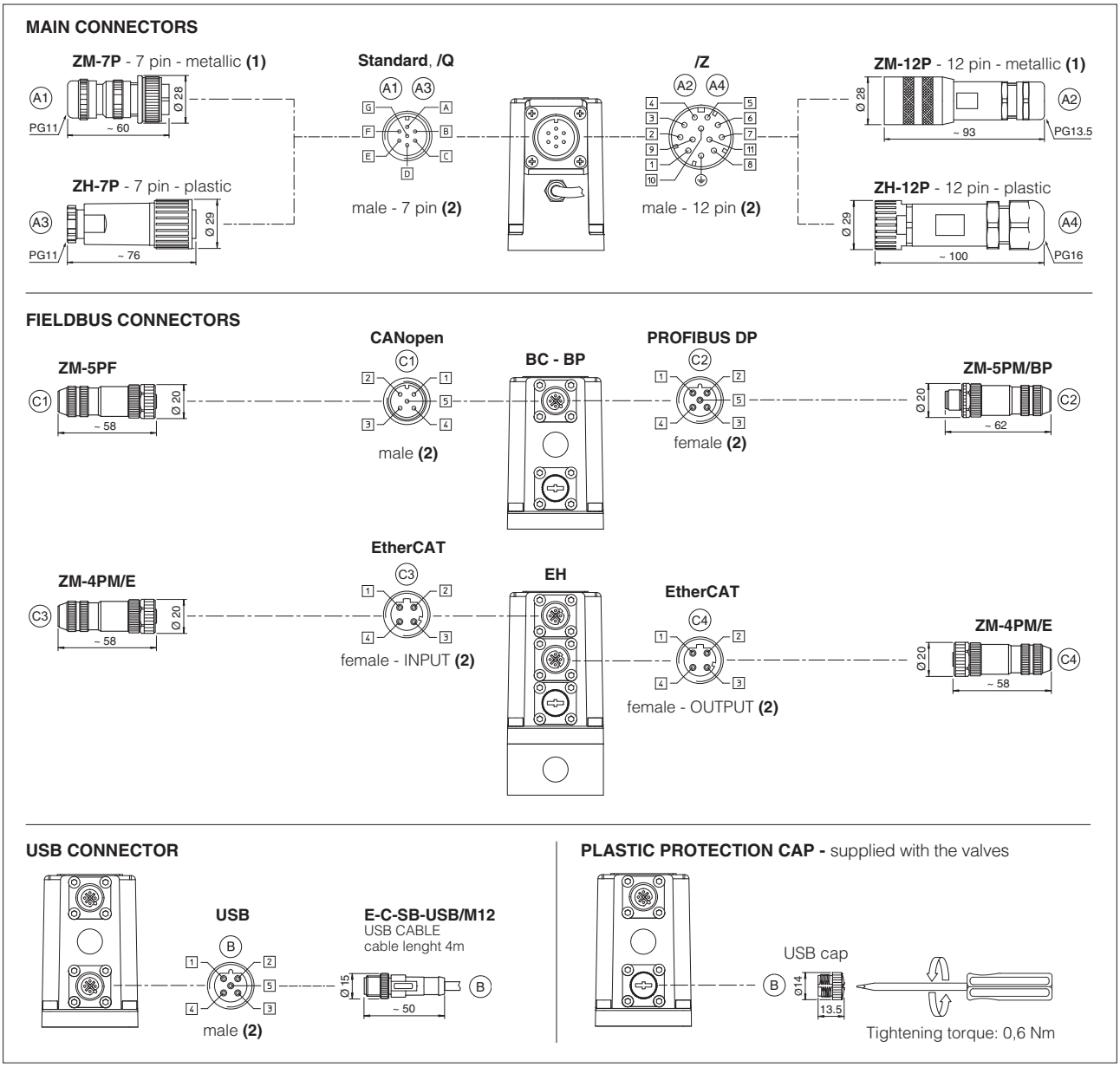
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

20.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

20.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

21.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

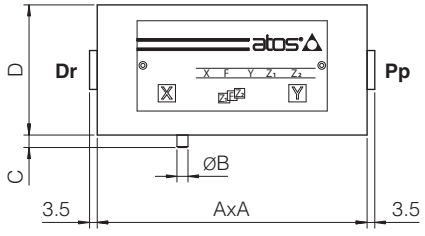
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500** **(2)** Internally terminated

22 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZO LICZO LIRZO	**1** = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO LICZO	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO	**6** = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

23 COVERS DIMENSIONS [mm]

Size	AxA	øB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4"
5 = 50	140x140	6	4	70	G 1/4"
6 = 63	180x180	6	4	80	G 3/8"
8 = 80	ø250	8	6	80	G 3/8"

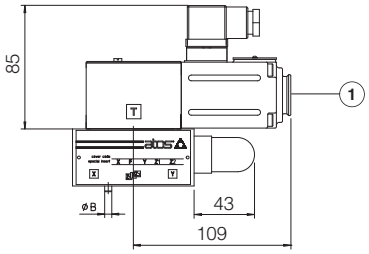


Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

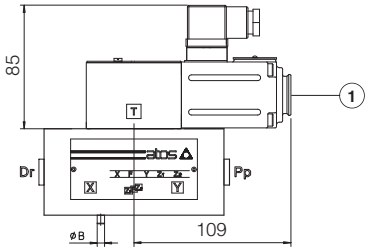
Version **A** for off-board driver

Mass [kg]			
	LICZO, LIMZO, LIRZO		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	3,3	-	0,2
2 = 25	4,0	-	0,5
3 = 32	5,3	-	0,9
4 = 40	10,7	11,7	1,7
5 = 50	14,2	15,2	2,9
6 = 63	23,7	24,7	6,7
8 = 80	32,3	33,3	13,1

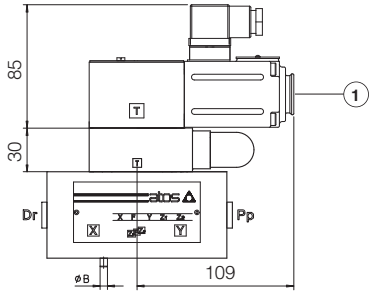
LICZO-A-1 **LIMZO-A-1** **LIRZO-A-1**
LICZO-A-2 **LIMZO-A-2** **LIRZO-A-2**
LICZO-A-3 **LIMZO-A-3** **LIRZO-A-3**



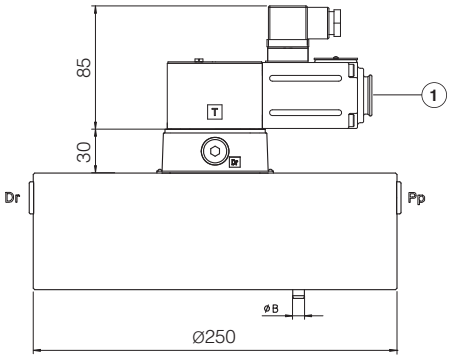
LICZO-A-4 **LIMZO-A-4** **LIRZO-A-4**
LICZO-A-5 **LIMZO-A-5**
LIMZO-A-6



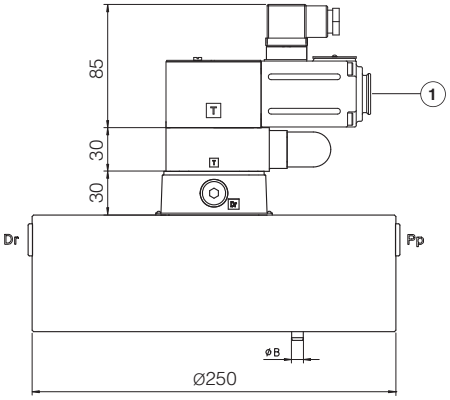
LICZO-A-4/P **LIMZO-A-4/P** **LIRZO-A-4/P**
LICZO-A-5/P **LIMZO-A-5/P**
LIMZO-A-6/P



LIMZO-A-8



LIMZO-A-8/P



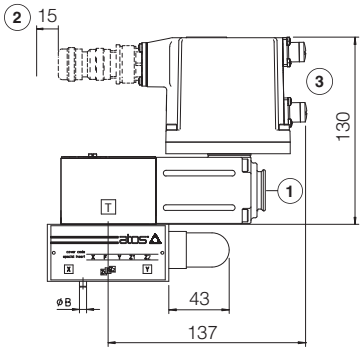
(1) = Air bleeding, see section 18

Note: for mounting surface and cavity dimensions, see tech. table P006

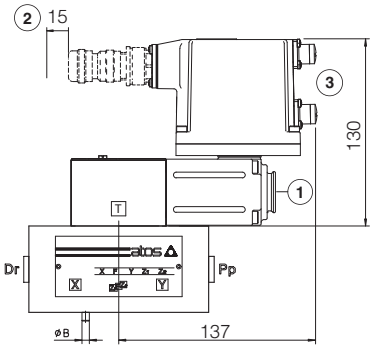
Versions **AEB** and **AES** for on-board driver

Mass [kg]			
	LICZO, LIMZO, LIRZO		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,0	-	0,2
2 = 25	4,5	-	0,5
3 = 32	5,8	-	0,9
4 = 40	11,2	12,2	1,7
5 = 50	14,7	15,7	2,9
6 = 63	24,2	25,2	6,7
8 = 80	32,8	33,8	13,1

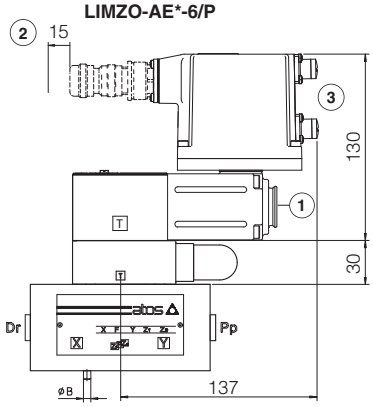
LICZO-AE*-1 LIMZO-AE*-1 LIRZO-AE*-1
LICZO-AE*-2 LIMZO-AE*-2 LIRZO-AE*-2
LICZO-AE*-3 LIMZO-AE*-3 LIRZO-AE*-3



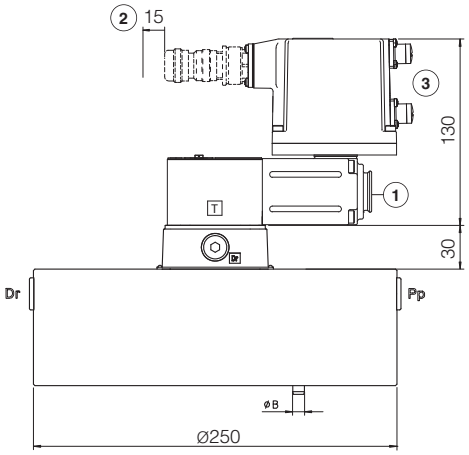
LICZO-AE*-4 LIMZO-AE*-4 LIRZO-AE*-4
LICZO-AE*-5 LIMZO-AE*-5
LIMZO-AE*-6



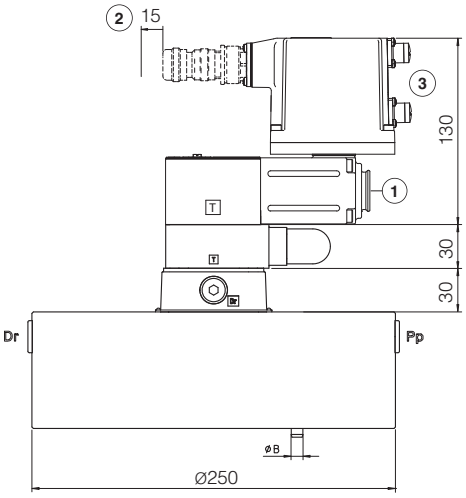
LICZO-AE*-4/P LIMZO-AE*-4/P LIRZO-AE*-4/P
LICZO-AE*-5/P LIMZO-AE*-5/P
LIMZO-AE*-6/P



LIMZO-AE*-8



LIMZO-AE*-8/P



(1) = Air bleeding, see section 18

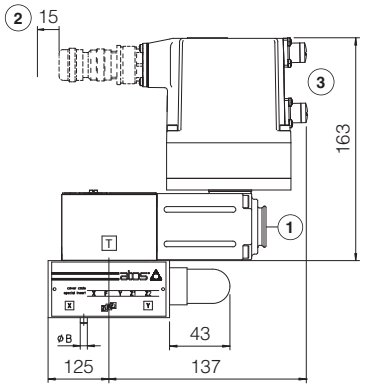
(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 20.5 and 20.6

Note: for mounting surface and cavity dimensions, see tech. table P006

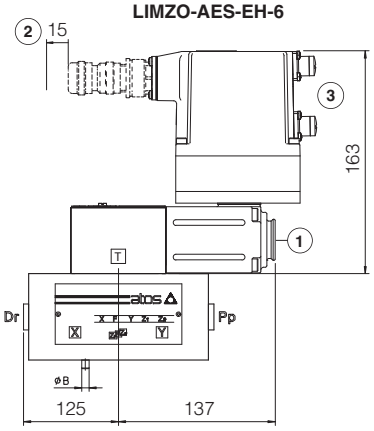
Version **AES-EH** for on-board driver

LICZO-AES-EH-1 LIMZO-AES-EH-1 LIRZO-AES-EH-1
LICZO-AES-EH-2 LIMZO-AES-EH-2 LIRZO-AES-EH-2
LICZO-AES-EH-3 LIMZO-AES-EH-3 LIRZO-AES-EH-3

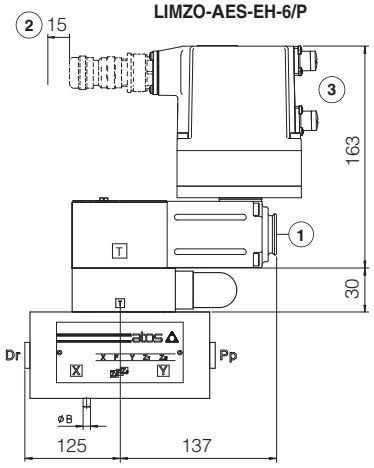


Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,1	-	0,2
2 = 25	4,6	-	0,5
3 = 32	5,9	-	0,9
4 = 40	11,3	12,3	1,7
5 = 50	14,8	15,8	2,9
6 = 63	24,3	25,3	6,7
8 = 80	32,9	33,9	13,1

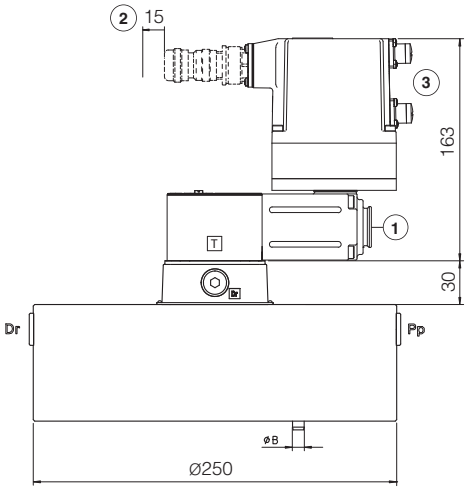
LICZO-AES-EH-4 LIMZO-AES-EH-4 LIRZO-AES-EH-4
LICZO-AES-EH-5 LIMZO-AES-EH-5
LIMZO-AES-EH-6



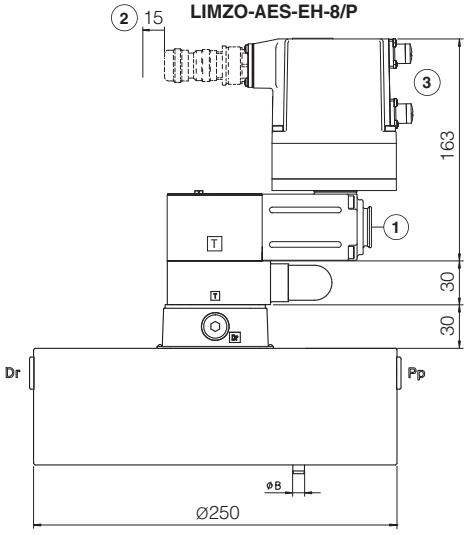
LICZO-AES-EH-4/P LIMZO-AES-EH-4/P LIRZO-AES-EH-4/P
LICZO-AES-EH-5/P LIMZO-AES-EH-5/P
LIMZO-AES-EH-6/P



LIMZO-AES-EH-8



LIMZO-AES-EH-8/P



(1) = Air bleeding, see section 18

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 20.5 and 20.6

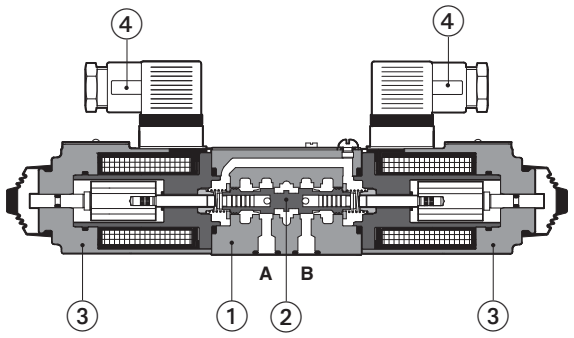
Note: for mounting surface and cavity dimensions, see tech. table P006

25 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P006**	Mounting surfaces and cavities for cartridge valves
G030	E-BM-AS digital driver	**QB200**	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	**QF200**	Quickstart for AES valves commissioning

Digital proportional reducing valves

3-way, direct, without transducer



DHRZO-A-012/25

① Valve body
② Spool
③ Proportional solenoid
④ Connector

DHRZO-A, DHRZO-AEB, DHRZO-AES

3 way, direct, digital proportional reducing valves for pressure open loop controls.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

They provide the pressure reduction on ports A, or B, or A and B, depending on the valve model.

The direct execution performs low internal leakages, fast response and low hysteresis.

Size: **06** - ISO 4401
Max flow: **24 l/min**
Max pressure: **25 bar**

1 MODEL CODE

DHRZO	-	A	-	*	-	010	/	25	/	*	/	*	*	/	*

Proportional pressure reducing valve, direct

A = off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Configuration:
010 = reduced pressure on port A
012 = reduced pressure on port A and B

Max regulated pressure:
25 = 25 bar

Hydraulic options:
For configuration 010:
B = reduced pressure on port B, solenoid at side of port A
For configuration 012:
B = solenoid with on-board digital driver at side of port A

Electronic options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

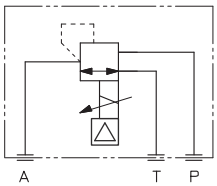
Coil voltage, only for **A** - see section 15 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

Series number

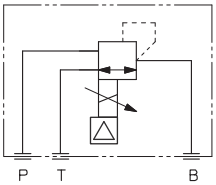
Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

(1) Only for **NP** **(2)** Only for **BC**, **BP**, **EH** **(3)** Omit for **A** execution **(4)** Possible combined options: see section 14

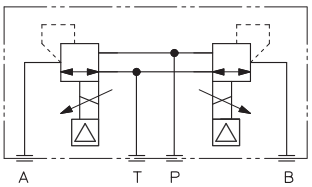
2 HYDRAULIC SYMBOLS (representation according to ISO 1219-1)



DHRZO-*-010/25*



DHRZO-*-010/25/B*



DHRZO-*-012/25*

Hydraulic symbols are represented with on-board digital driver

3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

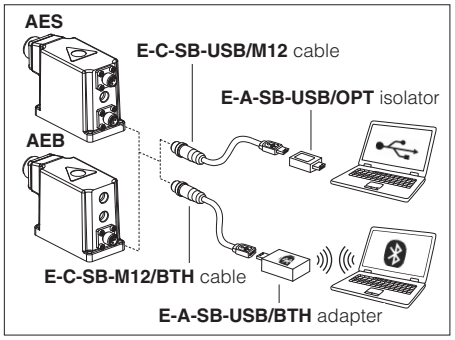
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DHRZO**
Max regulated pressure	[bar]	25
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure **(1)**	[bar]	3
Max flow	[l/min]	24
Response time 0-100% step signal (depending on installation) **(2)**	[ms]	≤ 45
Hysteresis		≤ 1,5 [% of max pressure]
Linearity		≤ 3,0 [% of max pressure]
Repeatability		≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard		option /6	option /18
Max. solenoid current	2,4 A 1,8 A for /32 - max pressure 32 bar		3 A 2,25 A for /32 - max pressure 32 bar	1 A 0,8 A for /32 - max pressure 32 bar
Coil resistance R at 20°C	3 ÷ 3,3 Ω		2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

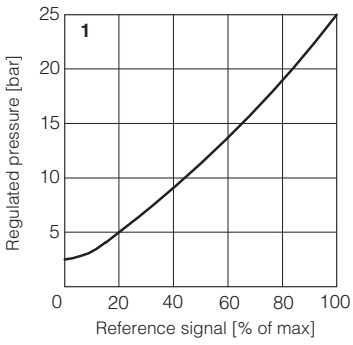
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog	
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5			
Hydraulic fluid	**Suitable seals type**		**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR		HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM		HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR		HFC	

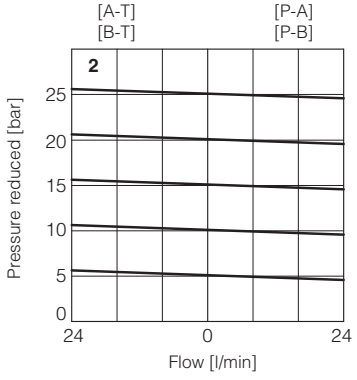
11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation



2 = Pressure/flow diagrams
reference signal set at Q = 1 l/min



12 HYDRAULIC OPTIONS

For configuration **010**:
B = reduced pressure on port B, solenoid at side of port A

For configuration **012**:
B = solenoid with on-board digital driver at side of port A (only for AEB and AES version)

13 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

14 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ

15 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) **Standard** and **/Q** option - for **AEB** and **AES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND / V0		Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) **/Z** option - for **AEB** and **AES**

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for **AEB** (B) and **AES** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

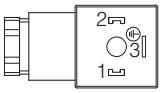
(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

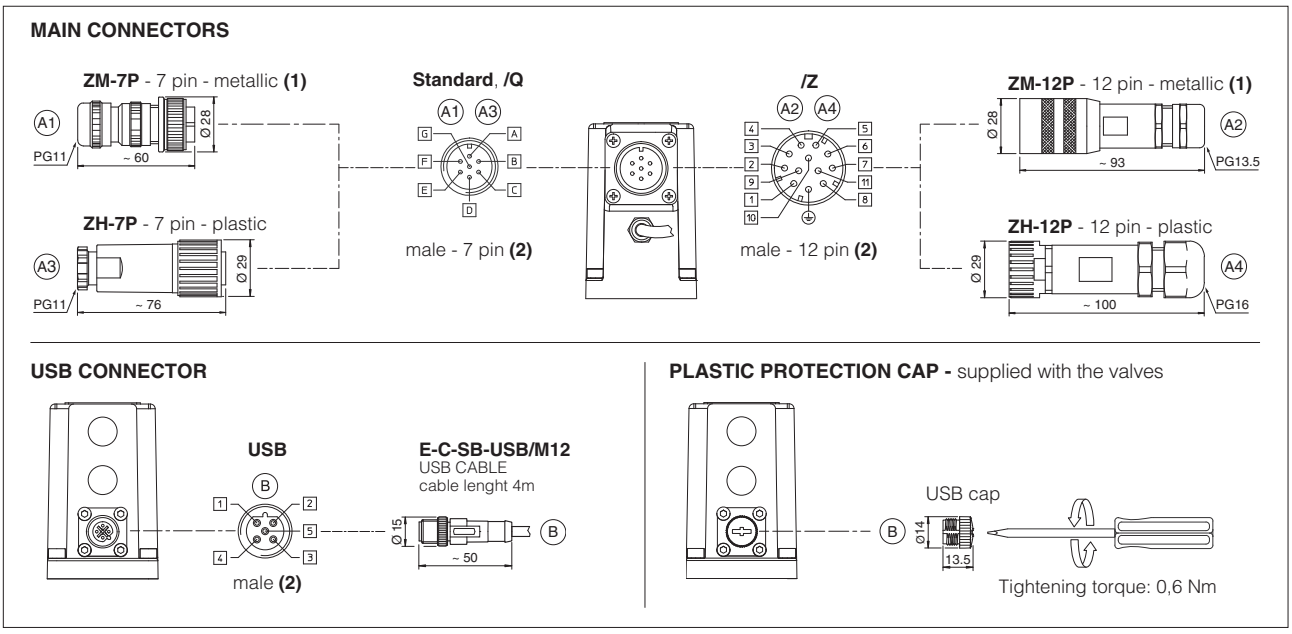
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

17.4 Solenoid connection - only for **A**

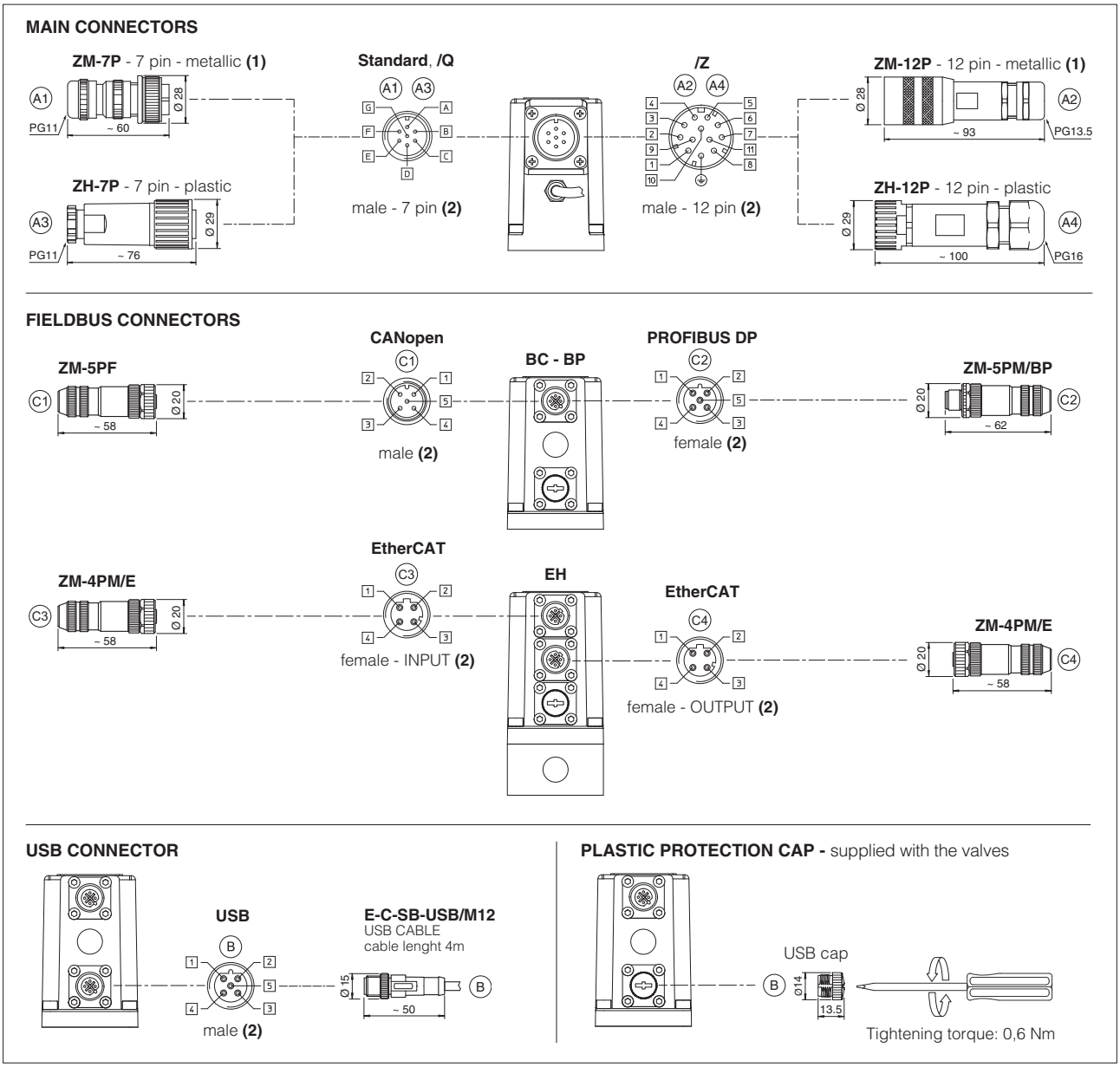
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

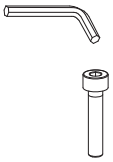
18.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 FASTENING BOLTS AND SEALS



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals:

4 OR 108

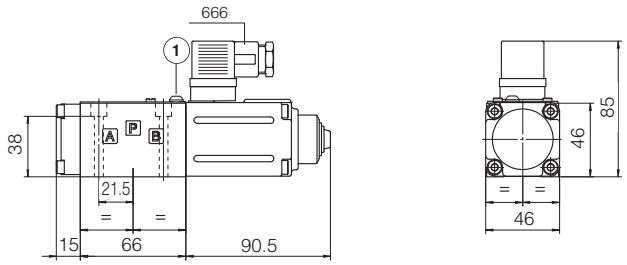
Diameter of ports P, A, T: Ø 7,5 mm

20 INSTALLATION DIMENSIONS [mm]

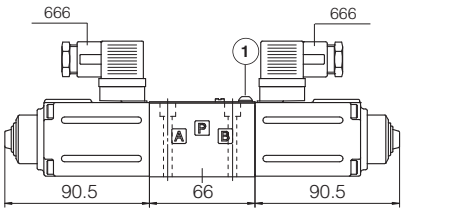
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
1,8	2,3	2,4

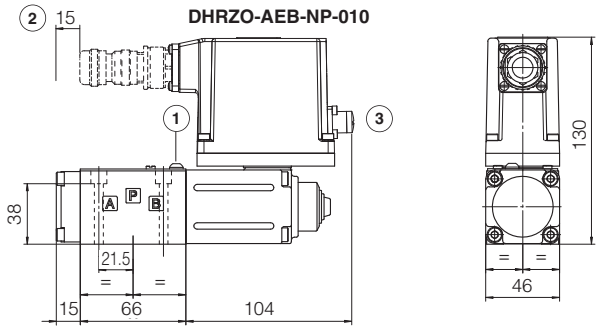
DHRZO-A-010



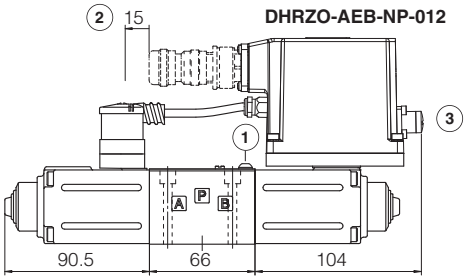
DHRZO-A-012



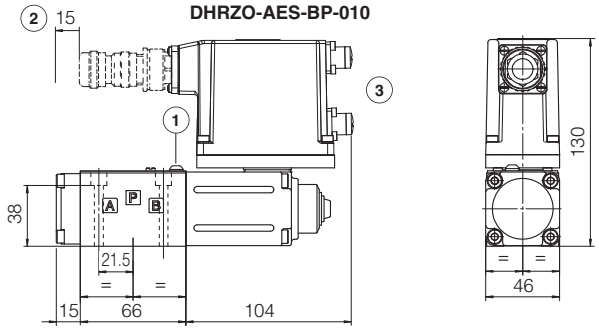
DHRZO-AEB-NP-010



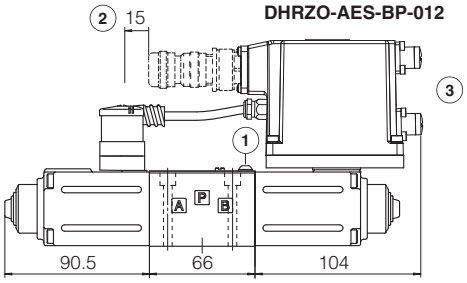
DHRZO-AEB-NP-012



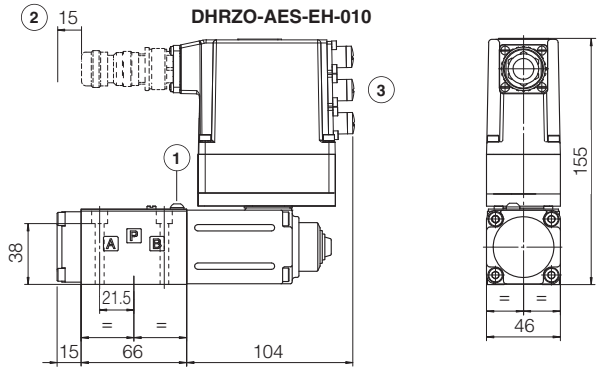
DHRZO-AES-BC-010
DHRZO-AES-BP-010



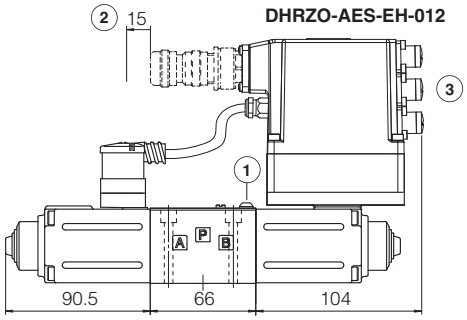
DHRZO-AES-BC-012
DHRZO-AES-BP-012



DHRZO-AES-EH-010



DHRZO-AES-EH-012



(1) = Air bleeding 3

(2) = Space to remove the connectors

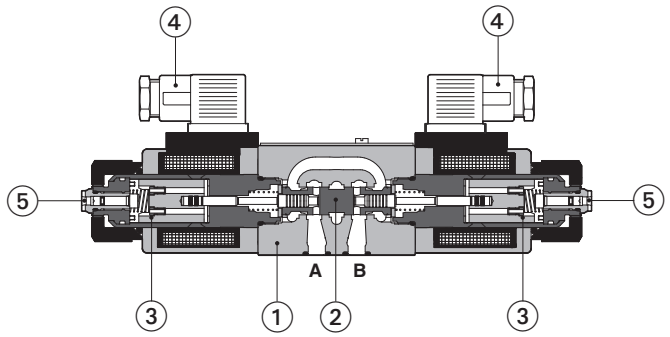
(3) = The dimensions of all connectors must be considered, see section 17.5 and 17.6

21 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB200	Quickstart for AEB valves commissioning
QF200	Quickstart for AES valves commissioning

Proportional reducing valves

3-way, direct, without transducer



DHRZE- A-012/25

① Valve body
② Spool
③ Proportional solenoid
④ Electric connector (supplied with the valve)
⑤ Bleeding screw

DHRZE-A

3 way, direct, pressure reducing valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

They provide the pressure reduction on ports A, or B or A and B, depending on the valve model.

The direct execution performs low internal leakages, fast response and low hysteresis.

The solenoids are certified according to North American standard **cURus.**

Typical applications:
- Pressure reduction in low flow systems
- Pilot stage of pilot operated valves

Size: **06** - ISO 4401
Max flow: **24 l/min**
Max pressure: **315 bar**
Max regulated pressure: **25 bar**

1 MODEL CODE

DHRZE	-	A	-	010	/	25	/	*	-	*	/	*	*	/	*

DHRZE — Proportional pressure reducing valve, direct

A = off-board driver, see section 3

Configuration:
010 = reduced pressure on port A (port B for option /B)
012 = reduced pressure on port A and B

Regulated pressure:
25 = reduced pressure range 3÷25 bar

Hydraulic option:
B = reduced pressure on port B, solenoid side of port A (only for valve configuration 010)

Series number

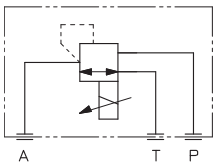
Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

Coil voltage, see section 10 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for 24VDC low current drivers **(1)**

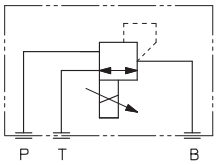
Coil with special connectors, see section 12 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

(1) Select valve's coil voltage **/18** in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

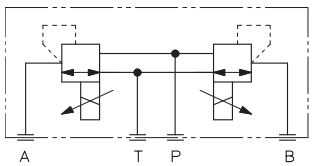
2 HYDRAULIC SYMBOL (representation according to ISO 1219-1)



DHRZE-A-010/25



DHRZE-A-010/25/B



DHRZE-A-012/25

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Valve model	**DHRZE**
Max regulated pressure (Q=1 l/min) [bar]	25
Min. regulated pressure (Q=1 l/min) **(1)** [bar]	3
Max. pressure at port P [bar]	315
Max. pressure at port T [bar]	210
Max. flow [l/min]	24
Response time 0-100% step signal **(2)** (depending on installation) [ms]	≤ 45
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3,0
Repeatability [% of the max pressure]	≤ 2,0

Notes: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	**cURus** North American Standard		

8 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

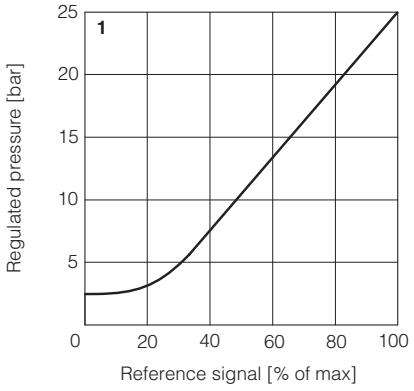
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 μm (β10 ≥75 recommended)		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

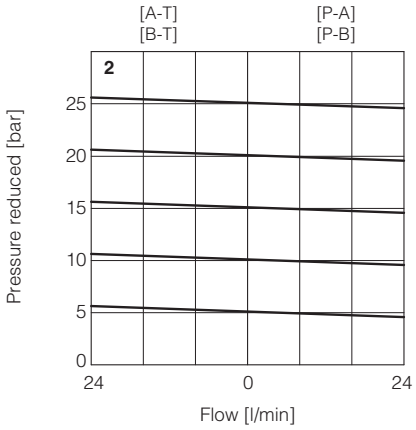
9 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

1 = Regulation diagrams
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation

2 = Pressure/flow diagrams
reference signal set at Q = 1 l/min





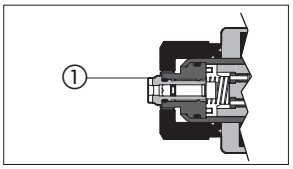
10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

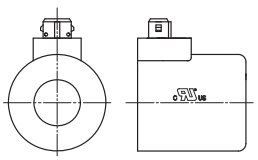
11 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

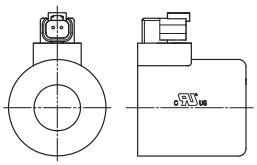


12 COILS WITH SPECIAL CONNECTORS

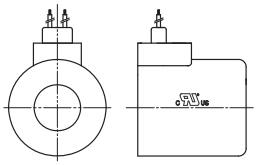
J option
Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



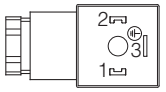
K option
Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67



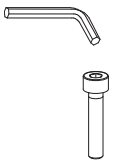
S option
Coil type COZES
Lead Wire connection
Cable lenght = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

14 FASTENING BOLTS AND SEALS FOR DHRZE



Fastening bolts:

4 socket head screws M5x30 class 12.9

Tightening torque = 8 Nm

Seals:

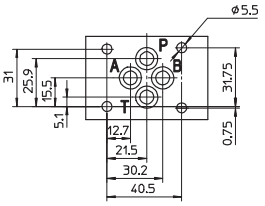
4 OR 108

Diameter of ports P, T, A: Ø 7,5 mm

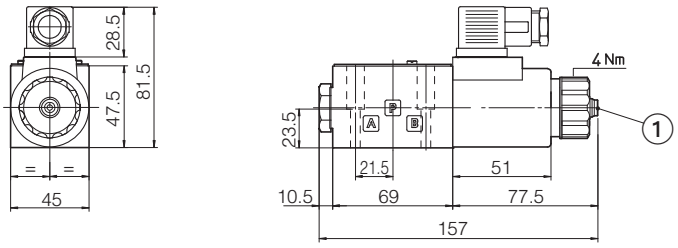
15 INSTALLATION DIMENSIONS FOR DHRZE [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

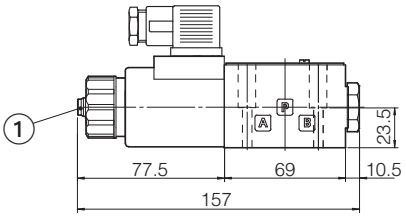
Mass [kg]	
DHRZE-A-010	1,9
DHRZE-A-012	2,6



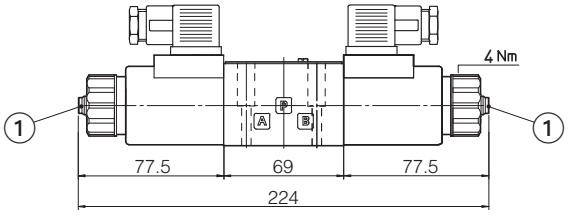
DHRZE-A-010



DHRZE-A-010/B



DHRZE-A-012



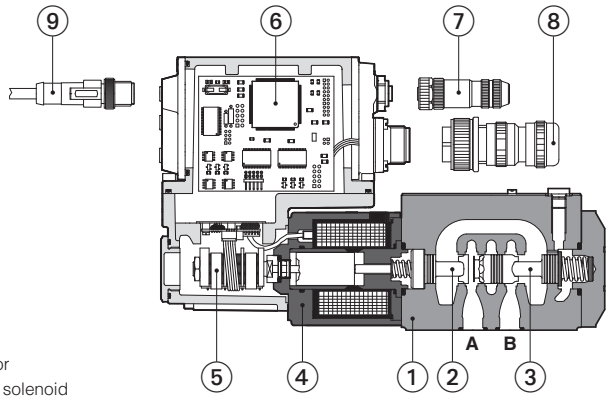
(1) = Air bleeding, see section 11 

16 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Digital proportional flow valves

direct, pressure compensated, with on-board driver and LVDT transducer



① Valve body
② Throttle
③ Compensator
④ Proportional solenoid
⑤ LVDT transducer
⑥ On-board digital driver
⑦ Communication connector
⑧ Main connector
⑨ USB connector

QVKZOR-TES-SN-BP

QVHZO-TEB, QVHZO-TES
QVKZOR-TEB, QVKZOR-TES

Proportional flow control valves, direct, pressure compensated, equipped with LVDT position transducer for best accuracy in flow regulations.

TEB basic execution with analog reference signal and USB port for software functional parameters setting.
TES full execution which includes also optional fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

QVHZO:	**QVKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZOR	-	TES	-	SN	-	NP	-	10	/	65	/	*	*	/	*

Proportional flow control valves, direct, pressure compensated
QVHZO = size 06
QVKZOR = size 10

TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

Alternated P/Q controls:
SN = none

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
06 = size 06 **10** = size 06

Max regulated flow:

QVHZO:		**QVKZOR**:
3 = 3,5 l/min	**36** = 35 l/min	**65** = 65 l/min
12 = 12 l/min	**45** = 45 l/min	**90** = 90 l/min
18 = 18 l/min		

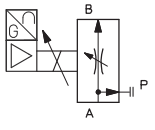
Electronic options (2):
I = current reference input and monitor 4÷20 mA (omit for std voltagea and monitor 0÷10 VDC)
F = fault signal
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector **(3)**

Series number

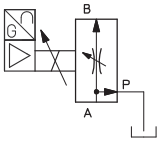
Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

(1) Only in version **SN-NP** **(2)** Possible combined options: /FI, /IQ, /IZ **(3)** Double power supply only for **TES**

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines
The port T must be always not connected (blocked)

For application examples of 2 and 3 way connections, see section 11

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

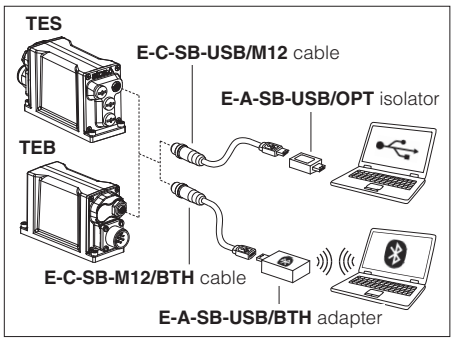
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for **TES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**QVHZO**					**QVKZOR**	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating Δp	[bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A	[l/min]	50				60	70	100
Max pressure	[bar]	210					210	
Response time 0÷100% step signal	[ms]	25					35	
Hysteresis	[% of the regulated max flow]	0,5					0,5	
Linearity	[% of the regulated max flow]	0,5					0,5	
Repeatability	[% of the regulated max flow]	0,1					0,1	
Thermal drift		zero point displacement < 1% at ΔT = 40°C						

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**QVHZO** = 2,6 A **QVKZOR** = 3 A			
Coil resistance R at 20°C	**QVHZO** = 3 ÷ 3,3 Ω **QVKZOR** = 3,8 ÷ 4,1 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 17			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

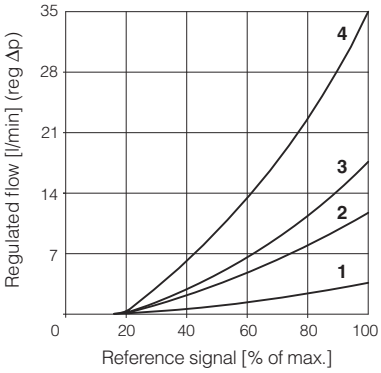
9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

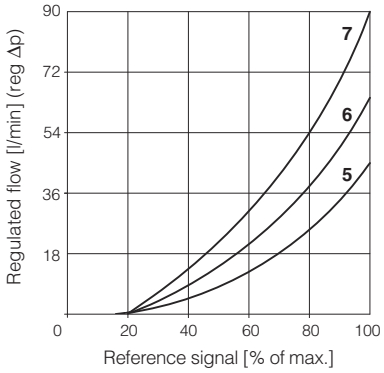
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

10 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

10.1 Regulation diagrams

1 = QVHZO-*-06**/3**
2 = QVHZO-*-06**/12**
3 = QVHZO-*-06**/18**
4 = QVHZO-*-06**/36**
5 = QVHZO-*-06**/45**
6 = QVKZOR-*-10**/65**
7 = QVKZOR-*-10**/90**



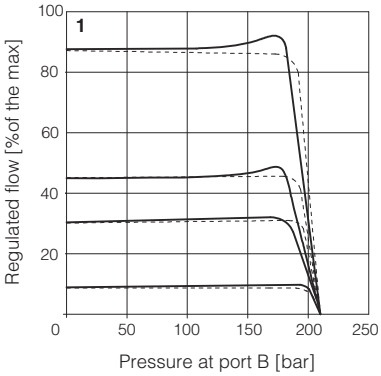


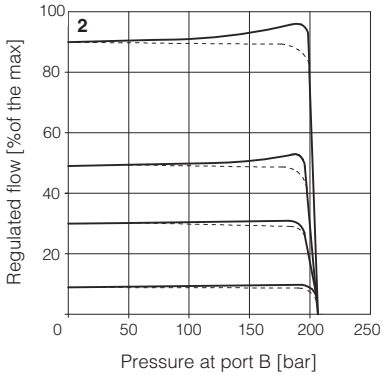
10.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

1 = QVHZO
2 = QVKZOR

Dotted line for 3-way versions

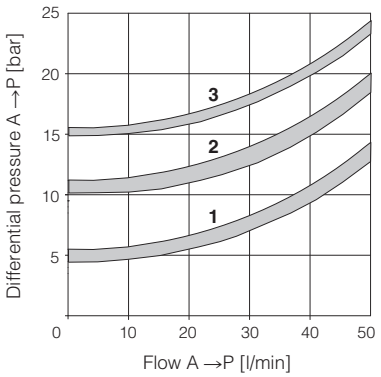


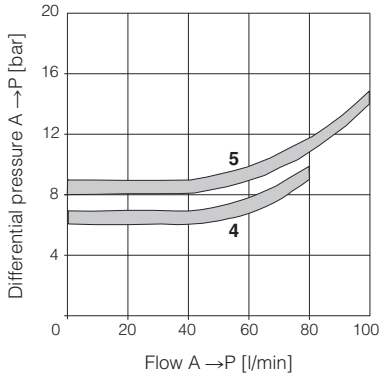


10.3 Flow A →P/Δp diagrams

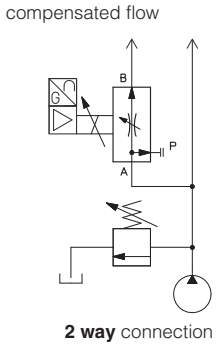
3-way configuration

1 = QVHZO-*-06**/3**
QVHZO-*-06**/12**
2 = QVHZO-*-06**/18**
QVHZO-*-06**/36**
3 = QVHZO-*-06**/45**
4 = QVKZOR-*-10**/65**
5 = QVKZOR-*-10**/90**

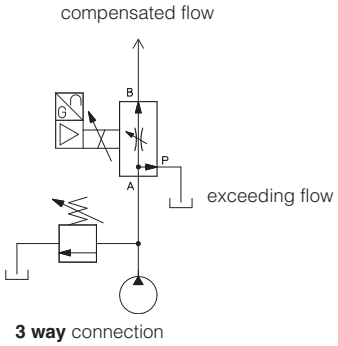




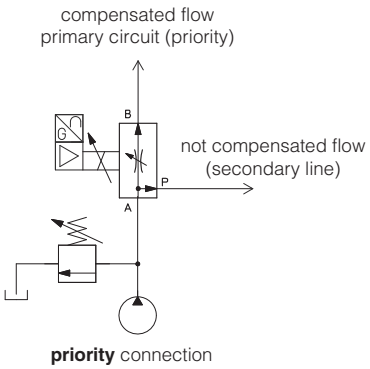
11 APPLICATIONS AND CONNECTIONS



2 way connection



3 way connection



priority connection

2 way connection
The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator.
The metered flow in the controlled line is kept constant, independently to the load variations
If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection
The 3 way connection is normally used when the valve directly controls the pump flow (main line)
The metered flow in the controlled line is kept constant, independently to the load variations
The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way)

Priority connection
The priority connection guarantees the pressure compensated flow supply to the primary circuit.
The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

12 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 14.7 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 14.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 14.6)
Power supply for driver's logics and communication - only for **TES** (see 14.2)

13 POSSIBLE COMBINED OPTIONS

/FI, /IQ, /IZ

14 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

14.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 14.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

14.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

14.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

14.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

14.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

14.6 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 14.5).

14.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

15 ELECTRONIC CONNECTIONS AND LEDS

15.1 Main connector signals - 7 pin - standard, **/F** and **/Q** options (A1)

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND V0			Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

15.2 Main connector signal - 12 pin - **/Z** option (A2)

PIN	TEB-SN /Z	TES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
	V+		Power supply 24 VDC	Input - power supply
1	**V0**		Power supply 0 VDC	Gnd - power supply
2 3	**ENABLE** referred to: V0 VL0		Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for Q_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND VL0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
7	**AGND**		Analog ground	Output - analog signal
		NC	Do not connect	Gnd - analog signal
8	**R_ENABLE**		Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
9	**NC**		Do not connect	
		VL+	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**NC**		Do not connect	
		VL0	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11 PE	**FAULT** referred to: V0 VL0		Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
	EARTH		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

15.3 Communications connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

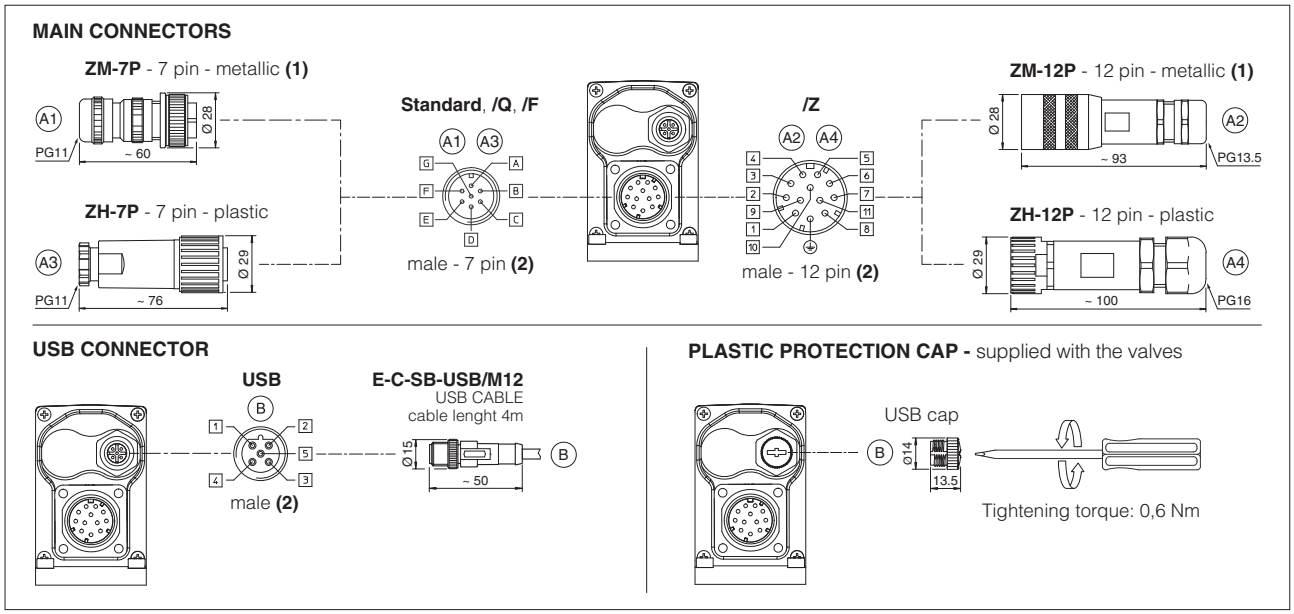
(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
	SHIELD	

(1) shield connection on connector's housing is recommended

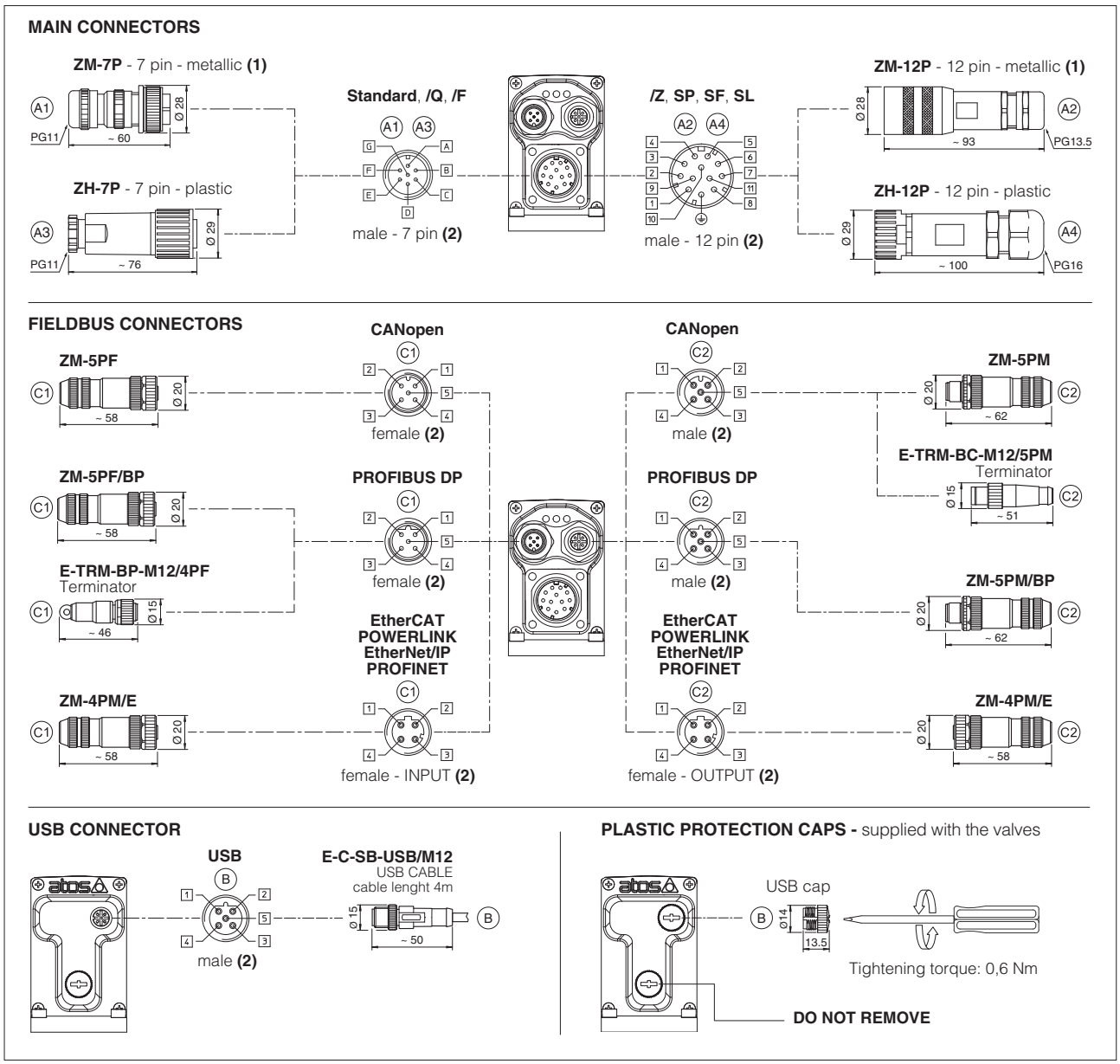
(2) Pin 2 can be fed with external +5V supply of CAN interface

15.4 TEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

15.5 TES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

15.6 Diagnostic LEDs - only for **TES**

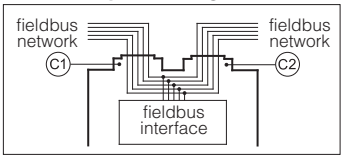
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

16 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



17 CONNECTORS CHARACTERISTICS - to be ordered separately

17.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

17.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

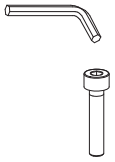
17.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

18 FASTENING BOLTS AND SEALS

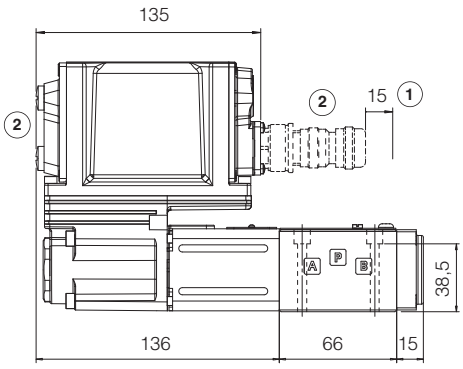
	QVHZO	QVKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

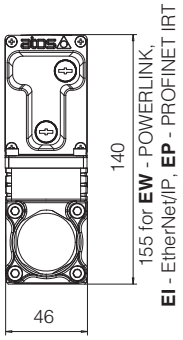
19 INSTALLATION DIMENSIONS [mm]

QVHZO-TEB, QVHZO-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZO-*	2,3

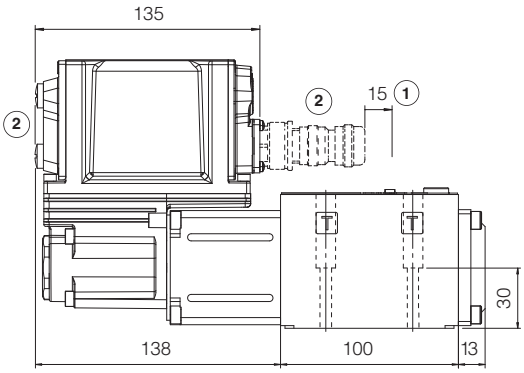


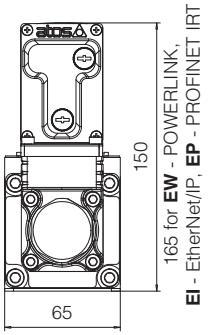


QVKZOR-TEB, QVKZOR-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZOR-*	4,3





Mass: 4,3 kg

(1) = Space to remove the connectors

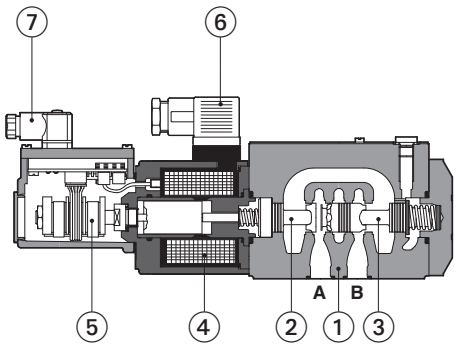
(2) = The dimensions of all connectors must be considered, see section 15.4 and 15.5

20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools	**QB300**	Quickstart for TEB valves commissioning
GS510	Fieldbus	**QF300**	Quickstart for TES valves commissioning

Proportional flow valves

direct, pressure compensated, with LVDT transducer



① Valve body
② Throttle
③ Compensator
④ Proportional solenoid
⑤ LVDT transducer
⑥ Solenoid connector
⑦ Transducer connector

QVKZOR-T-10/*

QVHZO-T, QVKZOR-T

Proportional flow control valves, direct, pressure compensated, equipped with LVDT position transducer for best accuracy in flow regulations.

The valves operate in association with digital off-board divers, see section [2].

The mechanical pressure compensator keeps a constant Δp across the proportional throttle, thus the regulated flow is independent to the load conditions.

The valves can be connected in 2-way or in 3-way, in this last the exceeding flow, not regulated from A to B ports, returns to tank trough the P port (3rd way).

QVHZO:	**QVKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZOR	-	T	-	10	/	65	/	*	/	*

QVKZOR

Proportional flow control valves, direct, pressure compensated

QVHZO = size 06
QVKZOR = size 10

T = with LVDT transducer

Valve size ISO 4401:
06 = size 06
10 = size 10

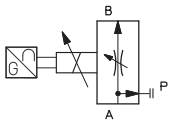
Max regulated flow:

QVHZO:		**QVKZOR**:
3 = 3,5 l/min	**36** = 35 l/min	**65** = 65 l/min
12 = 12 l/min	**45** = 45 l/min	**90** = 90 l/min
18 = 18 l/min		

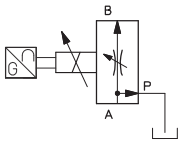
Series number

Seals material, see section [7]:
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines
The port T must be always not connected (blocked)

For application examples of 2 and 3 way connections, see section [9]

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**QVHZO**					**QVKZOR**	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating Δp	[bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A	[l/min]	50				60	70	100
Max pressure	[bar]	210					210	
Response time 0÷100% step signal	[ms]	25					35	
Hysteresis	[% of the regulated max flow]	0,5					0,5	
Linearity	[% of the regulated max flow]	0,5					0,5	
Repeatability	[% of the regulated max flow]	0,1					0,1	
Thermal drift		zero point displacement < 1% at ΔT = 40°C						

6 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	**QVHZO** = 2,6 A **QVKZOR** = 3 A
Coil resistance R at 20°C	**QVHZO** = 3 ÷ 3,3 Ω **QVKZOR** = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

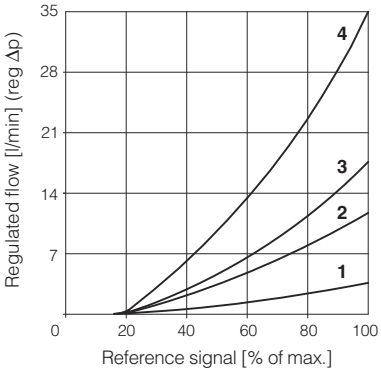
7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

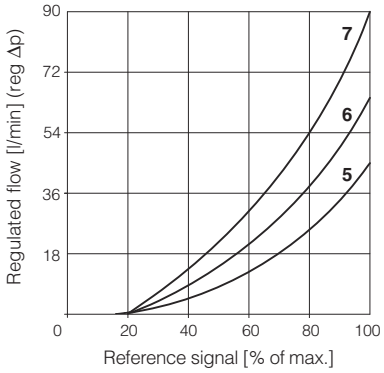
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

8 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

8.1 Regulation diagrams

1 = QVHZO-T-06**/3**
2 = QVHZO-T-06**/12**
3 = QVHZO-T-06**/18**
4 = QVHZO-T-06**/36**
5 = QVHZO-T-06**/45**
6 = QVKZOR-T-10**/65**
7 = QVKZOR-T-10**/90**

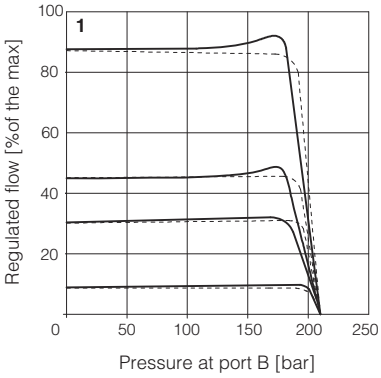


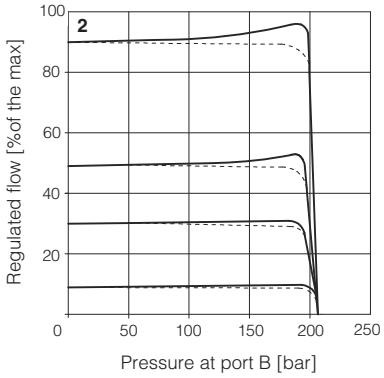


8.2 Regulated flow/outlet pressure diagrams
with inlet pressure = 210 bar

1 = QVHZO
2 = QVKZOR

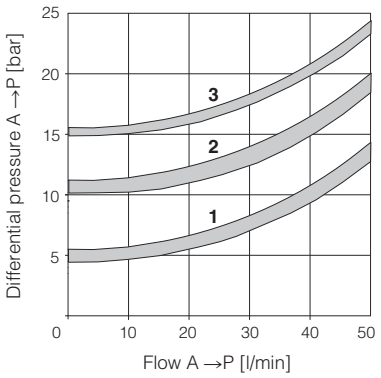
Dotted line for 3-way versions

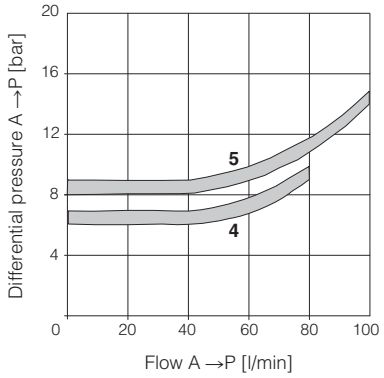




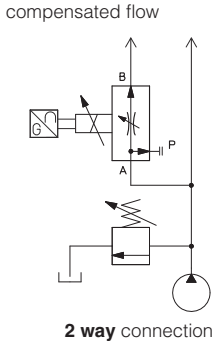
8.3 Flow A →P/Δp diagrams
3-way configuration

1 = QVHZO-T-06**/3**
QVHZO-T-06**/12**
2 = QVHZO-T-06**/18**
QVHZO-T-06**/36**
3 = QVHZO-T-06**/45**
4 = QVKZOR-T-10**/65**
5 = QVKZOR-T-10**/90**

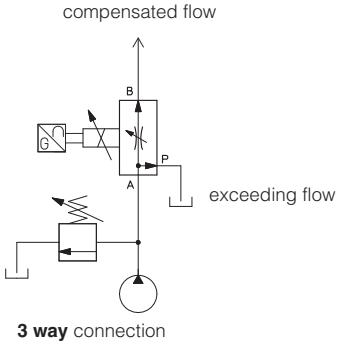




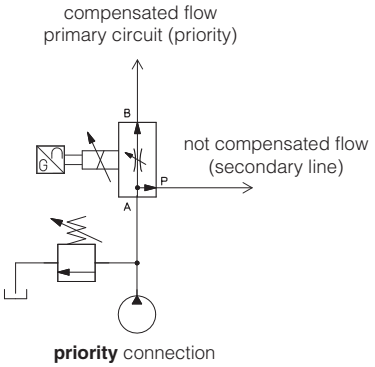
9 APPLICATIONS AND CONNECTIONS



2 way connection



3 way connection



priority connection

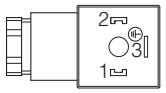
2 way connection
The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator.
The metered flow in the controlled line is kept constant, independently to the load variations
If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection
The 3 way connection is normally used when the valve directly controls the pump flow (main line)
The metered flow in the controlled line is kept constant, independently to the load variations
The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way)

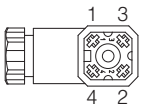
Priority connection
The priority connection guarantees the pressure compensated flow supply to the primary circuit.
The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

10 ELECTRICAL CONNECTION

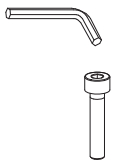
10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

11 FASTENING BOLTS AND SEALS

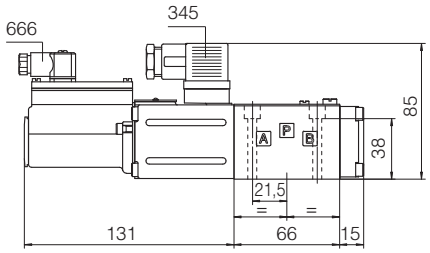
	QVHZO	QVKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

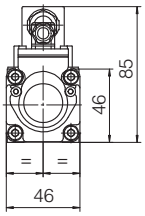
12 INSTALLATION DIMENSIONS [mm]

QVHZO-T

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZO-T	2,3

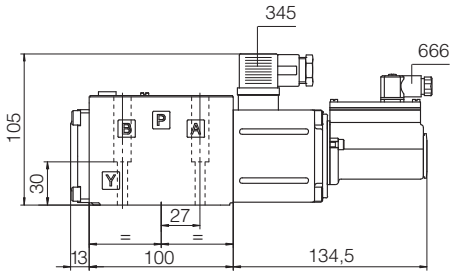


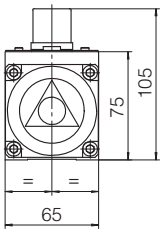


QVKZOR-T

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZOR-T	3,9



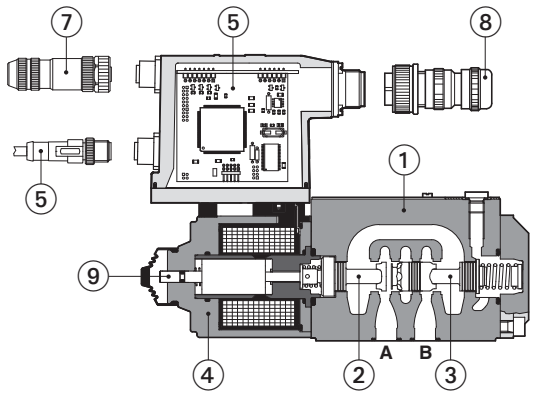


13 RELATED DOCUMENTATION

FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
GS230	E-BM-TEB digital driver	**GS510**	Fieldbus
GS235	E-BM-TID digital driver	**K800**	Electric and electronic connectors
GS240	E-BM-TES digital driver	**P005**	Mounting surfaces for electrohydraulic valves

Digital proportional flow valves

direct, pressure compensated, without transducer



QVKZOR-AES-BC

① Valve body
② Throttle
③ Compensator
④ Proportional solenoid
⑤ On-board digital driver
⑥ USB connector
⑦ Communication connector
⑧ Main connector
⑨ Standard manual override protected by rubber cap

QVHZO-A, QVHZO-AEB, QVHZO-AES
QVKZOR-A, QVKZOR-AEB, QVKZOR-AES

Proportional flow control valves, direct, pressure compensated without position transducer for open loop flow regulations.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

QVHZO:	**QVKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZOR	-	AES	-	BC	-	10	/	65	/	*	/	*	/	*	/	*

QVKZOR
Pressure compensated flow control valves, direct
QVHZO = size 06
QVKZOR = size 10

A = for off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 4401: **0** = 06 **1** = 10

Max regulated flow:
QVHZO:
3 = 3,5 l/min
12 = 12 l/min
18 = 18 l/min
36 = 35 l/min
45 = 45 l/min
QVKZOR:
65 = 65 l/min
90 = 90 l/min

Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

Coil voltage, only for **A** - see section 16 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

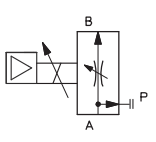
Hydraulic options (4):
D = quick venting of port B

Hand lever options, only for **QVHZO-A** - see section 13 :
MO = horizontal hand lever
MV = vertical hand lever

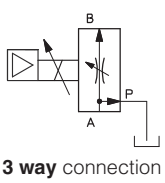
Electronics options, only for **AEB** and **AES (4)**:
C = current feedback for pressure transducer 4÷20 mA (omit for std voltage 0÷10 VDC) - only for **W**
I = current reference input 4÷20 mA (omit for std voltage ±10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector
W = power limitation function - 12 pin connector

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) For possible combined options, see section 15

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines
The port T must be always not connected (blocked)

For application examples of 2 and 3 way connections, see section 12

Note: hydraulic symbols are rapresented with on-board digital driver

3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

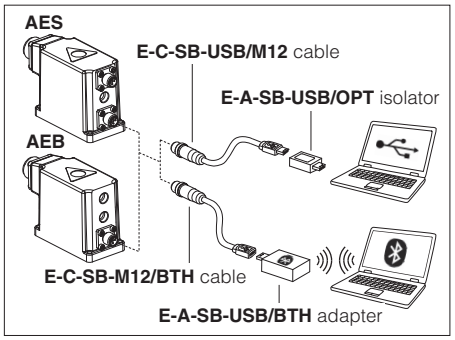
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		QVHZO					QVKZOR	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating Δp	[bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A	[l/min]	40			50	55	70	100
Max pressure	[bar]	210						
Response time 0-100% step signal	[ms]	≤ 30					≤ 45	
Hysteresis		≤ 5 [% of the regulated max flow]						
Linearity		≤ 3 [% of the regulated max flow]						
Repeatability		≤ 1 [% of the regulated max flow]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	QVHZO			QVKZOR		
	A = 30 W	**AEB**, **AES** = 50 W		**A** = 35 W	**AEB**, **AES** = 50 W	
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1,2 A	2,6 A	3,25 A	1,2 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω					
Monitor output	Output range: voltage ±5 VDC @ max 5 mA					
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ					
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)					
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Tropicalization	Tropical coating on electronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 19					

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

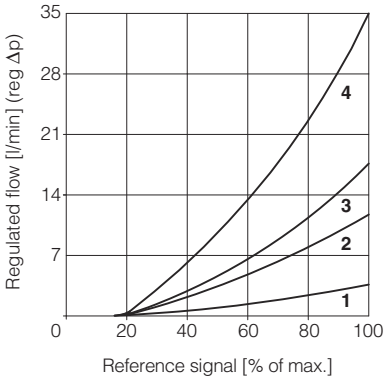
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

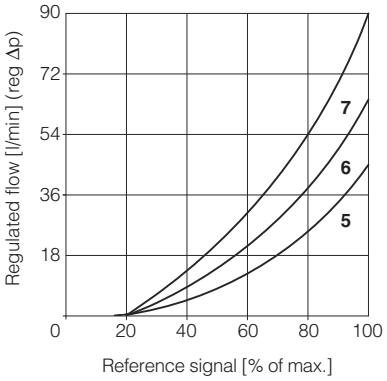
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

11.1 Regulation diagrams

1 = QVHZO-*-06**/3**
2 = QVHZO-*-06**/12**
3 = QVHZO-*-06**/18**
4 = QVHZO-*-06**/36**
5 = QVHZO-*-06**/45**
6 = QVKZOR-*-10**/65**
7 = QVKZOR-*-10**/90**



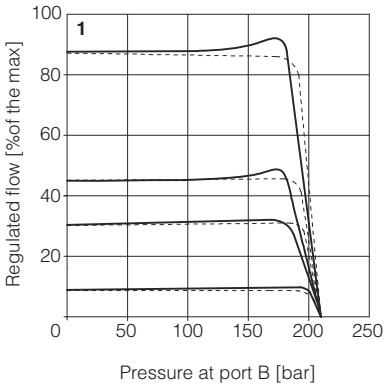


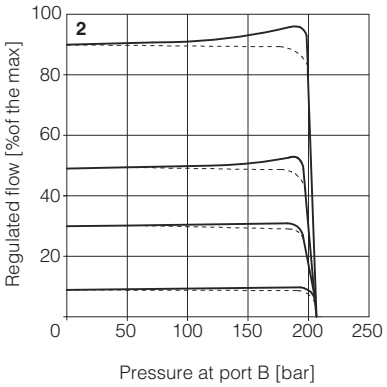
11.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

1 = QVHZO
2 = QVKZOR

Dotted line for 3-way versions

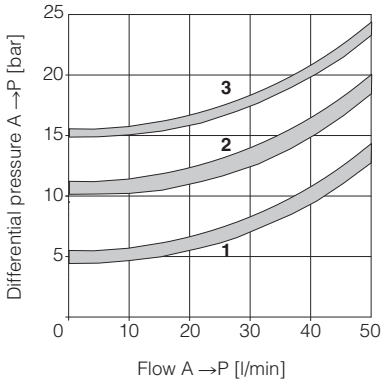


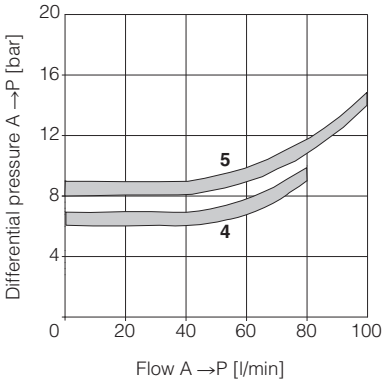


11.3 Flow A →P/Δp diagrams

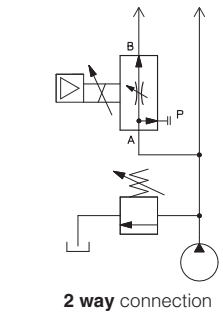
3-way configuration

1 = QVHZO-*-06**/3**
QVHZO-*-06**/12**
2 = QVHZO-*-06**/18**
QVHZO-*-06**/36**
3 = QVHZO-*-06**/45**
4 = QVKZOR-*-10**/65**
5 = QVKZOR-*-10**/90**

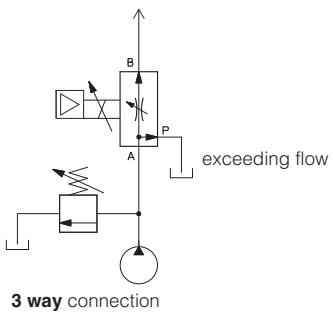




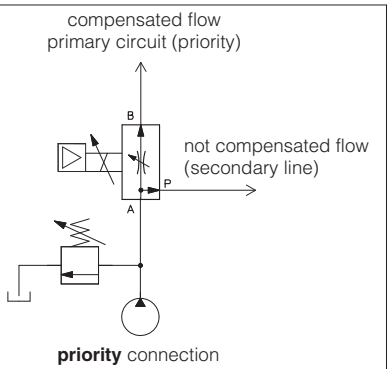
12 APPLICATIONS AND CONNECTIONS



2 way connection



3 way connection



priority connection

2 way connection
The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator.
The metered flow in the controlled line is kept constant, independently to the load variations.
If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection
The 3 way connection is normally used when the valve directly controls the pump flow (main line).
The metered flow in the controlled line is kept constant, independently to the load variations.
The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way).

Priority connection
The priority connection guarantees the pressure compensated flow supply to the primary circuit.
The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

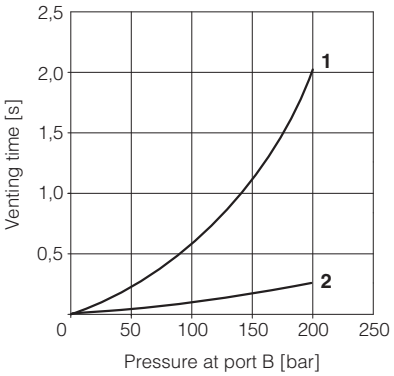
13 HYDRAULIC OPTIONS

D = This option provides a quick venting of the use port B when the valve is closed or de-energized.
The valve must be connected in 3 way, with P port connected to tank.
When the proportional throttle is fully closed, the valve's port B is internally connected to port P (tank), permitting a quickly decompression of the pressure in the use line.

In the diagram aside are represented the venting times of **QVHZO** and **QVKZOR** with option /D respect to standard versions:

1 = standard version

2 = option /Q

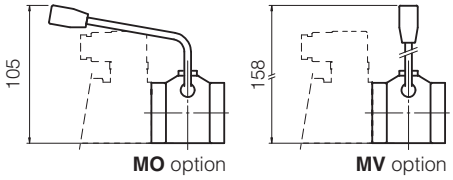


Hand lever option - only for **QVHZO-A**

It allows to operate the valve in absence of electrical power supply.
For detailed description of QVHZO-A with hand lever option see tech. table **E138**.

MO = Horizontal hand lever

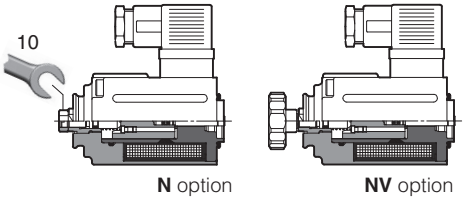
MV = Vertical hand lever



The following supplementary options allow to operate **QVHZO-A** and **QVKZOR-A** in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see tech. table **TK150**

N = Manual micrometric adjustment

NV = As option /N plus handwheel and graduated scale



14 ELECTRONICS OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

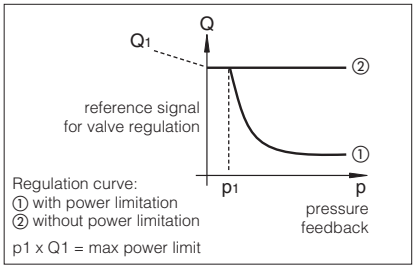
C = Only in combination with option **/W**
This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator, see tech table **D150**.

It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR.
When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve.
The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} \; ; \; \text{Flow Reference [INPUT+]} \right)$$

Hydraulic Power Limitation - only for option **/W**



15 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible
Electronics options: /IQ, /IZ, /IW, /CW, /CWI

16 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** and **/W** options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for **/Z** and **/W** options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

17.7 Remote pressure transducer input signal (TR+) - only for **/W** option

Analog pressure transducers can be directly connected to the driver (see 18.4).
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND | V0		Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**		Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**		Do not connect	
8	**NC**		Do not connect	
		MONITOR2	2nd monitor output signal: ±5 VDC maximum range, referred to VL0. Default is 0 ÷ 5 VDC	Output - analog signal
9	**VL+**		Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**		Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

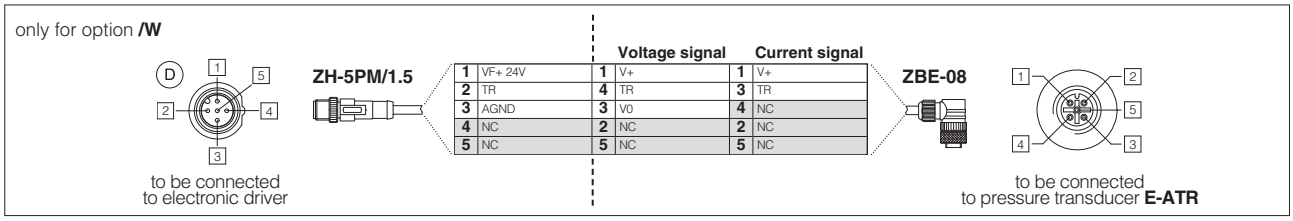
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

18.4 Remote pressure transducer connector - M12 - 5 pin - only for **/W** option - for **AEB** and **AES** (D)

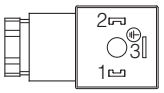
PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Connect	Connect
2	**TR**	Signal transducer maximum range ±10 VDC / ±20 mA, software selectable Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Connect	Connect
3	**AGND**	Common GND for transducer power and signals	Connect	/
4	**NC**	Not Connect	/	/
5	**NC**	Not Connect	/	/

Remote pressure transducer connection - example



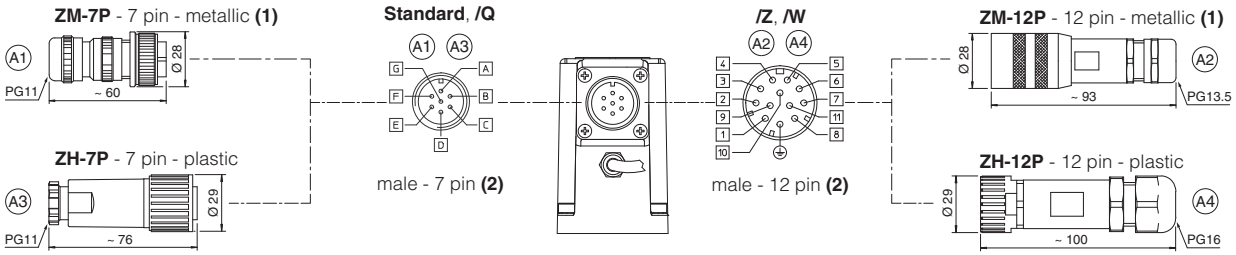
Note: connectors front view

18.5 Solenoid connection - only for **A**

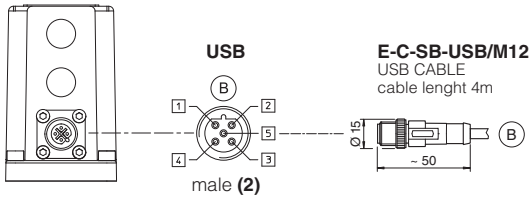
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.6 AEB connections layout

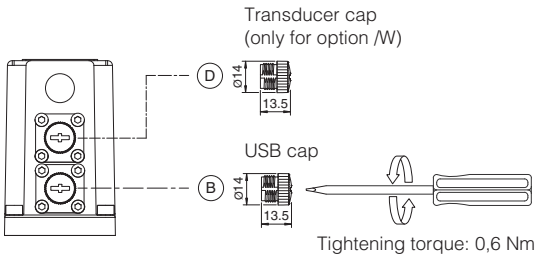
MAIN CONNECTORS



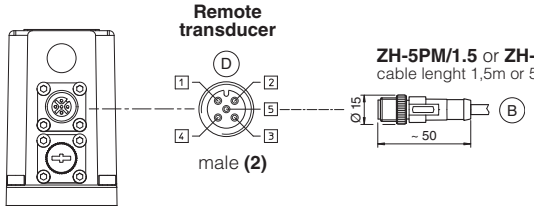
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



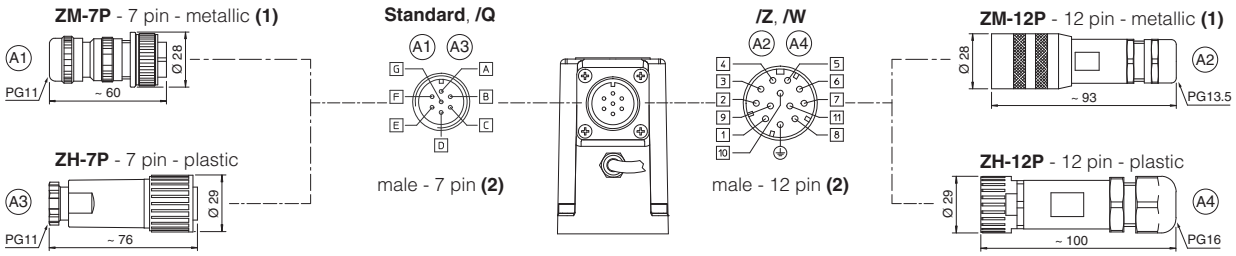
TRANSDUCER CONNECTOR - only for option **/W**



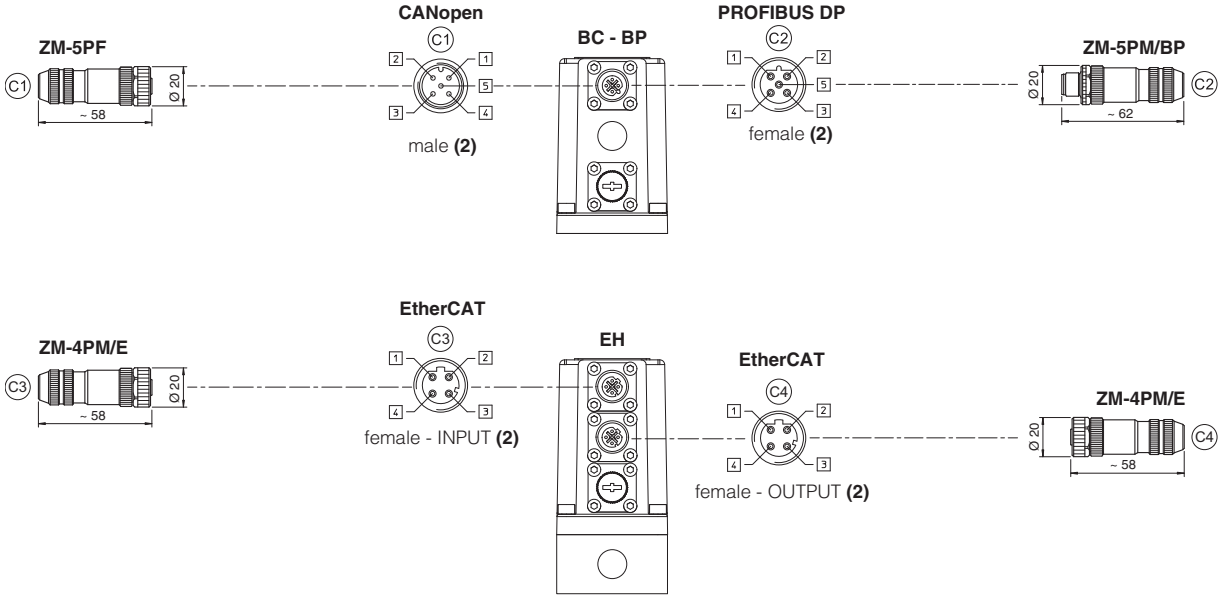
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 AES connections layout

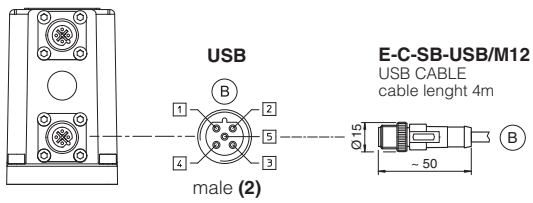
MAIN CONNECTORS



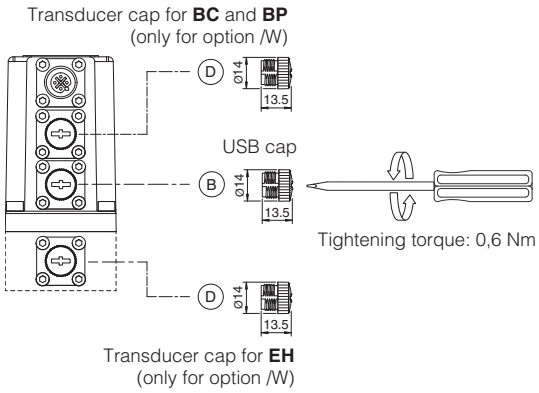
FIELDBUS CONNECTORS



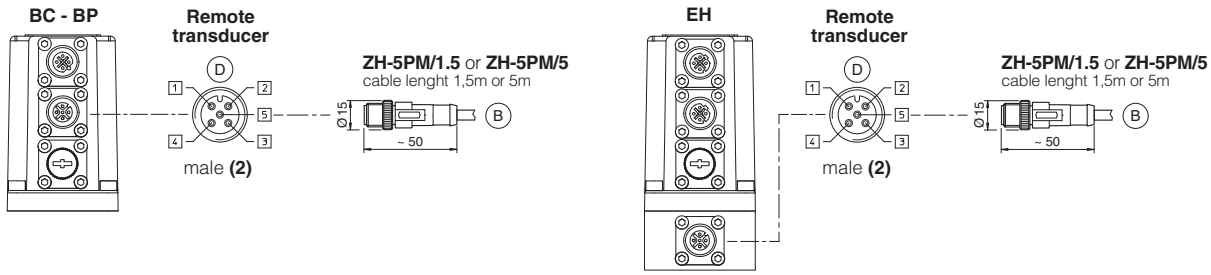
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option /W



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

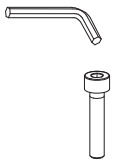
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19.4 Pressure transducer connectors - only for **/W** option

CONNECTOR TYPE	TRANSDUCER	
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm²	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

20 FASTENING BOLTS AND SEALS

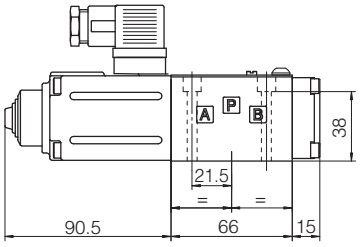
	QVHZO	QVKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm	**Seals:** 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm

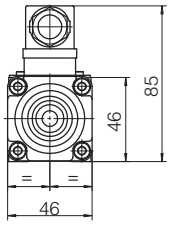
21 INSTALLATION DIMENSIONS FOR QVHZO [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

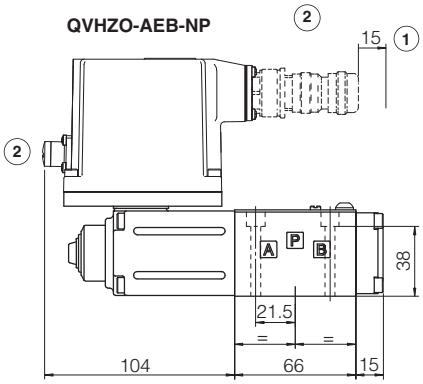
Mass [kg]		
A	**AEB, AES**	**AES-EH**
2,3	2,8	2,9

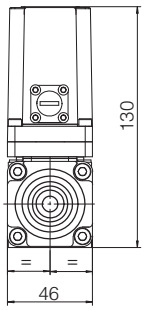
QVHZO-A



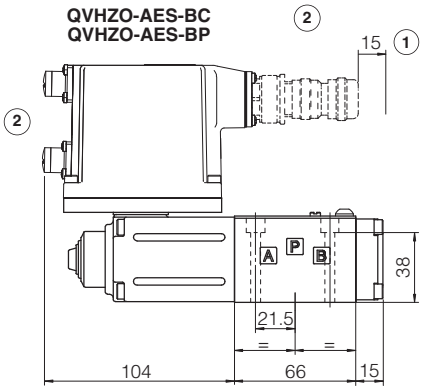


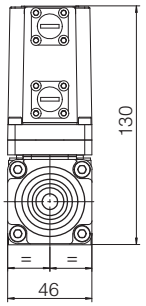
QVHZO-AEB-NP



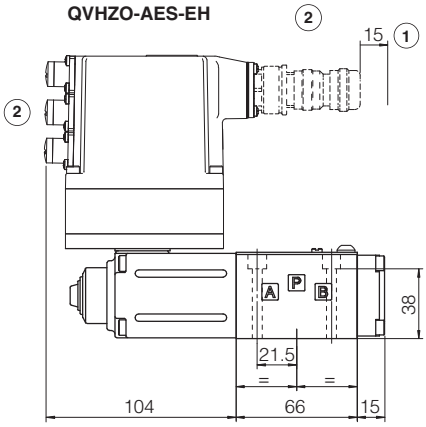


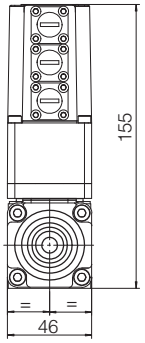
QVHZO-AES-BC
QVHZO-AES-BP





QVHZO-AES-EH





(1) = Space to remove the connectors

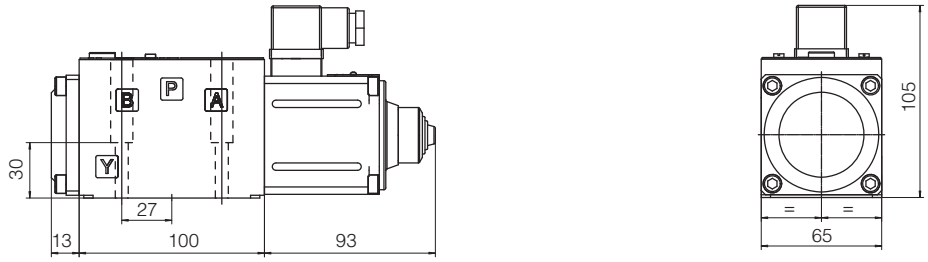
(2) = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 INSTALLATION DIMENSIONS FOR QVHZOR [mm]

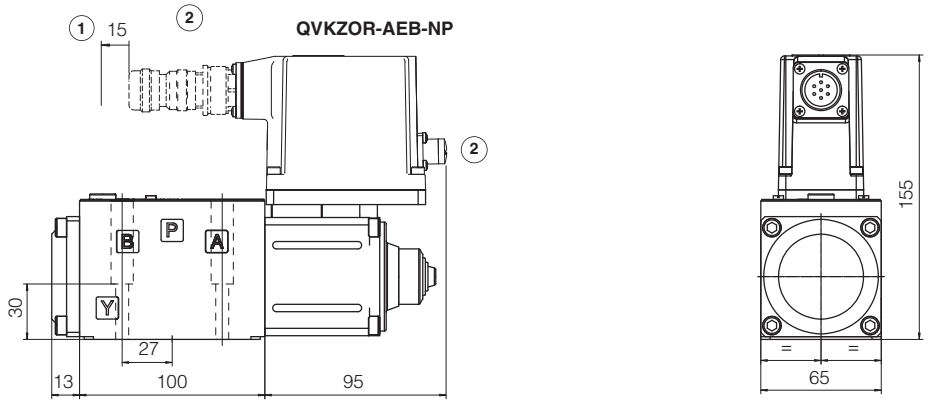
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
3,8	4,3	4,4

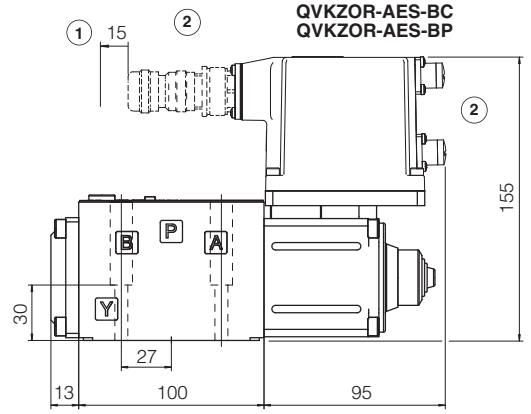
QVKZOR-A



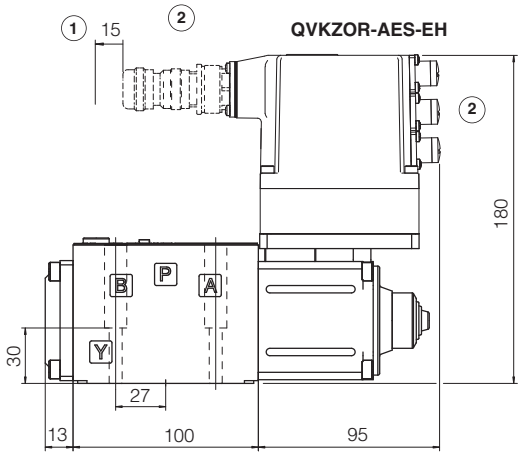
QVKZOR-AEB-NP



QVKZOR-AES-BC
QVKZOR-AES-BP



QVKZOR-AES-EH



(1) = Space to remove the connectors

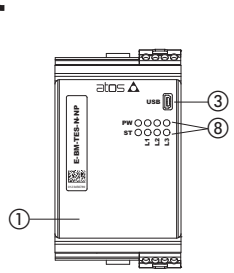
(2) = The dimensions of all connectors must be considered, see section 18.6 and 18.7

23 RELATED DOCUMENTATION

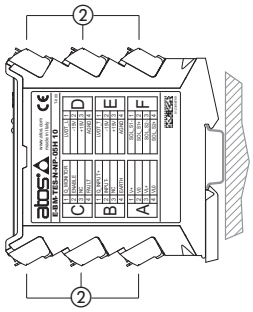
FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB200	Quickstart for AEB valves commissioning
QF200	Quickstart for AES valves commissioning

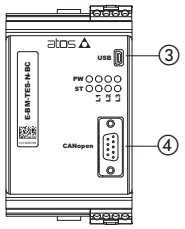
Digital E-BM-TES/LES drivers

DIN-rail format, for proportional valves with one or two LVDT transducers

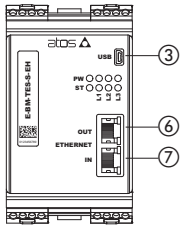


E-BM-TES-N- **NP** Not Present

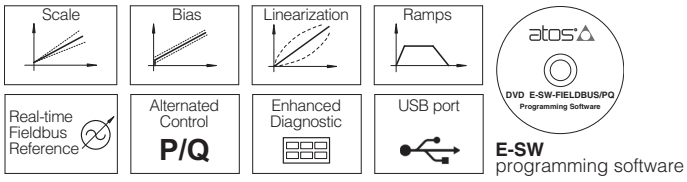




E-BM-TES-N- **BC** CANopen
BP PROFIBUS DP



E-BM-TES-S- **EH** EtherCAT
EW POWERLINK
EI EtherNet/IP
EP PROFINET RT/IRT



E-SW
programming software

Connectors ② included

E-BM-TES/LES

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.
TES execution controls direct operated directional/flow valves with one LVDT transducer.
LES execution controls pilot operated directional valves with two LVDT transducers.
Option S adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation (see section 4).
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- up to 9 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 6.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM	- TES -	N	- NP	- 01H	* / *	* / *

E-BM — Off-board electronic driver in DIN rail format

TES = digital full driver, for valves with one LVDT transducer
LES = digital full driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none
S = closed loop pressure/force (see tech table **FS500**)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen **EW** = POWERLINK
BP = PROFIBUS DP **EI** = EtherNet/IP
EH = EtherCAT **EP** = PROFINET RT/IRT

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TES**)

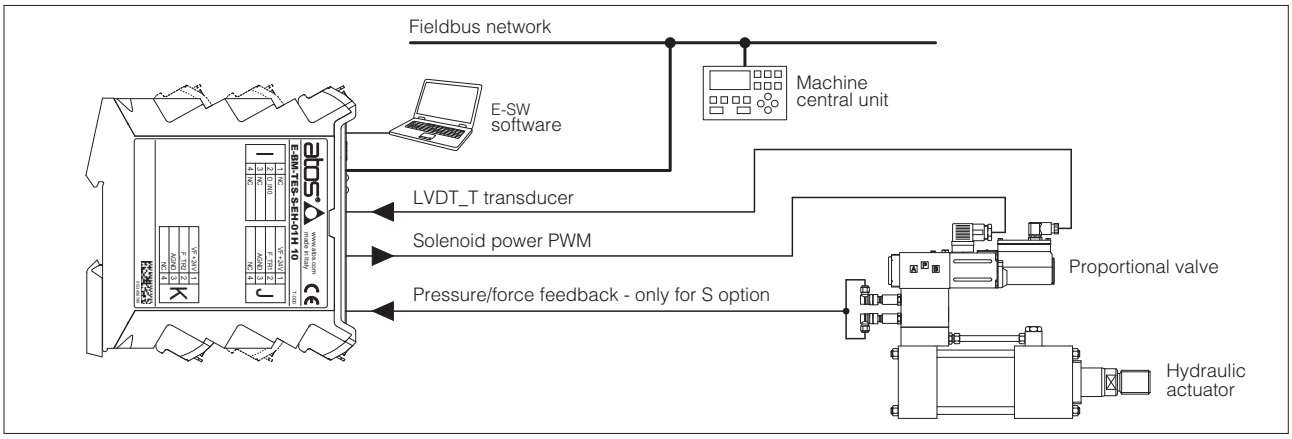
- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TES-N**)

Options, see section 6 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for remote transducers (only for option **S**) and LVDT transducers (only for option **A**)
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 VDC)

Series number

Set code (see section 7)

2 BLOCK DIAGRAM EXAMPLE



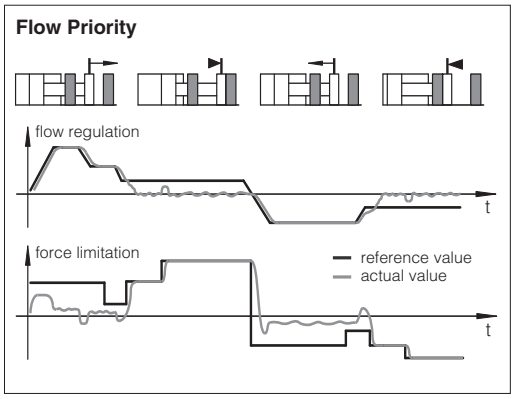
3 VALVES RANGE

Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	**DHZO-T, DKZOR-T** F165, F168	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F412	**DPZO-L** F175, F178	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Tech table	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	**LIQZA-L** FX350, FX370
Driver model	**E-BM-TES**				**E-BM-LES**	

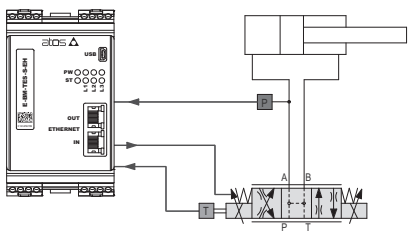
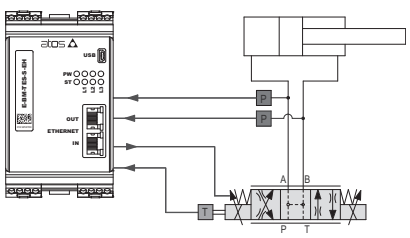
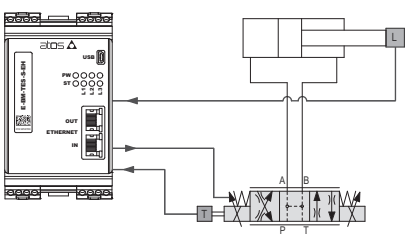
Option S not available

4 ALTERNATED P/Q CONTROL - only for **S** option

S option on digital drivers adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation.
The alternated P/Q control operates according to the two electronic reference signals by a dedicated algorithm that automatically selects which control will be active time by time.
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations.
Flow regulation is active when the actual system pressure/force is lower than the relevant input reference signal - the valve works normally to regulate the flow by controlling in closed-loop the spool/poppet position through the integral LVDT transducer.
Pressure/force control is activated when the actual system pressure/force, measured by remote transducers, grows up to the relevant input reference signal - the driver reduces the valve's flow regulation in order to keep steady the system pressure/force.
If the pressure/force tends to decrease under its input reference signal, the flow control returns active.
The dynamic response of pressure/force control can be adapted to different system's characteristics, by setting the internal PID parameters using Atos PC software.
Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.



Alternated control configurations - software selectable

SP	SF	SL
		
one remote pressure transducer has to be installed on the actuator's port to be controlled	two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve's spool transducer P pressure transducer L load cell

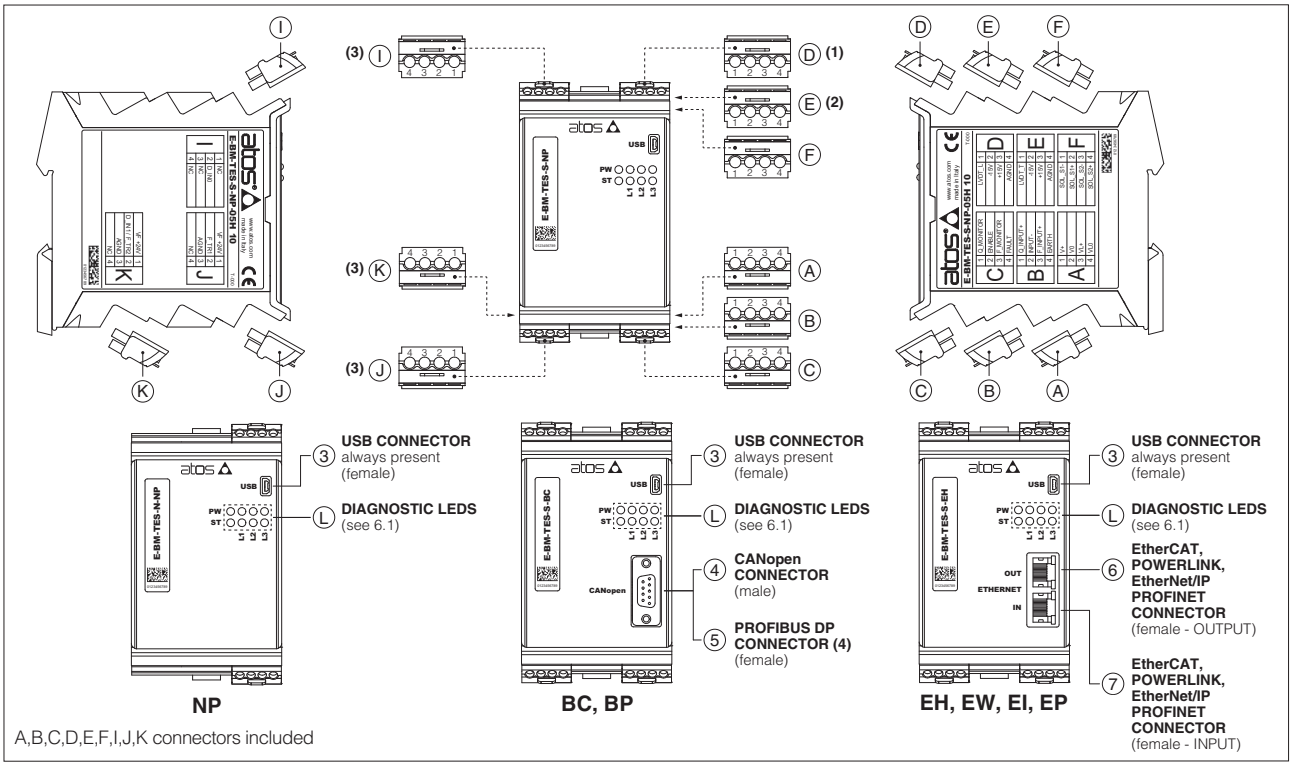
SP – flow/pressure control
Adds pressure control to standard flow control and permits to limit the max force in one direction controlling in closed loop the pressure acting on one side of the hydraulic actuator. A single pressure transducer has to be installed on hydraulic line to be controlled.
SF – flow/force control
Adds force control to standard flow control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.
SL – flow/force control
Adds force control to standard flow control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.
General Notes:
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **FS500**
- Atos technical service is available for additional evaluations related to specific applications usage

5 MAIN CHARACTERISTICS

Power supplies (see 8.1, 8.2)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Current supplied to solenoids	IMAX = 3.0 A for standard driver IMAX = 2.5 A for ex-proof driver (**/A option**)			
Analog input signals (see 8.3, 8.4)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs (see 8.5, 8.6)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input (see 8.7) Digital inputs (see 8.11)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output (see 8.8)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Pressure/Force transducers power supply (only for S option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +50 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 400 g			
Additional characteristics	8 leds for diagnostic; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet			
Max conductor size (see 12)	2,5 mm²			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

6 CONNECTIONS AND LEDS



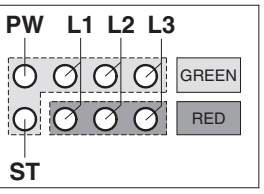
A,B,C,D,E,F,I,J,K connectors included

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I , J and K connectors are available only for TES-S and LES-S
(4) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector:
DG909MF1 - the connector will be oriented upwards
DG909MF3 - the connector will be oriented downwards

6.1 Diagnostic LEDs (L)

Eight leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET
L1	VALVE STATUS			LINK/ACT			
L2	NETWORK STATUS			NETWORK STATUS			
L3	SOLENOID STATUS			LINK/ACT			
PW	OFF = Power supply OFF		ON = Power supply ON				
ST	OFF = Fault present		ON = No fault				

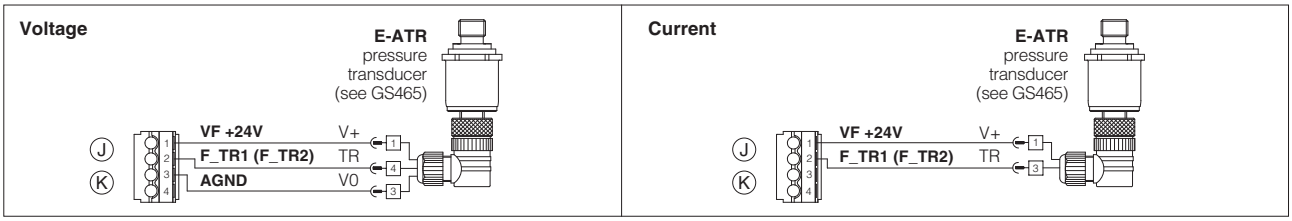


6.2 Connectors - 4 pin

CONNECTOR	PIN	ALTERNATED P/Q CONTROL **N** none / **S** pressure/force	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 8.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 8.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 VDC for driver's logic and communication (see 8.2)	Input - power supply
	A4	**VL0**	Power supply 0 VDC for driver's logic and communication (see 8.2)	Gnd - power supply
B	B1	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.3)	Input - analog signal **Software selectable**
	B2	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	B3	**NC**	Do not connect	
		F_INPUT+	Pressure/Force reference input signal ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.4)	Input - analog signal **Software selectable**
	B4	**EARTH**	Connect to system ground	
C	C1	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND. Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.5)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the controller, referred to VL0 (see 8.7)	Input - on/off signal
	C3	**NC**	Do not connect	
		F_MONITOR	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.6)	Output - analog signal **Software selectable**
	C4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 8.8)	Output - on/off signal
D (1)	D1	**LVDT_L**	Main stage valve position transducer signal (see 8.9)	Input - analog signal
	D2	**-15V**	Main stage valve position transducer power supply -15V	Output power supply
	D3	**+15V**	Main stage valve position transducer power supply +15V	Output power supply
	D4	**AGND**	Common gnd for transducer power and monitor outputs	Common gnd
E (2)	E1	**LVDT_T**	Direct valve or pilot valve position transducer signal (see 8.9)	Input - analog signal
	E2	**-15V**	Direct valve or pilot valve position transducer power supply -15V	Output power supply
	E3	**+15V**	Direct valve or pilot valve position transducer power supply +15V	Output power supply
	E4	**AGND**	Common gnd for transducer power and monitor outputs	Common gnd
F	F1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	F2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	F3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	F4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM
I	I1	**NC**	Do not connect	
	I2	**D_IN0**	NP execution: multiple pressure/force PID selection, referred to VL0 (see 8.11) Fieldbus execution: general purpose digital input 0 ÷ 24VDC, referred to VL0 (see 8.11)	Input - on/off signal
	I3	**NC**	Do not connect	
	I4	**NC**	Do not connect	
J	J1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	J2	**F_TR1**	1st signal pressure/force transducer: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /C option (see 8.10)	Input - analog signal **Software selectable**
	J3	**AGND**	Common gnd for transducer power and signals	Common gnd
	J4	**NC**	Do not connect	
K	K1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	K2	**F_TR2**	2nd signal pressure transducer (only for SF): ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /C option (see 8.10)	Input - analog signal **Software selectable**
		D_IN1	NP execution: multiple pressure/force PID selection (only for SP and SL), referred to VL0 (see 8.11) Fieldbus execution: general purpose digital input 0 ÷ 24VDC, referred to VL0 (see 8.11)	Input - on/off signal
	K3	**AGND**	Common gnd for transducer power and signals	Common gnd
	K4	**NC**	Do not connect	

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*

6.3 Pressure/force transducers connection - example - only for **S** option



6.4 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥ ⑦ **EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

(1) shield connection on connector's housing is recommended

7 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

8 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

8.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

8.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

8.3 Flow reference input signals (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve's spool position.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

8.4 Pressure or force reference input signal (F_INPUT+) - only for **S** option

Functionality of pressure or force input reference signal (pin B3), is used as reference for the driver pressure/force closed loop, see section 4 .
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

8.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

8.6 Pressure or force monitor output signal (F_MONITOR) - only for **S** option

The driver generates an analog output signal (C3) proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA

8.7 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as digital input by software selection.

8.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the status of the Enable input signal.
Fault output signal can be used as digital output by software selection.

8.9 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 VDC supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

8.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - only for **S** option

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

8.11 Multiple PID selection or digital input signals (D_IN0 and D_IN1) - only for **S** option

Two on-off input signals are available on the connectors I and K.
For NP executions pin I2 and/or pin K2 are used to select one of the four pressure (force) PID parameters setting, stored into the driver. Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.). Supply a 24 VDC or a 0 VDC on pin I2 and/or pin K2, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.
For fieldbus executions pin I2 and/or K2 can be used as generic purpose on-off input signals.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
I2	0	24 VDC	0	24 VDC
K2	0	0	24 VDC	24 VDC

8.12 Possible combined options: /AC, **/AI**, **/ACI**, **/CI** - combined options **/CI** is available only for E-BM-TES/LES-S.

9 VALVE SETTINGS AND PROGRAMMING TOOLS

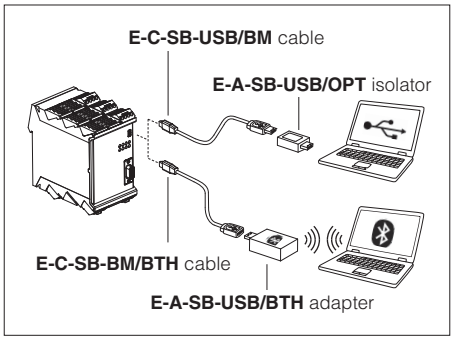
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

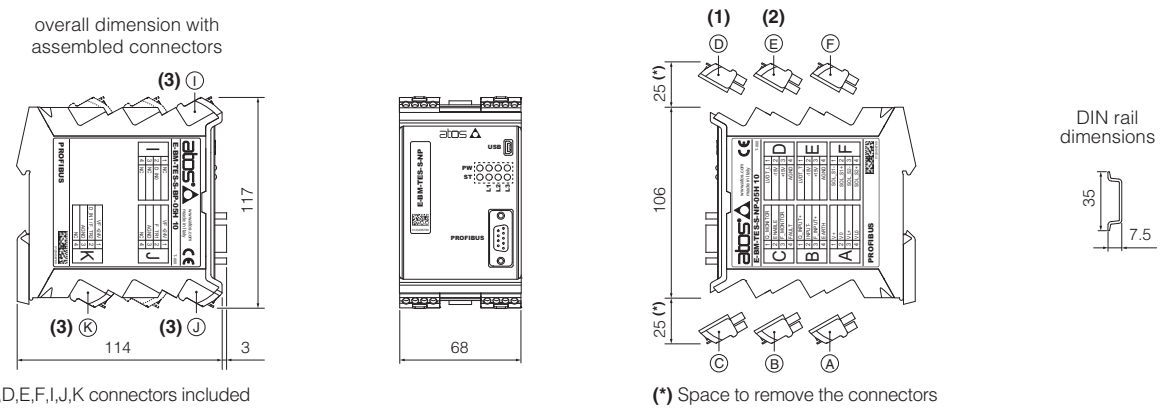
10 MAIN SOFTWARE PARAMETER SETTINGS

For basic information about main setting parameters by E-SW programming software, see tech table **FS900**

For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-LES - user manual for **E-BM-TES-N** and **E-BM-LES-N** digital drivers
E-MAN-BM-LES-S - user manual for **E-BM-TES-S** and **E-BM-LES-S** digital drivers

11 OVERALL DIMENSIONS [mm]



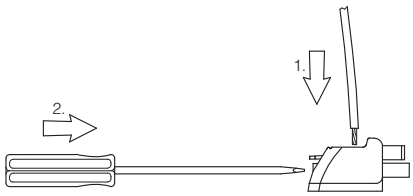
A,B,C,D,E,F,I,J,K connectors included

(*) Space to remove the connectors

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I , J and K connectors are available only for TES-S and LES-S

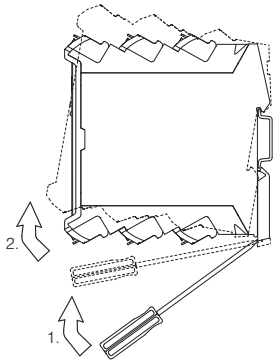
12 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



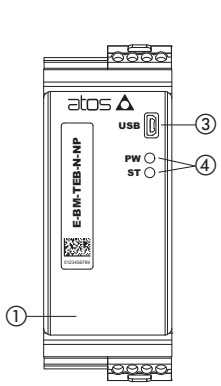
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

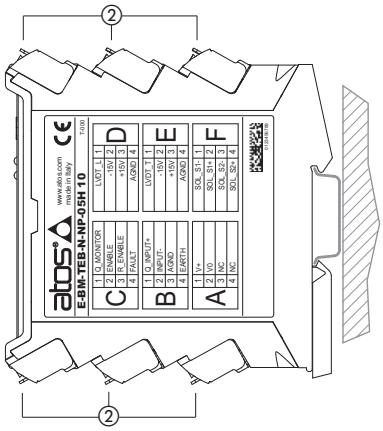
Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(e.g. connector A can not be inserted into connector slot of B,C,D,E,F,I,J,K)

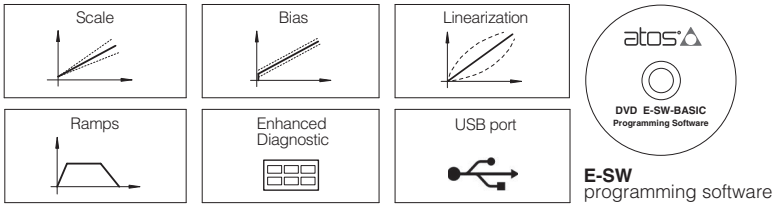
Digital E-BM-TEB/LEB drivers

DIN-rail format, for proportional valves with one or two LVDT transducers



E-BM- **TEB** -N-NP





E-SW
programming software

Connectors ② included

E-BM-TEB/LEB

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.
TEB execution controls direct operated directional/flow valves with one LVDT transducer.
LEB execution controls pilot operated directional valves with two LVDT transducers.
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 6 fast plug-in connectors ②
- Mini USB port ③ always present
- 2 leds for diagnostics ④ (see 5.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM	-	TEB	-	N	-	NP	-	01H	*	/	*	*	/	*

E-BM — Off-board electronic driver in DIN rail format

TEB = digital basic driver, for valves with one LVDT transducer
LEB = digital basic driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none

Fieldbus interface, USB port always present:
NP = Not Present

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TEB**)

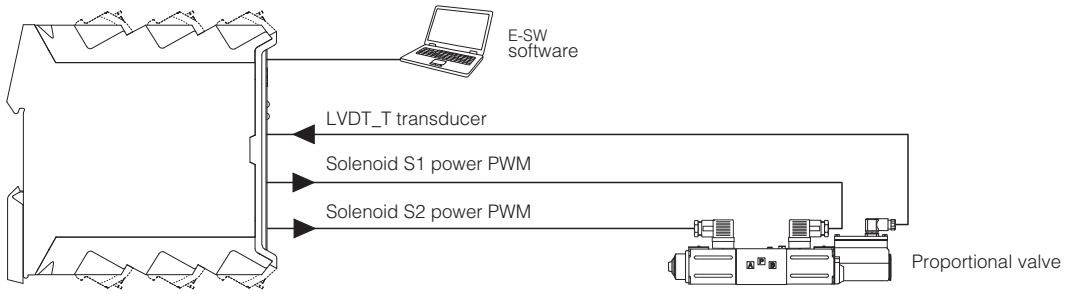
- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TEB**)

Options, see section 5 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for LVDT transducers only in combination with option **A**
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 VDC)

Series number

Set code (see section 6)

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

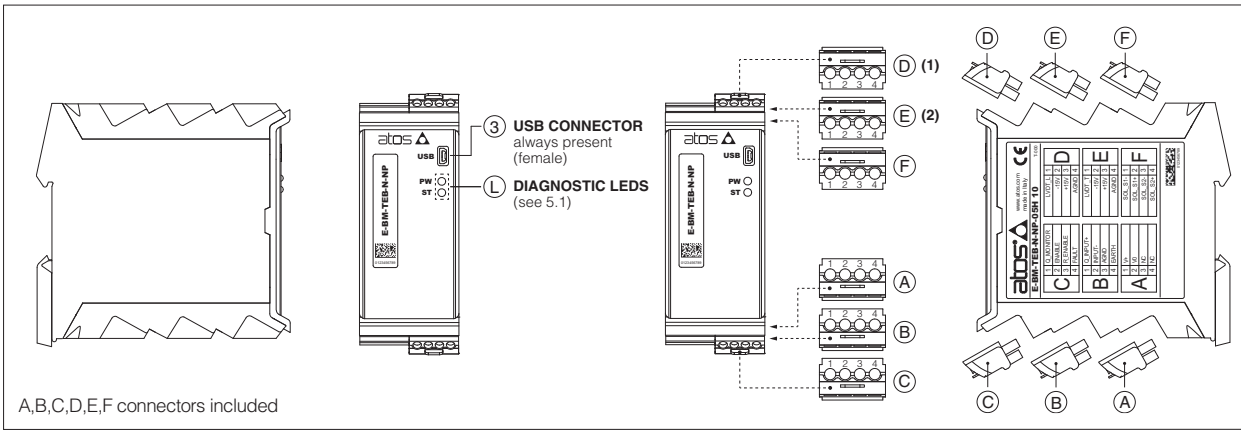
Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	**DHZO-T, DKZOR-T** F165, F168	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F412	**DPZO-L** F175, F178	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Tech table	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	**LIQZA-L** FX350, FX370
Driver model	**E-BM-TEB**				**E-BM-LEB**	

4 MAIN CHARACTERISTICS

Power supply (see 7.1)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	50 W
Current supplied to solenoids	IMAX = 3.0 A for standard driver IMAX = 2.5 A for ex-proof driver (**/A option**)
Analog input signal (see 7.2)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Monitor output (see 7.3)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance
Enable input (see 7.4)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ
Repeat enable output (see 7.5) Fault output (see 7.6)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)
Mass	Approx. 400 g
Additional characteristics	2 leds for diagnostic; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	USB Atos ASCII coding
Communication physical layer	USB 2.0 + USB OTG not insulated
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet
Max conductor size (see 11)	2,5 mm²

Note: a maximum time of 400 ms have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

5 CONNECTIONS AND LEDS

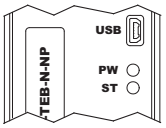


(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

5.1 Diagnostic LEDs (L)

Two leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LEDS	DESCRIPTION	
PW	OFF = Power supply OFF	ON = Power supply ON
ST	OFF = Fault present	ON = No fault



5.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNALS	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 7.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 7.1)	Gnd - power supply
	A3	**NC**	Do not connect	
	A4	**NC**	Do not connect	
B	B1	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 7.2)	Input - analog signal **Software selectable**
	B2	**INPUT-**	Negative reference input signal for Q_INPUT+	Input - analog signal
	B3	**AGND**	Common gnd for monitor output	Common gnd
	B4	**EARTH**	Connect to system ground	
C	C1	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 7.3)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the controller, referred to V0 (see 7.4)	Input - on/off signal
	C3	**R_ENABLE**	Repeat enable, output repeater signal of enable input, referred to V0 (see 7.5)	Output - on/off signal
	C4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to V0 (see 7.6)	Output - on/off signal
D (1)	D1	**LVDT_L**	Main stage valve position transducer signal (see 7.7)	Input - analog signal
	D2	**-15V**	Main stage valve position transducer power supply -15V	Output power supply
	D3	**+15V**	Main stage valve position transducer power supply +15V	Output power supply
	D4	**AGND**	Common gnd for transducer power	Common gnd
E (2)	E1	**LVDT_T**	Direct valve or pilot valve position transducer signal (see 7.7)	Input - analog signal
	E2	**-15V**	Direct valve or pilot valve stage position transducer power supply -15V	Output power supply
	E3	**+15V**	Direct valve or pilot valve tage position transducer power supply +15V	Output power supply
	E4	**AGND**	Common gnd for transducer power	Common gnd
F	F1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	F2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	F3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	F4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM

(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

6 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

7 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

7.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

7.2 Flow reference input signal (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve's spool position.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

7.3 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

7.4 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

7.5 Repeat enable output signal (R_ENABLE)

Repeat enable (pin C3) is used as output repeater signal of enable input signal (see 7.4).

7.6 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the status of the Enable input signal.

7.7 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 VDC supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

7.8 Possible combined options: /AC, /AI, /ACI

8 VALVE SETTINGS AND PROGRAMMING TOOLS

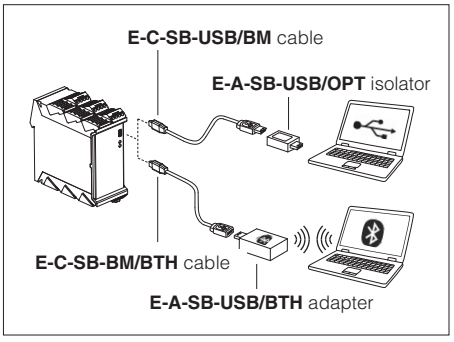
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

9 MAIN SOFTWARE PARAMETER SETTINGS

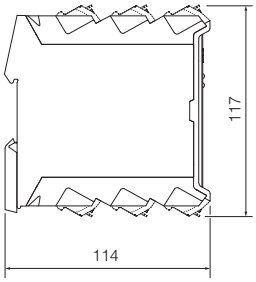
For basic information about main setting parameters by E-SW programming software, see tech table **FS900**

For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

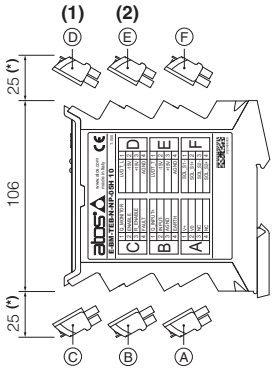
E-MAN-BM-LEB - user manual for **E-BM-TEB** and **E-BM-LEB** digital drivers

10 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors



A,B,C,D,E,F connectors included



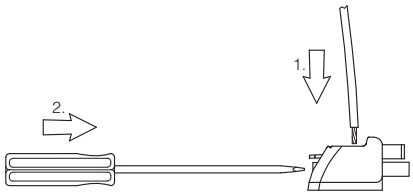
(*) Space to remove the connectors

DIN rail dimensions

(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

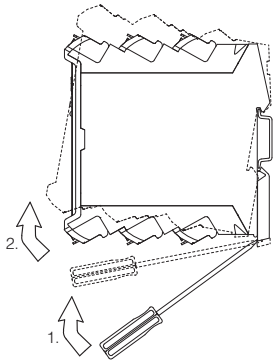
11 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



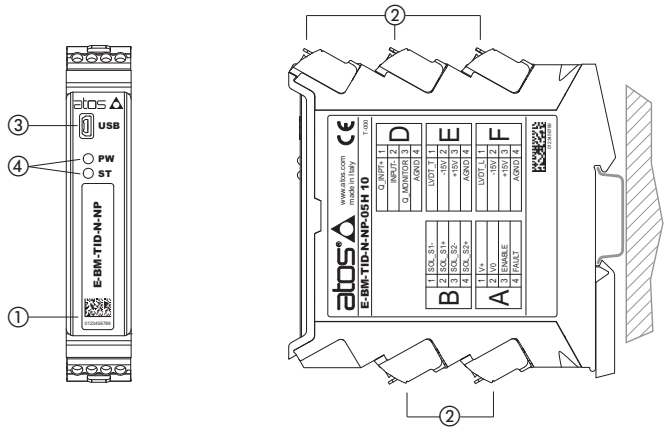
To extract the connectors:
1. push lever
2. pull connector

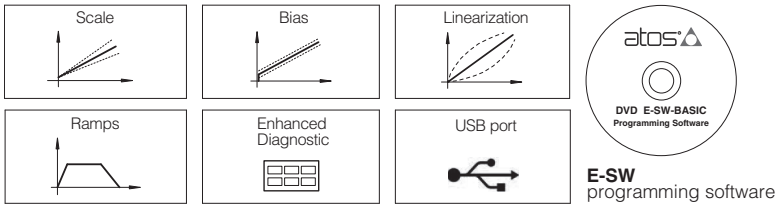
To insert the connectors:
1. push the connector in its slot

Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(e.g. connector A can not be inserted into connector slot of B,C,D,E,F)

Digital E-BM-TID/LID drivers

DIN-rail format, for proportional valves with one or two LVDT transducers





E-SW
programming software

Connectors ② included

E-BM-TID/LID

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.

TID execution controls direct operated directional/flow valves with one LVDT transducer.

LID execution controls pilot operated directional valves with two LVDT transducers.

Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 5 fast plug-in connectors ②
- Mini USB port ③ always present
- 2 leds for diagnostics ④ (see 5.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM	-	TID	-	N	-	NP	-	01H	*	/	*	*	/	*

E-BM
Off-board electronic driver in DIN rail format

TID = digital basic driver, for valves with one LVDT transducer
LID = digital basic driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none

Fieldbus interface, USB port always present:
NP = Not Present

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TID**)

- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TID**)

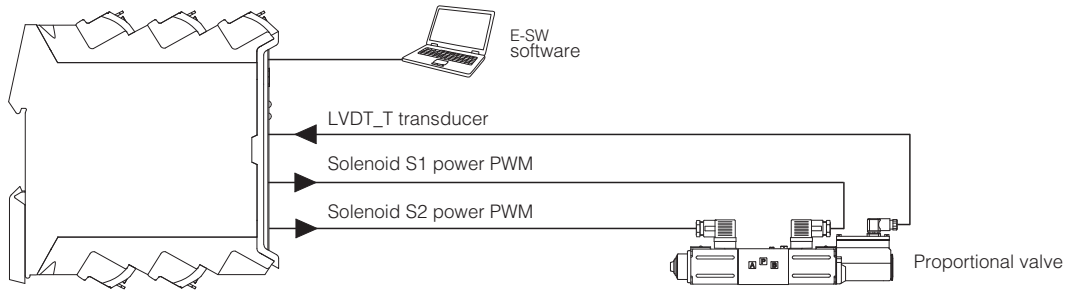
Options, see section 5 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for LVDT transducers only in combination with option A
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 VDC) **(1)**

Series number

Set code (see section 6)

(1) No software selectable

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

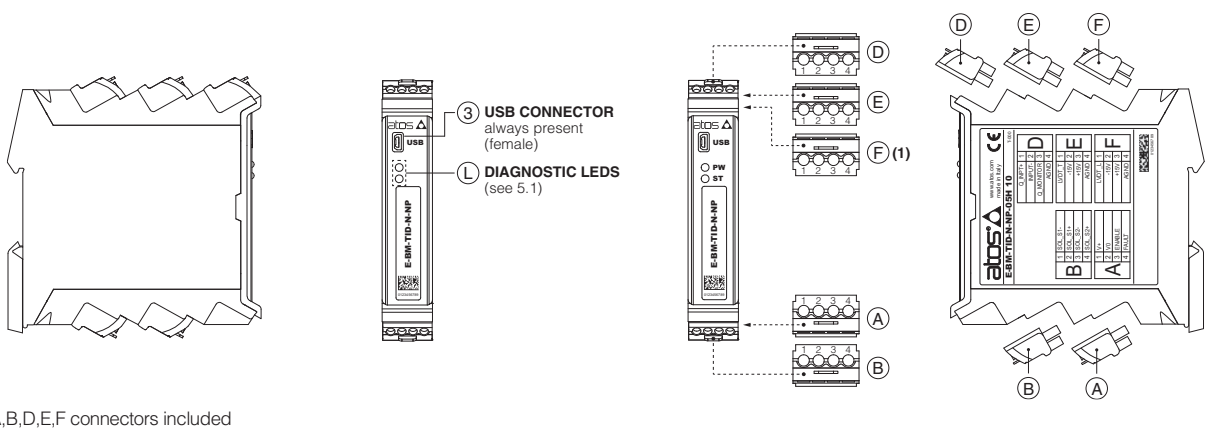
Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	**DHZO-T, DKZOR-T** F165, F168	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F412	**DPZO-L** F175, F178	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Tech table	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	**LIQZA-L** FX350, FX370
Driver model	**E-BM-TID**				**E-BM-LID**	

4 MAIN CHARACTERISTICS

Power supply (see 7.1)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	50 W
Current supplied to solenoids	IMAX = 3.0 A for standard driver IMAX = 2.5 A for ex-proof driver (**/A option**)
Analog input signal (see 7.2)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Monitor output (see 7.3)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance
Enable input (see 7.4)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ
Fault output (see 7.5)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)
Mass	Approx. 300 g
Additional characteristics	2 leds for diagnostic; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	USB Atos ASCII coding
Communication physical layer	USB 2.0 + USB OTG not insulated
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet
Max conductor size (see 11)	2,5 mm²

Note: a maximum time of 400 ms have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

5 CONNECTIONS AND LEDS



A,B,D,E,F connectors included

(1) F connector is available only for LID

5.1 Diagnostic LEDs (L)

Two leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LEDS	DESCRIPTION		
PW	OFF = Power supply OFF	ON = Power supply ON	
ST	OFF = Fault present	ON = No fault	

5.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNALS	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 7.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 7.1)	Gnd - power supply
	A3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the controller, referred to V0 (see 7.4)	Input - on/off signal
	A4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to V0 (see 7.5)	Output - on/off signal
B	B1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	B2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	B3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	B4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM
D	D1	**Q_INPUT+**	Flow reference input signal: ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 7.2)	Input - analog signal
	D2	**INPUT-**	Negative reference input signal for Q_INPUT+	Input - analog signal
	D3	**Q_MONITOR**	Flow monitor output signal: ±10 VDC for standard and 4 ÷ 20 mA for /I option, referred to AGND (see 7.3)	Output - analog signal
	D4	**AGND**	Common gnd for monitor output	Common gnd
E	E1	**LVDT_T**	Direct valve or pilot valve position transducer signal (see 7.6)	Input - analog signal
	E2	**-15V**	Direct valve or pilot valve stage position transducer power supply -15V	Output power supply
	E3	**+15V**	Direct valve or pilot valve tage position transducer power supply +15V	Output power supply
	E4	**AGND**	Common gnd for transducer power	Common gnd
F (1)	F1	**LVDT_L**	Main stage valve position transducer signal (see 7.6)	Input - analog signal
	F2	**-15V**	Main stage valve position transducer power supply -15V	Output power supply
	F3	**+15V**	Main stage valve position transducer power supply +15V	Output power supply
	F4	**AGND**	Common gnd for transducer power	Common gnd

(1) F connector is available only for LID

6 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

7 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

7.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

7.2 Flow reference input signal (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin D1) for the valve's spool position.
Standard (voltage reference input)
Default is ±10 VDC and can be reconfigured via software, within a maximum range of ±10 VDC.
Option /I (current reference input)
Default is 4 ÷ 20 mA and can be reconfigured via software, within a maximum range of ± 20 mA.

7.3 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin D3) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, valve spool position).
Standard (voltage monitor output)
Default is ±10 VDC and can be reconfigured via software, within a maximum range of ±10 VDC.
Option /I (current monitor output)
Default is 4 ÷ 20 mA and can be reconfigured via software, within a maximum range of ± 20 mA.

7.4 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin A3: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

7.5 Fault output signal (FAULT)

Fault output signal (pin A4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the status of the Enable input signal.

7.6 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin F1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 VDC supply output available at pin F2, F3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

7.7 Possible combined options: /AC, /AI, /ACI

8 VALVE SETTINGS AND PROGRAMMING TOOLS

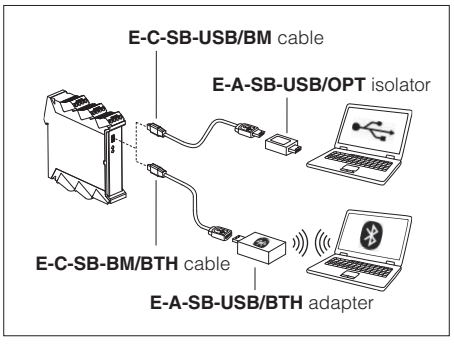
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

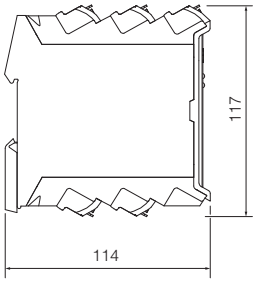
9 MAIN SOFTWARE PARAMETER SETTINGS

For basic information about main setting parameters by E-SW programming software, see tech table **FS900**
For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

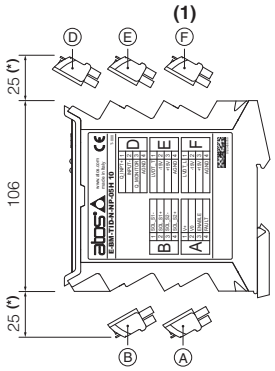
E-MAN-BM-LID - user manual for **E-BM-TID** and **E-BM-LID** digital drivers

10 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors



A,B,D,E,F connectors included



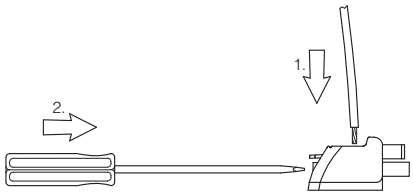
(*) Space to remove the connectors

DIN rail dimensions

(1) F connector is available only for LID

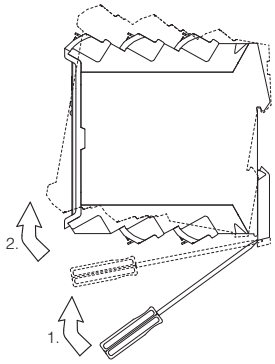
11 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



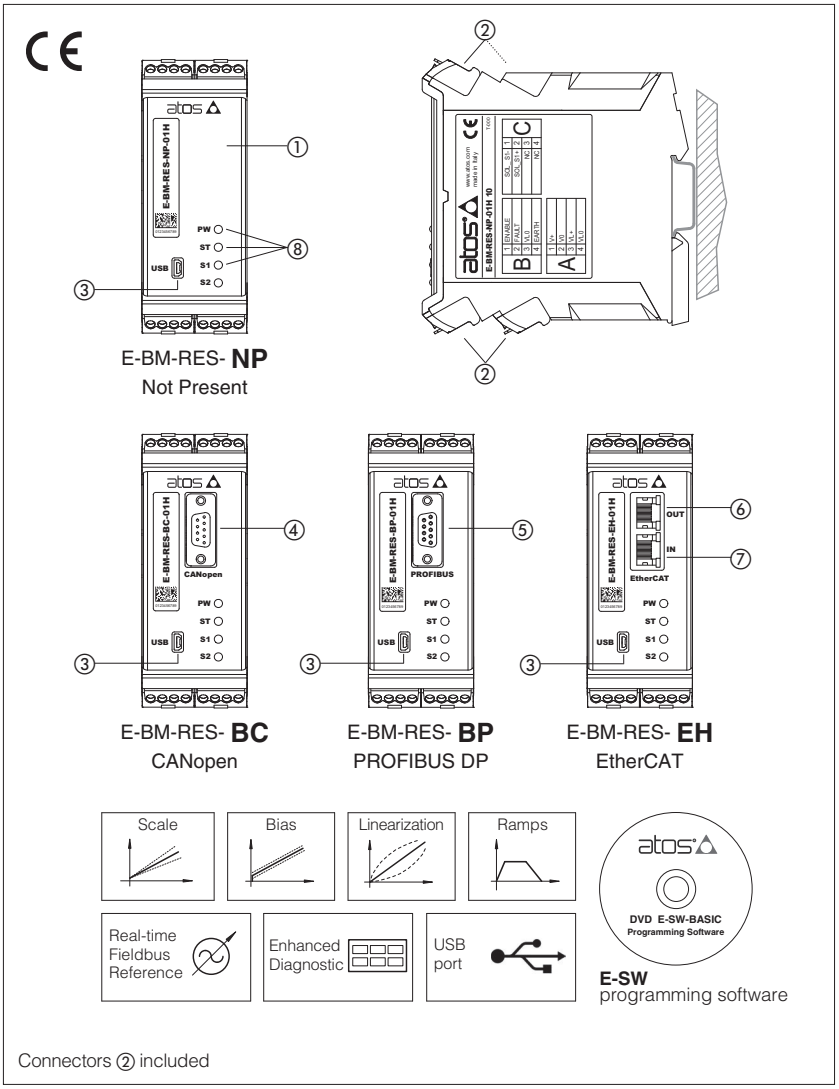
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(e.g. connector A can not be inserted into connector slot of B,D,E,F)

Digital electronic E-BM-RES drivers

DIN-rail format, for proportional valves with integral pressure transducer



E-BM-RES

Digital drivers ① control, in closed loop, the regulated pressure of direct and pilot operated proportional valves according to the electronic reference input signal.
E-BM-RES operate direct and pilot operated relief/reducing control valves ZO-R with integral pressure transducer.
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 7 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 CANopen ④ and PROFIBUS DP ⑤ communication connector
- RJ45 EtherCAT communication connectors ⑥ output and ⑦ input
- 3 leds for diagnostics ⑧ (see 4.1)
- Pressure transducer input signal 4 ÷ 20 mA
- ±5 VDC output supply for external reference potentiometer
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither, PID gains
- 4 factory pre-set dynamic response setting to match different hydraulic conditions (see 8.5)
- Linearization function for hydraulic regulation
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

Fieldbus Features:

- Valve direct communication with machine control unit for digital reference, diagnostics and settings
- Fieldbus execution allow to operate the valves via fieldbus or via analog signals available on the connectors (see 4.2)

1 MODEL CODE

E-BM	- RES	- NP	- 01H	/ *	/ *	* / *

E-BM — Off-board electronic driver in DIN rail format

RES = digital full driver, for valves with pressure transducer

Fieldbus interface - USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

01H = for single solenoid proportional valves

Option:
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input 0 ÷10 VDC)

Dynamic response preset - see 8.5 **:**
- = PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

Series number

Set code (see section 5)

2 VALVES RANGE

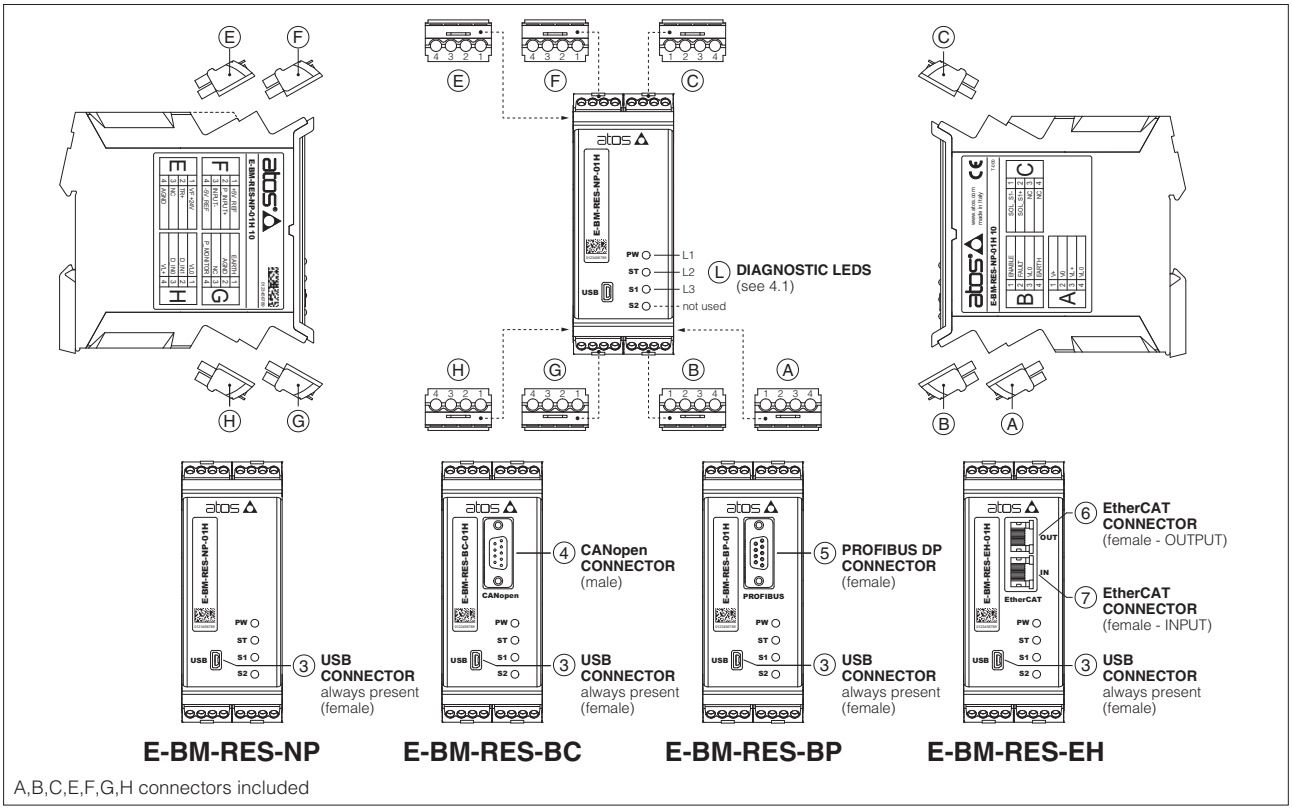
Valves model	Relief			Reducing			Compensator
	RZMO	**AGMZO**	**LIMZO**	**RZGO**	**AGRCZO**	**LIRZO**	**LICZO**
Tech table	FS010 FS067	FS040	FS305	FS020 FS075	FS055	FS305	FS305

3 MAIN CHARACTERISTICS

Power supply (see 6.1, 6.4)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Current supplied to solenoids	IMAX = 2.7 A with +24 VDC power supply to drive standard proportional valves (3,2 Ω solenoid)			
Analog input signals (see 6.2)	Voltage: maximum range ±10 VDC Input impedance: Ri > 50 kΩ Current: maximum range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output (see 6.3)	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input (see 6.5)	Range : 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Output supply (see 6.8)	±5 VDC @ max 10 mA : output supply for external potentiometer			
Fault output (see 6.6)	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure, alarms history storage function			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 330 g			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply and solenoids			
Max conductor size (see 10)	2,5 mm²			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

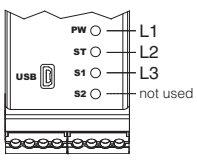
4 CONNECTIONS AND LEDS



4.1 Diagnostic LEDs (L)

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

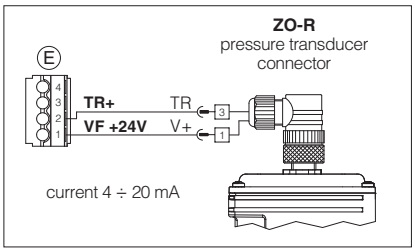
LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	PW	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	ST	OFF	Fault present
			ON	No fault
L3	YELLOW	S1	OFF	PWM command OFF
			ON	PWM command ON



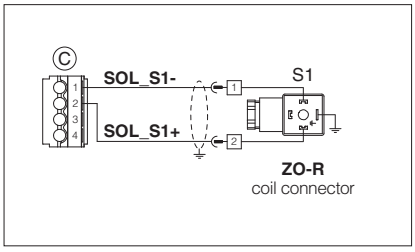
4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 6.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 6.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 VDC for driver's logic and communication (see 6.4)	Input - power supply
	A4	**VL0**	Power supply 0 VDC for driver's logic and communication (see 6.4)	Gnd - power supply
B	B1	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0 (see 6.5)	Input - on/off signal
	B2	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 6.6)	Output - on/off signal
	B3	**VL0**	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	**EARTH**	Connect to system ground	
C	C1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	C2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	C3	**NC**	Do not connect	
	C4	**NC**	Do not connect	
E	E1	**VF +24V**	Power supply +24 VDC	Output - power supply
	E2	**TR+**	Positive pressure transducer input signal: ±20 mA maximum range (see 6.7) Default is 4 ÷ 20 mA	Input - analog signal **Software selectable**
	E3	**NC**	Do not connect	
	E4	**AGND**	Common GND for transducer power, signals and external potentiometer	
F	F1	**+5V_REF**	External potentiometer power supply +5 VDC @ 10mA (see 6.8)	Output - power supply
	F2	**P_INPUT+**	Positive pressure reference input signal: ±10 VDC / ±20 mA maximum range (see 6.2) Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	F3	**INPUT-**	Negative pressure reference input signal for P_INPUT+	Input - analog signal
	F4	**-5V_REF**	External potentiometer power supply -5 VDC @ 10mA (see 6.8)	Output - power supply
G	G1	**EARTH**	Connect to system ground	
	G2	**AGND**	Analog ground for P_MONITOR and external potentiometer	Gnd - analog signal
	G3	**NC**	Do not connect	
	G4	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range (see 6.3) Default are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
H	H1	**VL0**	Power supply 0 VDC for digital input (see 6.4)	Gnd - power supply
	H2	**D_IN1**	Pressure PID selection, referred to VL0 (see 6.9)	Input - on/off signal
	H3	**D_IN0**	Pressure PID selection, referred to VL0 (see 6.9)	Input - on/off signal
	H4	**VL+**	Power supply 24 VDC for digital input (see 6.4)	Output - power supply

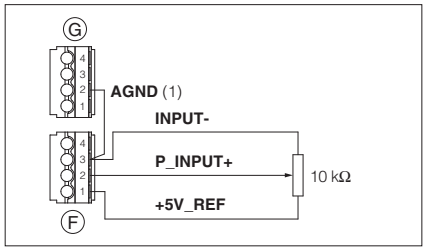
Pressure transducer connection



Coil connection



Potentiometer connection



(1) As alternative the AGND on pin E4 can be used

4.3 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

(1) shield connection on connector's housing is recommended

⑥ ⑦ **EH fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

5 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve **ZO-R** to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve **ZO-R**. For further information about set code, please contact Atos technical office.

6 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software. Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

6.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of double power supply see 6.4.
A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

6.2 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

6.3 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

6.4 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin A3 and A4, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.
A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

6.5 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin B1: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

6.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

6.7 Pressure transducer integrated to the valve, input signal (TR+)

Analog pressure transducer integrated to the valve, has to be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, default is 4 ÷ 20 mA.
Input signal can be reconfigured via software, within a maximum range of ± 20 mA.

6.8 Output supply for external potentiometer (±5V_REF) - not available for **EH** version

The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the ±5 VDC supply output available at pin F1 and F4.
Note: using an external potentiometer, the reference input signal must be set via software at 0 ÷ 5 VDC (default 0 ÷10 VDC, see 6.2)

6.9 PID selection (D_IN0 and D_IN1)

Two on-off input signals are available on the pin H2 and H3 to select one of the four pressure PID parameters setting, stored into the driver.
Supply a 24 VDC or a 0 VDC on pin H2 and/or pin H3, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.
Refer to dynamic response for function description (see 8.5).

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
H2	0	24 VDC	0	24 VDC
H3	0	0	24 VDC	24 VDC

7 PROGRAMMING TOOLS - see tech table **GS500**

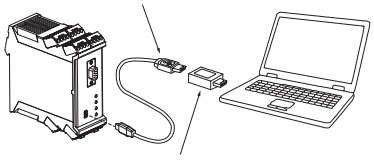
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB connection



Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

8 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers.
For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-RES - user manual for **E-BM-RES**

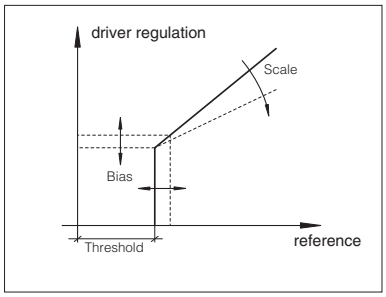
8.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max pressure valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the pressure proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.

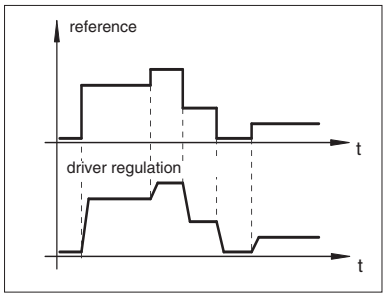
8.2 Bias and Threshold

Pressure proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the pressure valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input).
The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current to the specific pressure proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If fieldbus reference signal is active (see 6.2), threshold should be set to zero.
Refer to the programming manuals for a detailed description of other software selectable Bias functions.

8.1, 8.2 - Scale, Bias & Threshold



8.3 - Ramps

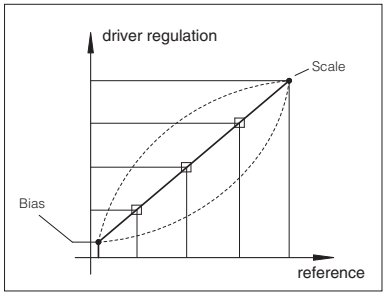


8.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.
Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the pressure proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

8.4 - Linearization



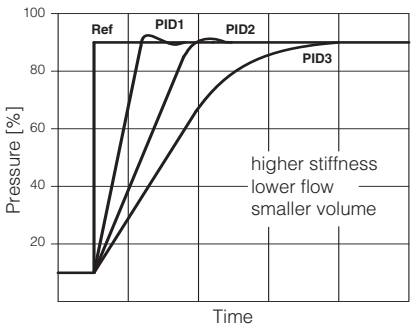
8.4 Linearization - E-SW level 2 functionality

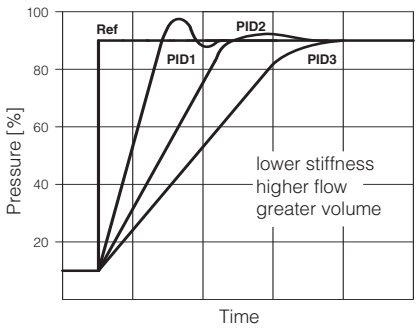
Linearization function allows to set the relation between the reference input signal and the controlled valve's pressure regulation. Linearization is useful for applications where it is required to linearize the valve's pressure regulation in a defined working condition.

8.5 Dynamic response – 4 pressure PIDs

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected in real time through digital inputs (see 6.9). Only for BC, BP, EH execution, the PID can be also selected in real time through PLC via fieldbus.

PID	Dynamic response example diagrams at side
1	Fast (default) interchangeable with TERS version
2	Standard
3	Smooth
4	Open Loop





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

In case of pressure instability, select PID4 to operate the valve in open loop.

If the instability still persists, check eventual anomalies in the hydraulic circuit as the presence of air.

If the instability disappears, select an alternative configuration within PID selection 1, 2 or 3 which better matches the application requirements.

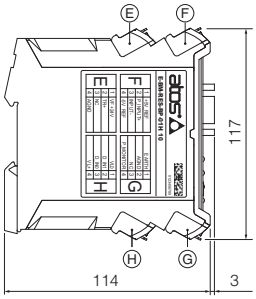
If no one of the above selection fulfills the application, tune P - I - D parameters at E-SW software level 2 to obtain the desired dynamic response.

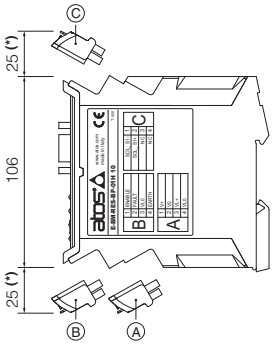
8.6 Pressure transducer failure

This function is available only for pressure transducer input configured in current as 4 ÷ 20 mA.
In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

9 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors





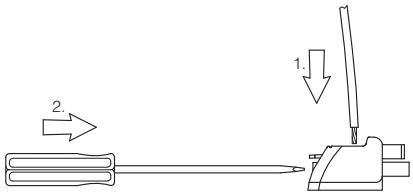
DIN rail dimensions

A, B, C, E, F, G, H connectors included

(*) Space to remove the connectors

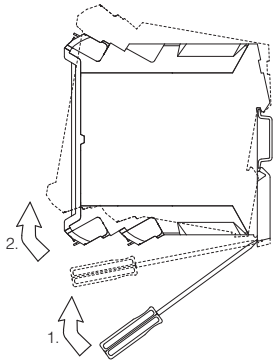
10 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



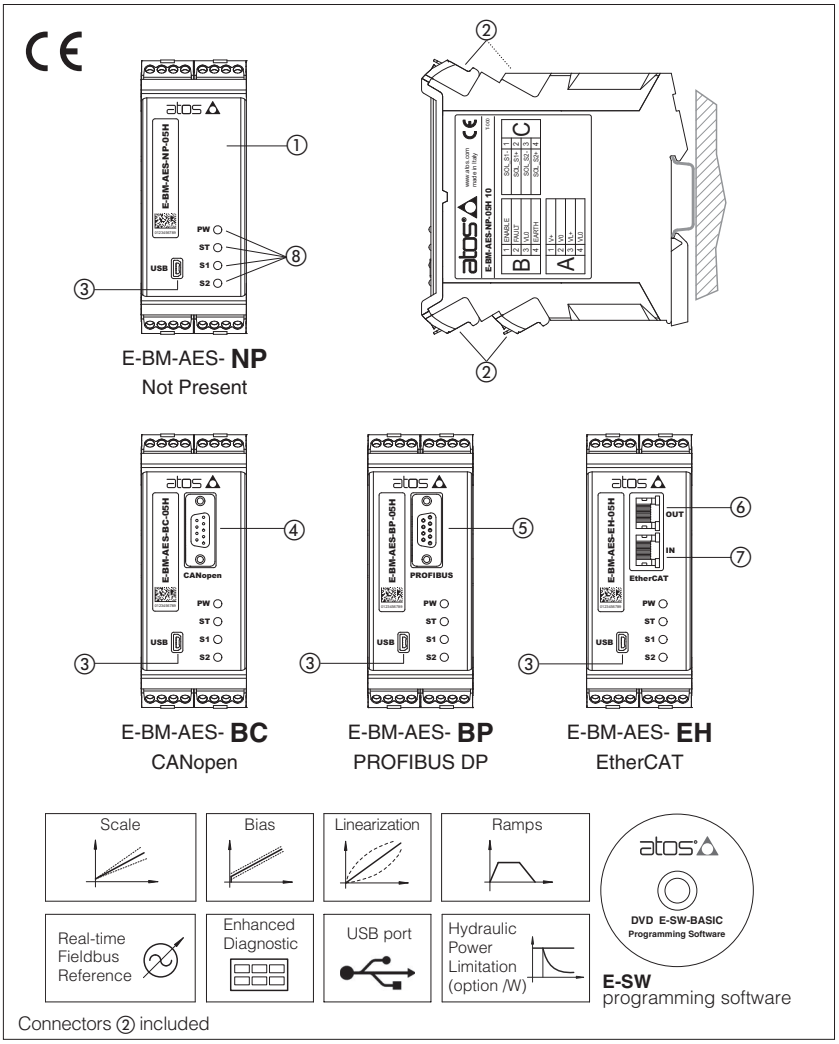
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)

Digital electronic E-BM-AES drivers

DIN-rail format, for proportional valves without transducer



E-BM-AES

Digital drivers ① control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.
E-BM-AES operate direct and pilot operated proportional valves ZO-A without transducer.
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 7 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 CANopen ④ and PROFIBUS DP ⑤ communication connector
- RJ45 EtherCAT communication connectors ⑥ output and ⑦ input
- 4 leds for diagnostics ⑧ (see 4.1)
- ±5 VDC output supply for external reference potentiometer
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither, PID gains
- Linearization function for hydraulic regulation
- /W option max power limitation function
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

Fieldbus Features:

- Valve direct communication with machine control unit for digital reference, diagnostics and settings
- Fieldbus execution allow to operate the valves via fieldbus or via analog signals available on the connectors (see 4.2)

1 MODEL CODE

E-BM	-	**AES**	-	**NP**	-	**01H**	/	*	*	/	*
Off-board electronic driver in DIN rail format									Series number		Set code **(1)**

AES = digital full driver, for valves without transducer

Fieldbus interface - USB port always present**:**
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Options:
A= max current limitation for Ex-proof valves
C= current feedback 4 ÷ 20 mA for remote transducer, only in combination with option **W**
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input ±10 VDC)
W= power limitation function

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves

(1) set code identifies the corrispondence between the driver and the relevant valve

2 VALVES RANGE

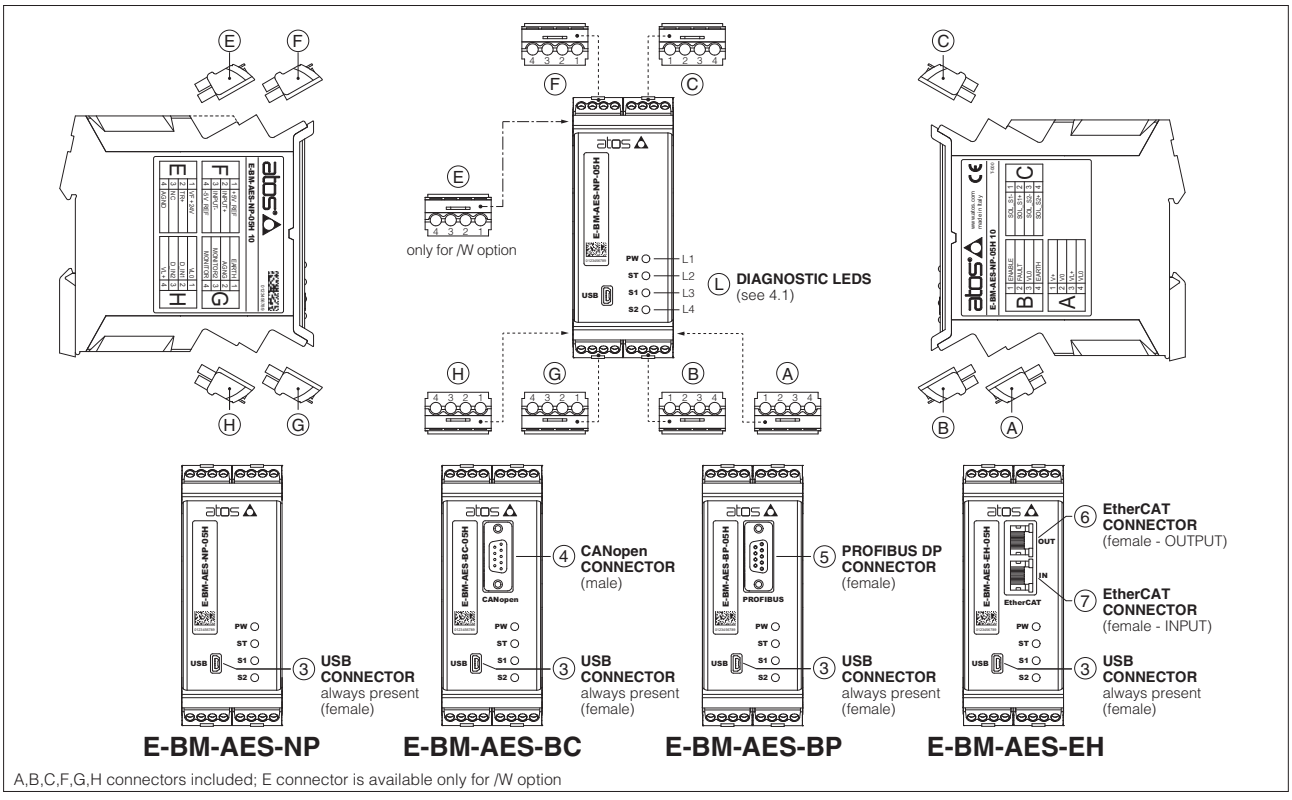
Valves	Pressure									Directional			Cartridge	Flow
Industrial	**RZMO HMZO**	**RZME**	**RZGO HZGO, KZGO**	**RZGE CART RZGE**	**AGMZO**	**AGMZE**	**AGRCZO**	**DHRZO**	**DHRZE**	**DHZO DKZOR**	**DHZE DKZE**	**DPZO**	**LI*ZO**	**QVHZO QVKZOR**
Tech table	FS007, FS065	F005	FS015, FS070	F012	FS035	F030	FS050	FS025	F022	FS160	F150	FS170	FS300	FS410
Ex-proof	**RZMA HZMA**	-	**RZGA HZGA, KZGA**	-	**AGMZA**	-	**AGRCZA**	**DHRZA**	-	**DHZA DKZA**	-	**DPZA**	**LI*ZA**	**QVHZA, QVKZA**
Tech table	FX010		FX040		FX010		FX040	FX070		FX100		FX200	FX300	FX400

3 MAIN CHARACTERISTICS

Power supply (see 5.1, 5.2)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Current supplied to solenoids	IMAX = 2.7 A with +24 VDC power supply to drive standard proportional valves (3,2 Ω solenoid) IMAX = 2.5 A with +24 VDC power supply to drive ex-proof proportional valves (3,2 Ω solenoid) for **/A option**			
Analog input signals (see 5.3)	Voltage: maximum range ±10 VDC Input impedance: Ri > 50 kΩ Current: maximum range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output (see 5.4)	Voltage: maximum range ±5 VDC @ max 5 mA			
Enable input (see 5.5)	Range : 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Output supply (see 5.8)	±5 VDC @ max 10 mA : output supply for external potentiometer			
Fault output (see 5.6)	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 330 g			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply and solenoids			
Max conductor size (see 9)	2,5 mm²			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

4 CONNECTIONS AND LEDS

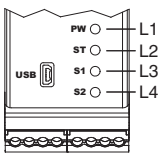


A,B,C,F,G,H connectors included; E connector is available only for /W option

4.1 Diagnostic LEDs (L)

Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

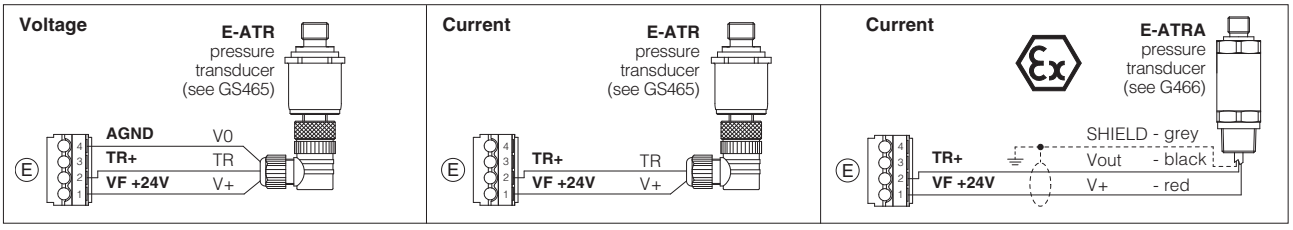
LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	PW	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	ST	OFF	Fault present
			ON	No fault
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF
			ON	PWM command ON



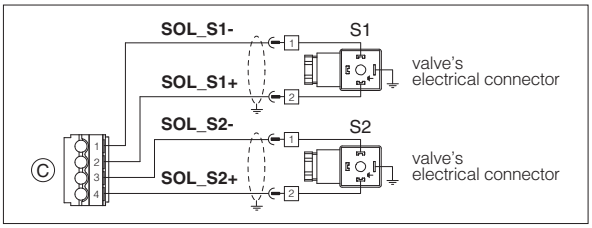
4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 5.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 5.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 VDC for driver's logic and communication (see 5.2)	Input - power supply
	A4	**VL0**	Power supply 0 VDC for driver's logic and communication (see 5.2)	Gnd - power supply
B	B1	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0 (see 5.5)	Input - on/off signal
	B2	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 5.6)	Output - on/off signal
	B3	**VL0**	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	**EARTH**	Connect to system ground	
C	C1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	C2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	C3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	C4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM
E available only for **/W** option	E1	**VF +24V**	Power supply +24 VDC	Output - power supply
	E2	**TR+**	Positive pressure transducer input signal: ±10 VDC / ±20 mA maximum range (see 5.7) Default are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Input - analog signal **Software selectable**
	E3	**NC**	Do not connect	
	E4	**AGND**	Common GND for transducer power, signals and external potentiometer	
F	F1	**+5V_REF**	External potentiometer power supply +5 VDC @ 10mA (see 5.8)	Output - power supply
	F2	**INPUT+**	Positive reference input signal: ±10 VDC / ±20 mA maximum range (see 5.3) Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	F3	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	F4	**-5V_REF**	External potentiometer power supply -5 VDC @ 10mA (see 5.8)	Output - power supply
G	G1	**EARTH**	Connect to system ground	
	G2	**AGND**	Analog ground for MONITOR and external potentiometer	Gnd - analog signal
	G3	**MONITOR2**	Only for /W option, 2nd monitor output signal: ±5 VDC maximum range (see 5.4) Default is 0 ÷ 5 VDC	Output - analog signal **Software selectable**
	G4	**MONITOR**	Monitor output signal: ±5 VDC maximum range (see 5.4) Default is ±5 VDC (1V = 1A)	Output - analog signal **Software selectable**
H	H1	**VL0**	Power supply 0 VDC for digital input (see 5.2)	Gnd - power supply
	H2	**D_IN1**	Digital input 0 ÷ 24VDC, referred to VL0	Input - on/off signal
	H3	**D_IN0**	Digital input 0 ÷ 24VDC, referred to VL0	Input - on/off signal
	H4	**VL+**	Power supply 24 VDC for digital input (see 5.2)	Output - power supply

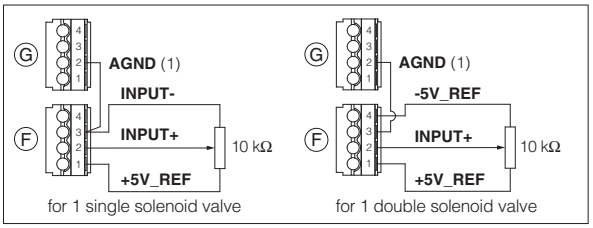
Pressure transducer connections - only for **/W** option



Coils connection



Potentiometer connection



(1) As alternative the AGND on pin E4 can be used (only /W option)

4.3 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

(1) shield connection on connector's housing is recommended

⑥ ⑦ **EH fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

5 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

5.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
In case of double power supply see 5.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

5.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin A3 and A4, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

5.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

5.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC.

5.5 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin B1: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

5.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

5.7 Remote pressure transducer input signal (TR+) - only for **/W** option

Analog pressure transducers can be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

5.8 Output supply for external potentiometer (±5V_REF) - not available for **EH** version

The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the ±5 VDC supply output available at pin F1 and F4.

Note: using an external potentiometer, the reference input signal must be set via software at ±5 VDC (default ±10 VDC, see 5.3)

5.9 Possible combined options: /AI, /AW, /IW, /AIW, /ACW, /CIW, /ACIW, /CW

6 VALVE SETTINGS AND PROGRAMMING TOOLS

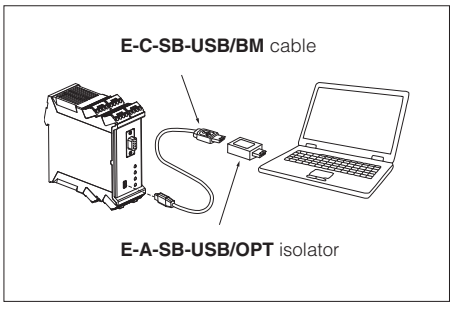
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB connection



Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers.
For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:
E-MAN-BM-AES - user manual for **E-BM-AES**

7.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.
Two different Scale regulations are available for double solenoid valves: ScaleA for positive reference signal and ScaleB for negative reference signal.

7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input).
The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current to the specific proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If fieldbus reference signal is active (see 5.3), threshold should be set to zero.
Two different Bias regulations are available for double solenoid valves: positive reference signals activate BiasA and negative reference signals activate BiasB.
Refer to the programming manuals for a detailed description of other software selectable Bias functions.

7.3 Offset

Proportional valves may be provided with zero overlapping in the hydraulic regulation corresponding to zero reference input signal (valve's central spool position).
The Offset function allows to calibrate the Offset current, required to obtain valve's spool central position, to the specific hydraulic system setup (e.g. valve applied to cylinder with differential areas).

7.4 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.
Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations
- four ramps for positive/negative signal values and increasing/decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

7.5 Linearization - E-SW level 2 functionality

Linearization function allows to set the relation between the reference input signal and the controlled valve's regulation.
Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition.

7.6 Variable Dither

The dither is the frequency modulation of the current supplied to the solenoid. To reduce the hysteresis should be selected a lower value of frequency, despite a lower regulation stability, because a small vibration in the valve regulating parts considerably reduces static friction effects.
To improve the regulation stability, should be selected a high value of frequency, despite a higher hysteresis. This solution in some application can lead to vibration and noise. Normally, the right setting is a compromise and depends on system setup.
E-BM-AES drivers allow to realize a variable dither frequency that linearly depends on the demanded current: variable dither frequency allows an higher degree to optimize the valve hysteresis.

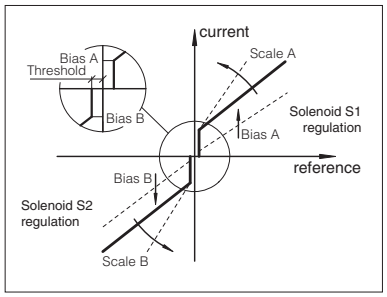
7.7 Hydraulic Power Limitation - only for **/W** option

Digital E-BM-AES drivers with /W option electronically perform hydraulic power limitation on:
- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tech table **A170**)

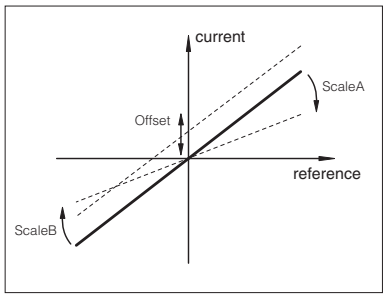
The driver receives the flow reference signal by the analog external input INPUT+ (see 5.3) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR (see 5.7).
When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\ \left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}}\ ;\ \text{Flow Reference [INPUT+]}\right)$$

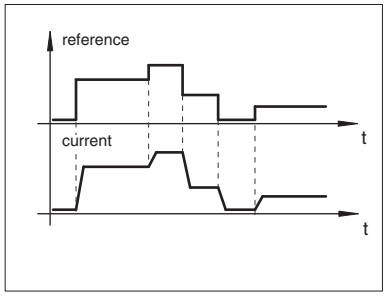
7.1, 7.2 - Scale, Bias & Threshold



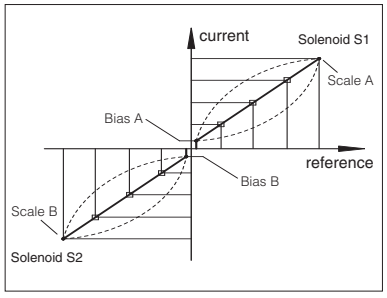
7.3 - Offset



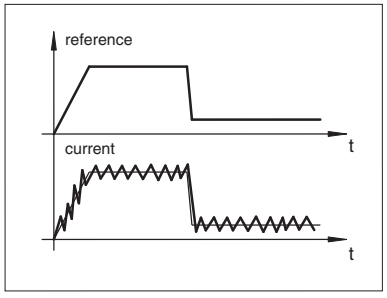
7.4 - Ramps



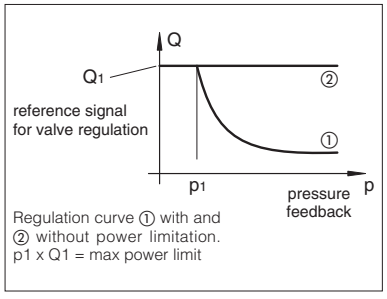
7.5 - Linearization



7.6 - Variable Dither

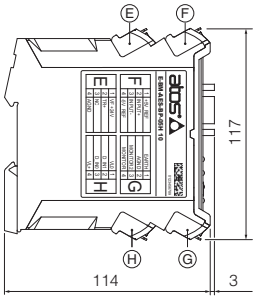


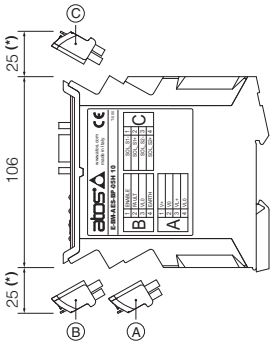
7.7 - Hydraulic Power Limitation



8 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors





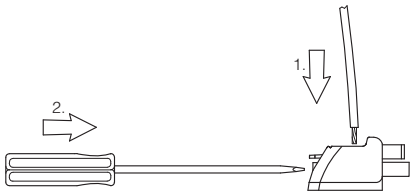
DIN rail dimensions

A,B,C,F,G,H connectors included; E connector is available only for /W option

(*) Space to remove the connectors

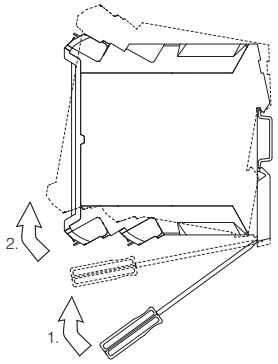
9 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



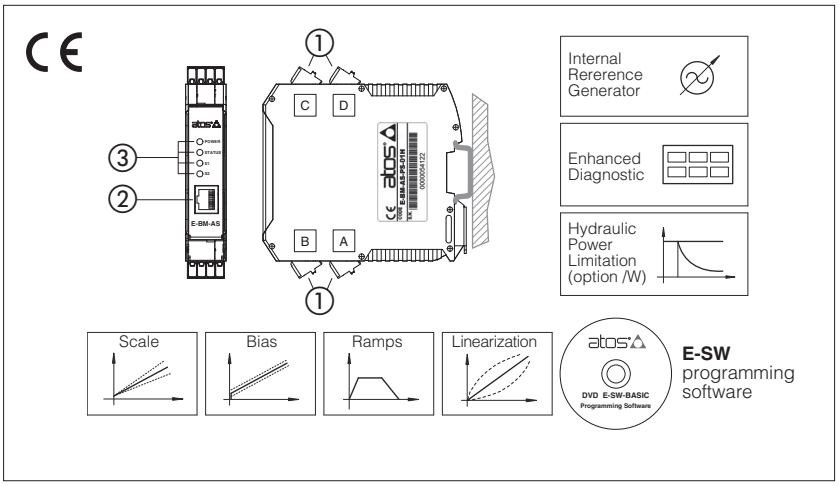
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)

Digital electronic E-BM-AS drivers

DIN-rail format, for proportional valves without transducer



1 MODEL CODE

E-BM	- AS	- PS	- 01H	/ *	*
Off-board electronic driver in DIN rail format					Series number

AS = digital basic driver, for valves without transducer

PS = Serial communication interface

01H = for single solenoid proportional valves
05H = for double solenoid or two single solenoid proportional valves

Options:

- = standard 24 VDC power supply
12 = 12 VDC power supply
A = max current limitation for ex-proof valves
C = current feedback 4 ÷ 20 mA for remote transducer, only for **IW**
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input ±10 VDC)
P = electrical supply for external potentiometers to generate reference signal, not available with **I** option (see 4.4)
W = power limitation function, only for **05H** (see 7.7)

E-BM-AS

Digital drivers control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.
The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the hydraulic regulation.
E-BM-AS can drive up to two single or one double solenoid proportional valves.

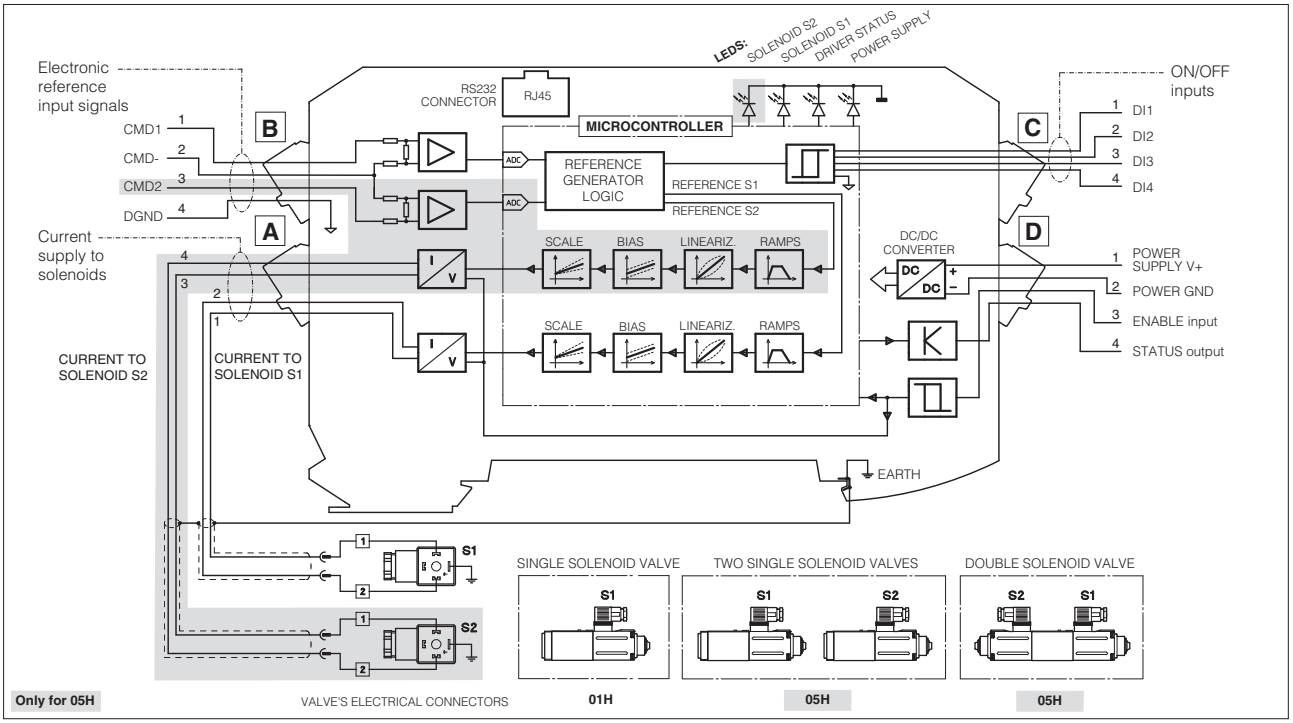
Electrical Features:

- 4 fast plug-in connectors ①
- RJ45 connector ② for RS232 Serial communication to program the driver with the Atos PC software
- 4 leds for diagnostics ③ (see section 10)
- ±5 VDC output supply for external reference potentiometers (/P option)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- /W option max power limitation function
- Complete diagnostics of driver status

2 BLOCK DIAGRAM



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	**Standard** Nominal: +24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP) **option /12** Nominal: +12 VDC Rectified and filtered: VRMS = 10 ÷ 14 VMAX (ripple max 10 % VPP)
Max power consumption	50 W 01H single solenoid valve and 05H double solenoid valve 100 W 05H two single solenoid valves
Current supplied to solenoids	IMAX = 2.7 A with +24 VDC power supply for standard proportional valves (3,2 Ω solenoid) IMAX = 3.3 A with +12 VDC power supply for proportional valves with /6 option (2,1 Ω solenoid) IMAX = 2.5 A with +24 VDC power supply for ex-proof proportional valves (3,2 Ω solenoid) for **/A option**
Analog input signal (see 4.2)	Voltage: range ±10 VDC Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Enable and optical insulated ON/OFF inputs (see 4.5, 4.7)	Range : 0 ÷ 24 VDC (OFF state: 0 ÷ 5 VDC ; ON state: 9 ÷ 24 VDC) Input impedance: Ri > 10 kΩ
Output supply (see 4.4)	±5 VDC @ max 10 mA : output supply for external potentiometers (only for **/P option**)
Status output (see 4.6)	Output range : 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 1,4 A
Alarms	Solenoid not connected, short circuit and cable break with current reference signal
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (-20 ÷ +40 °C for 05H version if drive two single solenoid proportional valves; storage -25 ÷ +85 °C)
Mass	130 g
Additional characteristics	Short circuit protection of current output to solenoids; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	RS232 serial connection (not insulated), Atos protocol with ASCII coding (see section 9)
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² for length up to 40 m [1,5 mm² for power supply and solenoids]
Max conductor size (see section 12)	2,5 mm²

4 POWER SUPPLY AND SIGNALS SPECIFICATIONS

4.1 Power supply

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve
5 A time lag fuse for 05H two single solenoid valves

Option /12

This driver execution is designed to receive a 12 VDC power supply and it is commonly used in mobile application.
A safety fuse is required in series to each driver power supply:

⚠ A safety fuse is required in series to each power supply: 4 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve
6,3 A time lag fuse for 05H two single solenoid valves

4.2 Reference Input Signals (pin B1 and B3, both referred to pin B2)

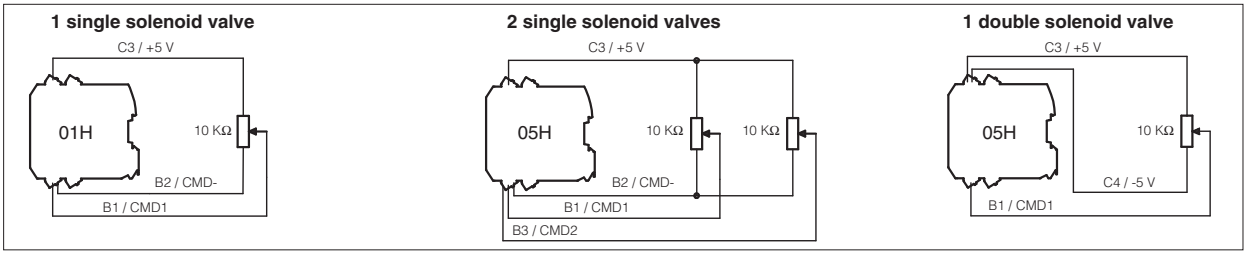
The driver proportionally transforms the external reference input signal into the current supplied to the solenoid.
The driver is designed to receive one (01H) or two (05H) analog reference inputs (CMD1 on pin B1, CMD2 on pin B3); both signals are referred to a common electric ground (CMD- on pin B2). CMD1 has to be used in case of 05H version that drives one double solenoid valve. CMD2 has to be used in case of 05H version that drives two single solenoid valves or transducer input for /W option (see 4.3).
The input range is software selectable among voltage (0 ÷ ±10 VDC) or current (4 ÷ 20 mA with cable break detection or 0 ÷ ±20 mA).
Defaults for standard: 0 ÷ 10 VDC for two position valves; 0 ÷ ±10 VDC for three position valves (see valve's tech. table).
Default for /I option: 4 ÷ 20 mA (see valve's tech. table)
Other ranges can be set by software. Internal reference generation is software selectable (see 7.6).
Note: software selection of analog input range (voltage or current) is applied to both signals CMD1 and CMD2.

4.3 Pressure Input Signal (pin B3 referred to pin B2) only for, /W option)

When hydraulic power limitation is active (see 7.7), input signal CMD2 must be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 ÷ 10 VDC.

4.4 Output supply Signal for external reference potentiometers (/P option)

The reference analog signals can be generated by one (01H) or two (05H) external potentiometers directly connected to the driver, using the ±5 VDC supply output available at pin C3 and C4. Reference input signal can be set up via software to ±5 VDC, in order to match potentiometer output signal.



4.5 Enable Input Signal (pin D3 referred to pin D2)

Enable input signal allows to enable/disable the current supply to the solenoids, without removing the electrical power supply to the driver; it is used to maintain active the serial connection and the other driver functions when the valve must be disabled for safety reasons.
To enable the driver, supply a 24VDC on pin D3 referred to pin D2.

4.6 Status Output Signal (pin D4 referred to pin D2)

Status output signal indicates fault conditions of the driver (short circuits, solenoids not connected, cable broken for 4 ÷ 20mA input) and is not affected by Enable input signal status: fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
When hydraulic power limitation function is active (see 7.7), status output signal can be software configured to indicate power limitation status: not active (0 VDC) or active (24 VDC).

4.7 ON/OFF Input Signals (pin C1...C4 referred to DGND pin B4)

Analog Drivers Compatibility - **default** for series 12 or higher

The four ON/OFF digital input signals (DI) can be used to activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers (see section 5). If digital inputs are not connected, the driver behavior corresponds to an E-BM-AS series 11 or lower

or

Internal Reference Generation - software selectable

When the driver is configured in internal reference generation mode (see 7.6), the 4 ON/OFF input signals (DI) are used to select the active reference signal, among the available stored values. If the 4 ON/OFF input signals (DI) are not active, the driver can be commanded by external analog reference. The polarity of the digital inputs can be customized: active status = 24 VDC is the default setting.

Note: for /P option DI3 and DI4 are not available

4.8 Possible combined options:

/12W, **/12PW**, **/12CIW**, **/AW**, **/ACIW**, **/APW**, **/CIW**, **/PW** only for 05H
/12I, **/12P**, **/AI**, **/AP** for 01H and 05H

5 ANALOG DRIVERS COMPATIBILITY - only for E-BM-AS series 12 or higher

E-BM-AS digital inputs (DI1..DI4) activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers:

REFERENCE COMPATIBILITY

Digital Inputs Signals		Digital driver	Analog driver	24 VDC to DI1:	0 VDC to DI1:
DI1	24 VDC	E-BM-AS 01H E-BM-AS 05H	E-BM-AC 01F E-BM-AC 05F E-BM-AC 011F E-ME-AC 01F E-ME-AC 05F	01H Voltage 0 ÷ 5 VDC / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100% 05H Voltage ± 5 VDC / ± 100% Current 4 ÷ 20 mA / 0 ÷ 100%	See section 4.2
DI2	0 VDC				
DI3	0 VDC				
DI4	0 VDC				

Note: set 0 VDC to DI1 and power-off/on the driver to restore latest settings

REFERENCE INVERSION

Digital Inputs Signals		Digital driver	Analog driver	24 VDC to DI2:	0 VDC to DI2:
DI1	24 VDC	E-BM-AS 05H	E-BM-AC 05F	Voltage 0 ÷ 5 VDC / 0 ÷ -100% Current 4 ÷ 20 mA / 0 ÷ -100%	Voltage 0 ÷ 5 VDC / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100%
DI2	24 VDC				
DI3	0 VDC				
DI4	0 VDC				

Note: to enable reference inversion, set 24 VDC to DI1 before driver power-on

RAMP SWITCH OFF

Digital Inputs Signals		Digital driver	Analog driver	24 VDC to DI3:	0 VDC to DI3:
DI1	24 VDC	E-BM-AS 01H E-BM-AS 05H	E-ME-AC 01F E-ME-AC 05F	Ramp excluded	Ramp activated
DI2	0 VDC				
DI3	24 VDC				
DI4	0 VDC				

Notes: to enable ramp switch off, set 24 VDC to DI1 before driver power-on; DI3 not available for /P option

011F CONFIGURATION

Digital inputs dignals		Digital driver	Analog driver	24 VDC to DI4:	0 VDC to DI4:
DI1	(*)	E-BM-AS 05H	E-BM-AC 011F	Driver configuration 011F (*) = don't care	Driver configuration 05H (*) = don't care
DI2	(*)				
DI3	(*)				
DI4	24 VDC				

Notes: set 0 VDC to DI4 and power-off/on the driver to restore latest settings; DI4 not available for /P option

6 VALVE SETTINGS AND PROGRAMMING TOOLS

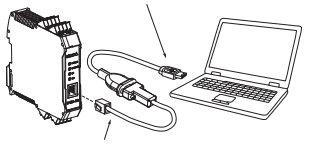
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via RS232 serial port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

Connection

E-A-PS-USB/DB9 USB to serial adapter



E-C-PS-DB9/RJ45 serial cable

WARNING: drivers RS232 port is not isolated!

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-AS - user manual for **E-BM-AS**

7.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.
For double solenoid valves two different Scale regulations are available:
ScaleA for positive reference signal and ScaleB for negative reference signal

7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).
The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If internal reference generation is active (see 7.6), threshold should be set to 0.
For double solenoid valves two different Bias regulations are available: positive reference signal activates BiasA for solenoid S1 and negative reference signal activates BiasB for solenoid S2

7.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.
Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations
- four ramps for positive/negative signal values and increasing/decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting)

7.4 Dither

The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve's regulation: a small vibration in the valve's regulating parts considerably reduces static friction effects.
Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).
Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup.
Default dither is a valid setting for a wide range of hydraulic applications

7.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.
Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition (e.g. maximum pressure control at defined working flow)

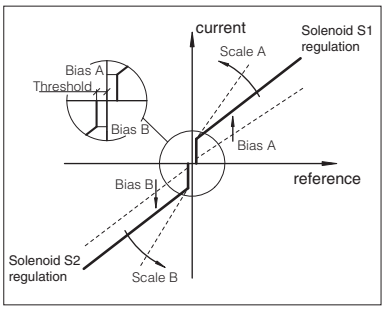
7.6 Internal Reference Generation

Internal generation of reference values is software selectable.
In this mode the 4 digital inputs of the driver (DI1..DI4) allow to activate the desired internal reference signal, among the different driver's stored values: external control unit can thus manage complex machine profile by simple switching the reference signal, by 4 digital inputs (see 4.7).
The digital inputs are software configurable into 2 different reference selection mode:

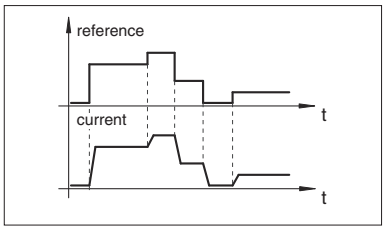
- *Standard mode*
  each digital input corresponds to a different value; up to 4 different internal values are available (2+2 with E-BM-AS-PS-05H driving two single solenoid valves)
- *Binary mode*
  each digital input combination corresponds to a different value; up to 15 different internal values are available (3+3 with E-BM-AS-PS-05H when driving two single solenoid valves)

A dedicated ramp time value can be set by software for each available stored reference value.
Note: with all input signals (DI) set to zero, the driver can be commanded by external analog reference also if internal reference generation is selected (for more information please refer to the programming manual E-MAN-BM-AS).

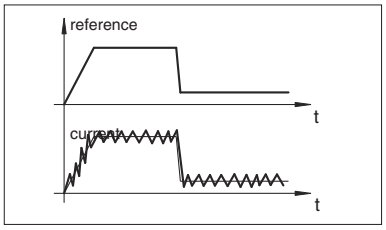
7.1, 7.2 - Scale, Bias & Threshold



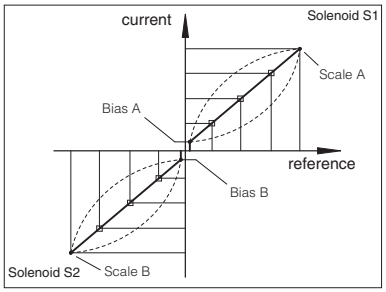
7.3 - Ramps



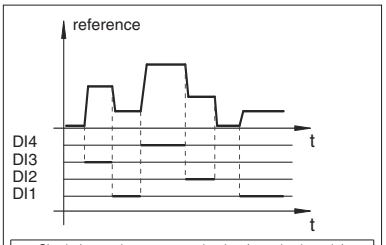
7.4 - Dither



7.5 - Linearization



7.6 - Internal Reference Generation



Single internal generator selection (standard mode)				
DI1	**DI2**	**DI3**	**DI4**	**Reference**
OFF	OFF	OFF	OFF	External
ON	OFF	OFF	OFF	Generation 1
(*)	ON	OFF	OFF	Generation 2
(*)	(*)	ON	OFF	Generation 3
(*)	(*)	(*)	ON	Generation 4

Double internal generator selection (standard mode)					
DI1	**DI2**	**S1**	**DI3**	**DI4**	**S2**
OFF	OFF	External	OFF	OFF	External
ON	OFF	Generation 1	ON	OFF	Generation 1
(*)	ON	Generation 2	(*)	ON	Generation 2

(*) don't care

7.7 Hydraulic Power Limitation (**/W option**, only for drivers E-BM-AS-PS-05H)

E-BM-AS drivers with /W option electronically perform hydraulic power limitation on:

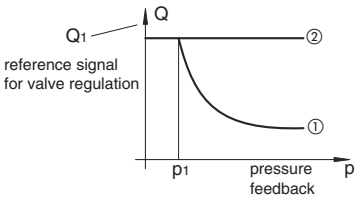
- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tech. table A170)

The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) or by the internal generator (see 7.6) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input CMD2.

When the actual requested hydraulic power **p**x**Q** (CMD2xCMD1) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [CMD2]}}\ ;\ \text{Flow Reference [CMD1]}\right)$$

7.7 - Hydraulic Power Limitation



Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

8 CONNECTIONS

The 4 fast plug-in connectors (A,B,C,D), included in the supply, provide simple wirings, easy driver's replacement and the possibility to test the signals directly on the connectors.

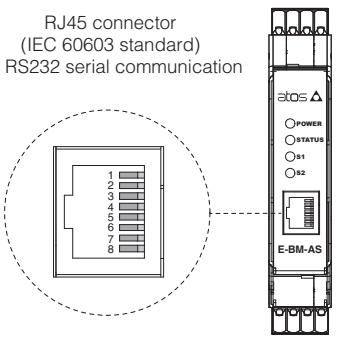
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS		NOTES	
A	A1	SOL S1	Current to solenoid S1		Output - power PWM	
	A2					
	A3	SOL S2	Current to solenoid S2 (only for 05H version)			
	A4					
B	B1	CMD1	Reference analog input: ±10 VDC / ± 20 mA maximum range software selectable (see 4.2)		Input - analog signal	
	B2	CMD-	Standard	/P option (see 4.4)		
			Zero signal, ground for reference signals	Reference for ±5 VDC output (AGND)		
	B3	CMD2 **(1)**	Reference analog input: ±10 VDC / ± 20 mA maximum range software selectable (see 4.2)			
	B4	DGND	Optical insulated ground for on/off inputs (DI1 ÷ DI4)			
C			Standard	/P option (see 4.4)	Standard	Option /P
	C1	DI1	Optical insulated on/off input 0 ÷ 24 VDC referred to pin B4 DGND (see 4.7) For analog driver compatibility see section 5	Optical insulated on/off input 0 ÷ 24 VDC referred to pin B4 DGND (see 4.7) For analog driver compatibility see section 5	Input - on/off signal	
	C2	DI2				
	C3	DI3		+5 VDC @ 10 mA output supply to pin B2 (AGND)	Input - on/off	Output - reference analog
	C4	DI4		-5 VDC @ 10 mA output supply to pin B2 (AGND)		
D	D1	V+	Power supply 24 VDC (see 4.1)		Input - power supply	
	D2	V0	Power supply 0 VDC			
	D3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (see 4.5)		Input - on/off signal	
	D4	STATUS	Fault (default) or software selected output (see 4.6)		Output - on/off signal	

(1) Only for 05H version, when used to drive two single solenoid valves or transducer input for /W option
WARNING: if CMD2 is not used has to be connect to CMD- (ground)

9 RJ45 CONNECTOR

RJ45 CONNECTOR		
PIN	SIGNAL	DESCRIPTION
1	/	Not connected
2	/	Not connected
3	/	Not connected
4	GND	Signal zero data line
5	RX	Driver receiving data line
6	TX	Driver transmitting data line
7	/	Not connected
8	/	Not connected

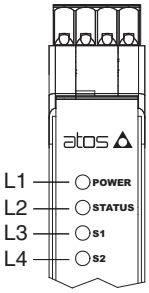
RJ45 connector
(IEC 60603 standard)
for RS232 serial communication



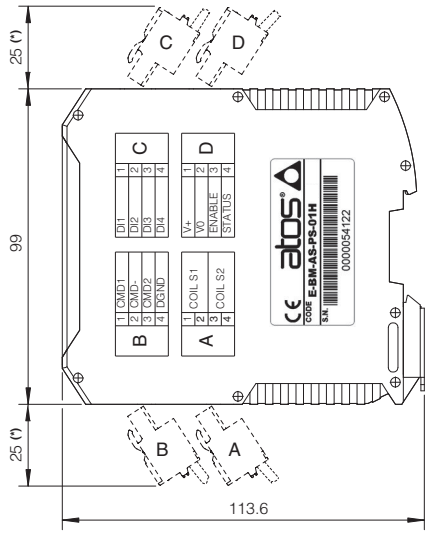
10 DIAGNOSTIC LEDS

Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

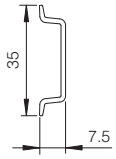
LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	POWER	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	STATUS	OFF or ON	Fault conditions
			Slow blinking	Driver disabled
			Fast blinking	Driver enabled
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF
			ON	PWM command ON
			Slow blinking	Coil not connected
			Fast blinking	Short circuit on the solenoid



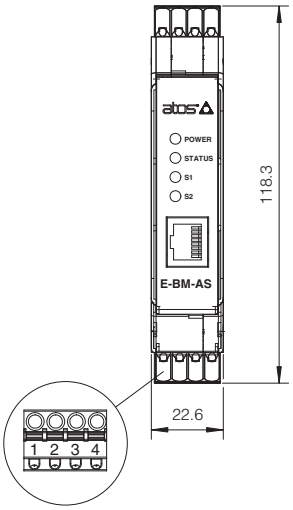
11 OVERALL DIMENSIONS [mm]



DIN rail dimensions



overall dimension with assembled connectors

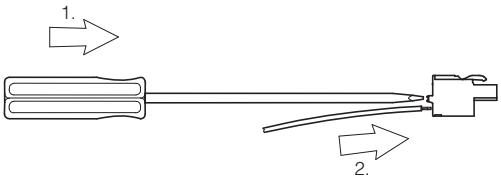


A, B, C, D connectors included

(*) Space to remove the connectors

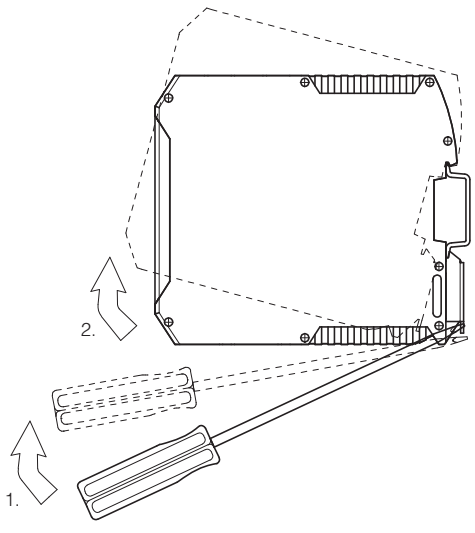
12 INSTALLATION

To wire cables in the connectors:
1. press the button with a screwdriver
2. insert the cable termination



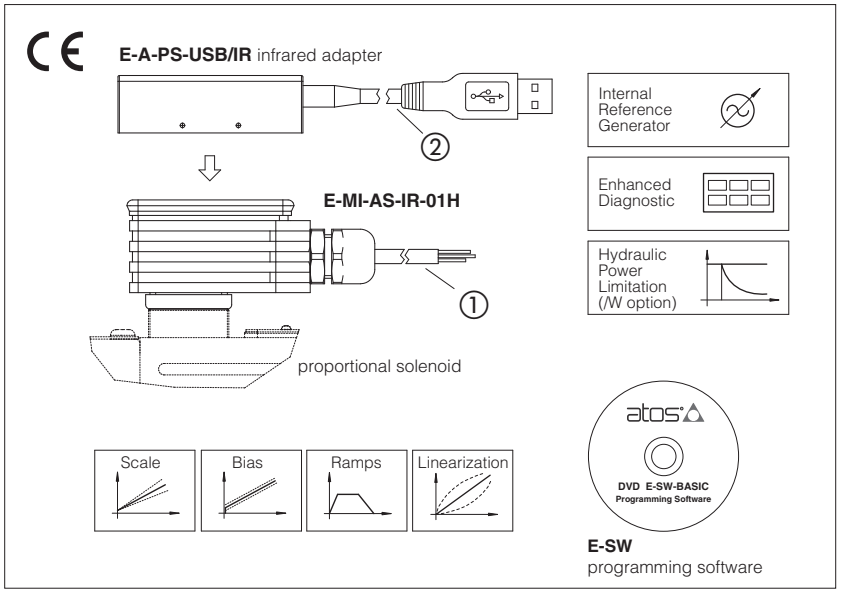
Note: max conductor size: 2,5 mm²

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



Digital electronic E-MI-AS-IR drivers

DIN 43650 plug-in format, for proportional valves without transducer



E-MI-AS-IR

Digital drivers are designed for mounting on the solenoid's DIN connector of proportional valves without transducer. They supply and control the current to the solenoid according to the electronic reference input signal. The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the valve's hydraulic regulation.
E-MI-AS drivers can drive single or double solenoid proportional valve.

Electrical Features:

- Standard 5m cable connection ① or M12 connector (/M12 option)
- Infrared communication interface ② to program the driver with Atos PC software
- 2 leds for diagnostics (see 9)
- +5 VDC output supply for external reference potentiometer (not available for /M12 option)
- Operating temperature range: -20° ÷ +50°
- Current reference input (/I option)
- Plastic box with IP65 protection degree and standard DIN43650 plug-in format with double earth connection to allow double-side orientation
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- /W option max power limitation function (see 6.7)
- Complete diagnostics of driver status

1 MODEL CODE

E-MI	-	A	S	-	IR	-	01H	/	*	*

E-MI = On-board driver DIN 43650 plug-in format

A = driver for valves without transducer

S = digital execution

IR = Serial infrared communication interface

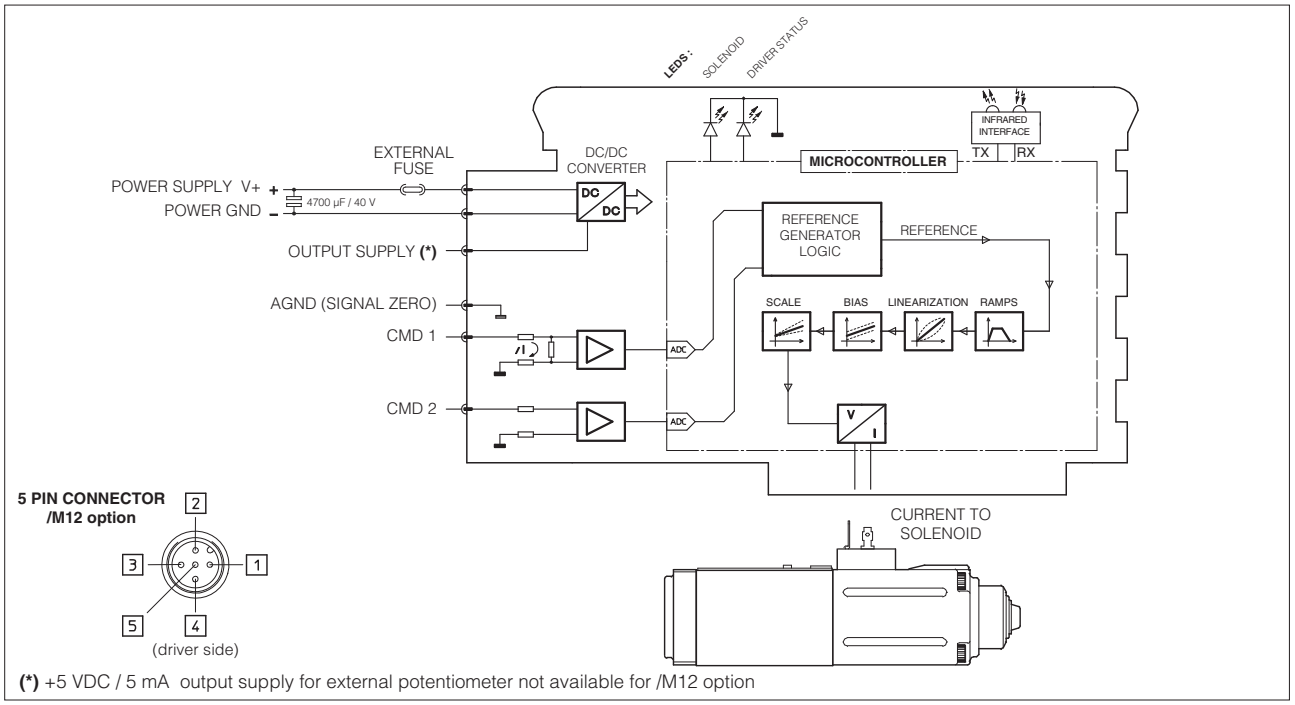
01H = for single solenoid proportional valves

Options, see section 4 **:**
- **-** = standard version (with 5 m cable)
- **I** = current reference input
- **M12** = with 5 poles M12 connector **(1)**
- **W** = power limitation function (see 6.7)

***** = Series number

(1) ZH-5P female connector must be ordered separately

2 BLOCK DIAGRAM



(*) +5 VDC / 5 mA output supply for external potentiometer not available for /M12 option

3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Nominal: +24 VDC Nominal: +12 VDC	Rectified and filtered: VRMS = 20 ÷ 27 VMAX (ripple max 10 % VPP) Rectified and filtered: VRMS = 10 ÷ 14 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W				
Current supplied to solenoids	IMAX = 2.7 A with +24 VDC power supply to drive standard proportional valves (3,2 Ω solenoid) IMAX = 3.3 A with +12 VDC power supply to drive proportional valves with /6 option (2,1 Ω solenoid)				
Reference input signal **(1)** (CMD1 - see 4.2)	Standard (voltage) **/I option** (current)	Input range: Input range:	0 ÷ 10 VDC 4 ÷ 20 mA / 0 ÷ 20 mA	Input impedance: Input impedance:	Ri > 50 kΩ Ri = 500 Ω
Enble Input Signal (CMD2 - see 4.5) ON/OFF Input Signal (CMD1,CMD2 - see 4.6)		Input range: Input impedance:	0 ÷ 24 VDC (OFF state: 0 ÷ 5 VDC; ON state: 9 ÷ 24 VDC) Ri > 10 kΩ		
Pressure transducer input (CMD2 - see 4.3)	**/W option**	Input range:	0 ÷ 10 VDC	Input impedance:	Ri > 50 kΩ
Output supply (see 4.4)	+5 V @ max 5 mA: output supply for external potentiometer (not available for **/M12 option**)				
Alarms	Solenoid coil not connected, short circuit and cable break with current reference signal (**/I option**)				
Format	Plastic box ; IP65 protection degree (when fixed on solenoid); DIN43650 format				
Operating temperature	-20 ÷ +50 °C (storage -25 ÷ +85 °C)				
Mass	Standard version: 450 g; /M12 option: 70 g				
Additional characteristics	Short circuit protection of current output to solenoid				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006				
Communication interface	Infrared, Atos protocol with ASCII coding; E-A-PS-USB/IR adapter is required (see section 5)				
Wiring cable characteristics	2 poles x 0,5 mm^2 plus 4 poles x 0,35 mm^2, external diameter 7,4 mm				

(1) Negative reference input signal not allowed

4 POWER SUPPLY AND SIGNALS SPECIFICATIONS

4.1 Power supply

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
According to power supply value, a safety fuse is required in series to each driver:
+24 VDC - 2,5 A time lag fuse
+12 VDC - 4 A time lag fuse

4.2 Reference Input Signal (CMD1: yellow/pin 4, referred to AGND: white/pin 3)

The driver proportionally transforms the external reference signal input into the current supplied to the solenoid.
The driver is designed to receive one analog reference input (CMD1 on yellow/pin 4) referred to the analog electric ground (AGND on white/pin3) and with a maximum range of 0 ÷ 10 VDC . Internal reference generation is software selectable (see 6.6).
Option /I (current reference input)
The reference input signal maximum range is software selectable among current 4 ÷ 20 mA (with cable break detection) or 0 ÷ 20 mA.

4.3 Pressure Input Signal (CMD2: blue/pin 5) - only for **/W** option

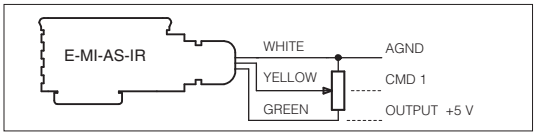
When hydraulic power limitation is active (see 6.7), enable input (CMD2) is managed as an analog input and has to be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 ÷ 10 VDC.

4.4 Output supply for external potentiometer - (OUTPUT SUPPLY: green, referred to AGND: white) - not available for **/M12** option

The reference analog signal can be generated by an external potentiometer directly connected to the driver, using the +5VDC supply output available at green wire thus generating the desired reference signal.

4.5 Enable Input Signal (CMD2: blue/pin 5, referred to AGND: white/pin 3)

Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to maintain active the infrared connection and the other driver functions when the valve must be disabled for safety reasons.
To enable the driver, supply a 24VDC on CMD2 (blue/pin 5, referred to white/pin 3).
The polarity of the enable input can be customized and the enable function can be deactivated, see table at side.



ENABLE CONFIGURATION			
Signal	default polarity	reverse polarity	deactiveted
9 ÷ 24 VDC	solenoid ON	solenoid OFF	solenoid ON
0 ÷ 5 V	solenoid OFF	solenoid ON	solenoid ON

4.6 ON/OFF Input Signals (CMD1: yellow/pin 4, CMD2: blue/pin 5)

When the driver is configured in internal reference generation mode (see 6.6), both reference input (CMD1) and enable input (CMD2) are managed as ON/OFF input signals. In this mode they are used to select the active reference signal, among the available stored values.

4.7 Possible combined options: /IM12, /IM12W, /IW and /M12W

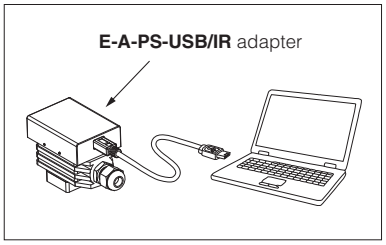
5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via RS232 serial port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

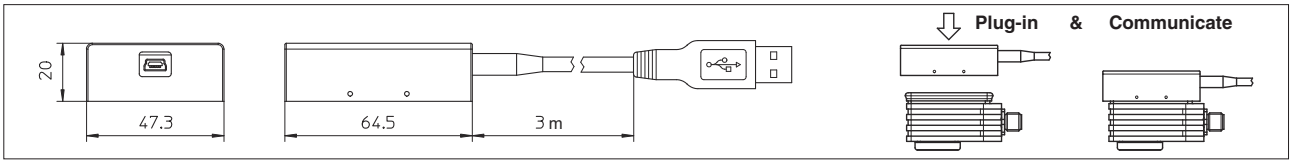
E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

Connection



WARNING: drivers USB port is not isolated!

Adapter, to be ordered separately :
E-A-PS-USB/IR = adapter from USB connector (PC communication port) to driver infrared communication interface: plug the adapter on the driver to establish the infrared communication



6 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers.
For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:
E-MAN-MI-AS - user manual for **E-MI-AS-IR**

6.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also usefull to reduce the maximum valve regulation in front of maximum reference signal.

6.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).
The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If internal reference generation is active (see 6.6), threshold should be set to 0.

6.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.
Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting)

6.4 Dither

The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve's regulation: a small vibration in the valve's regulating parts considerably reduces static friction effects.
Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).
Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup.
Default dither is a valid setting for a wide range of hydraulic applications

6.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.
Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition (e.g. maximum pressure control at defined working flow)

6.6 Internal Reference Generation

Internal generation of reference values is software selectable.
In this mode the 2 driver inputs (see 4.6) allow to select the desired solenoid current reference signal, among the different internal stored values: external control unit can thus manage complex machine profile by simple switching of the reference signal, by 2 digital inputs (see 4.6).
Each digital input combination corresponds to a different reference value; up to 4 different internal values are available:

	Internal generated references			
	REF1	REF2	REF3	REF4
CMD1	0	24 VDC	24 VDC	0
CMD2	0	0	24 VDC	24 VDC

A different ramp time value can be set by software for each available stored reference value.

6.7 Hydraulic Power Limitation (/W option)

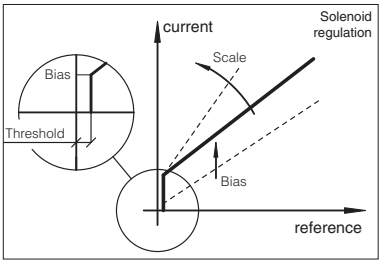
E-MI-AS drivers with /W option electronically perform hydraulic power limitation on single solenoid valves:

- flow control valves (direct and pilot operated)
- directional control valves (direct and pilot operated) + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tab. A170)

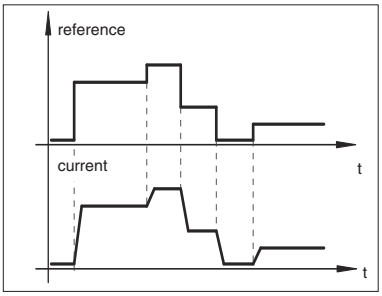
The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input CMD2 (see 4.3).
When the actual requested hydraulic power **p**x**Q** (CMD2xCMD1) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure transducer feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [CMD2]}}; \text{Flow Reference [CMD1]}\right)$$

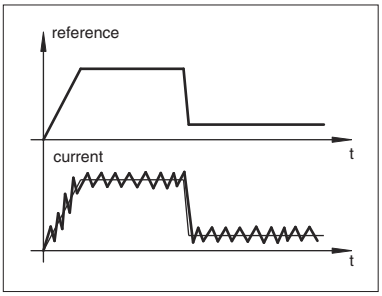
6.1, 6.2 - Scale, Bias & Threshold



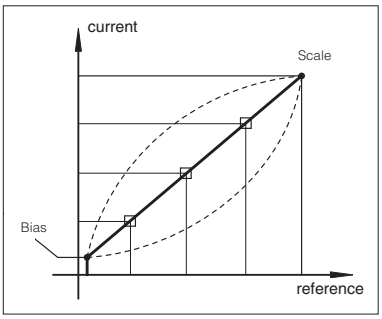
6.3 - Ramps



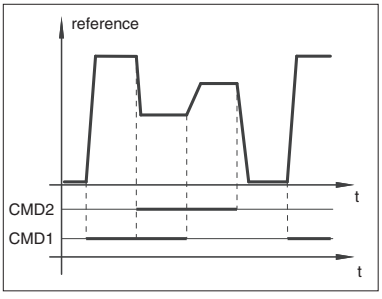
6.4 - Dither



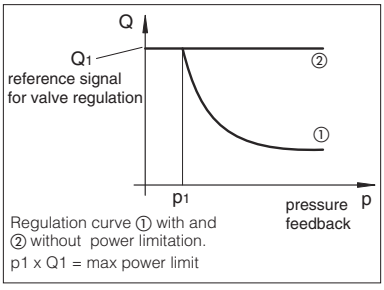
6.5 - Linearization



6.6 - Internal Reference Generation



6.7 - Hydraulic Power Limitation



7 CONNECTIONS

Standard cable wire color	/M12 option pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
RED	1	V+	Power supply +24 VDC or +12 VDC (see 4.1)	Input - power supply
BLACK	2	V0	Power supply 0 VDC	
WHITE	3	AGND (Signal zero)	Ground for CMD1,CMD2 and OUTPUT SUPPLY	Input - analog signal
GREEN	N.A.	OUTPUT SUPPLY	+5 VDC @ 5 mA output supply for external potentiometer (not available for option /M12) (see 4.4)	Output - analog signal

The two input signals CMD1 and CMD2 can be managed as analog input or ON/OFF signals; their function depends on the selected software setting:

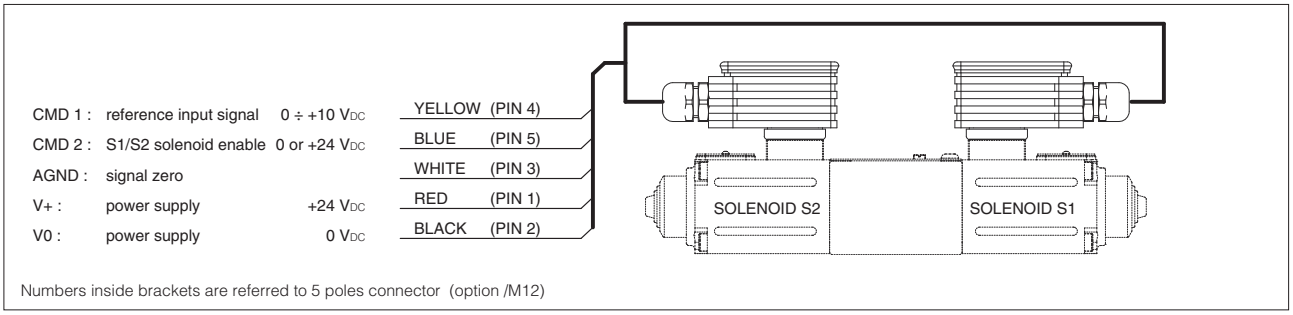
Standard cable wire color	/M12 option pin	SIGNAL	TECHNICAL SPECIFICATIONS (software setting dependent)			NOTES
			Default (see 4.2 ; 4.5)	**Internal Reference Generation** (see 4.6 ; 6.6)	**Hyraulic Power Limitation** (only for /W option - see 4.3 ; 6.7)	
YELLOW	4	CMD 1	Reference analog input: 0 ÷ 10 VDC (4 ÷ 20 mA; 0 ÷ 20 mA for /I option)	ON/OFF: 24 VDC / 0 VDC	Reference analog input: 0 ÷ 10 VDC (4 ÷ 20 mA; 0 ÷ 20 mA for option /I)	Input - analog or digital
BLUE	5	CMD 2	Enable/disable the driver: 24VDC / 0VDC	ON/OFF: 24 VDC / 0 VDC	Pressure transducer input: 0 ÷ 10 VDC	

8 DOUBLE SOLENOID VALVES OPERATION

It is possible to use two E-MI-AS drivers to operate one double solenoid proportional valve supplying the same analog signal to both CMD1 inputs reference. The enable input signal is used to select which driver/solenoid has to be active.

To operate double solenoid valves it is required to:

- parallel wire the two drivers (see following scheme).
- select opposite polarity (default and reverse) for the two enable signals (see 4.5)
- manage from PLC or machine unit: 1 analog reference signal corresponding to desired valve's regulation and 1 ON/OFF signal to select the active solenoid.

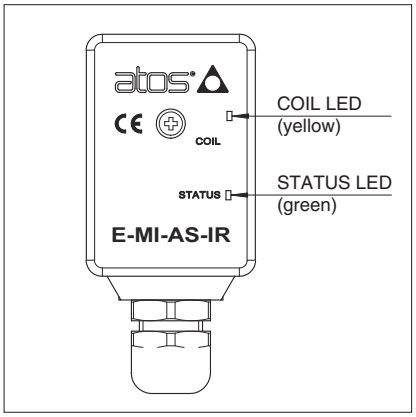


Numbers inside brackets are referred to 5 poles connector (option /M12)

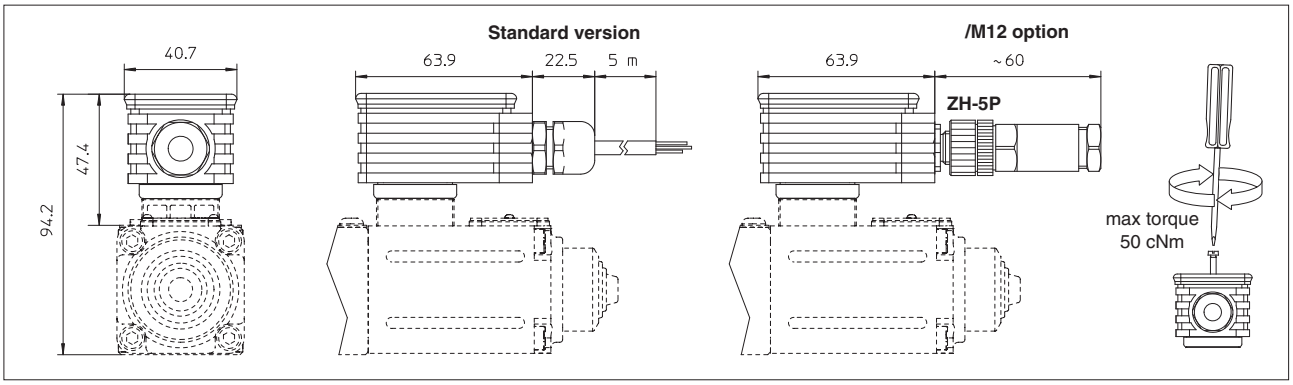
9 DIAGNOSTIC LEDS

It is possible to verify the actual status of solenoid command (yellow LED) and the driver status (green LED).
The following table details the possible displayed conditions:

COIL (YELLOW LED)	
Light signal displayed	Coil status
Light Off	PWM command OFF
Light On	PWM command ON
Slow blinking	Solenoid not connected
Fast blinking	Short circuit on the solenoid
STATUS (GREEN LED)	
Light signal displayed	Driver status
Light Off	Absence of power supply
Light On	Malfunctioning
Slow blinking	Driver disabled or Alarm present
Fast blinking	Driver enabled

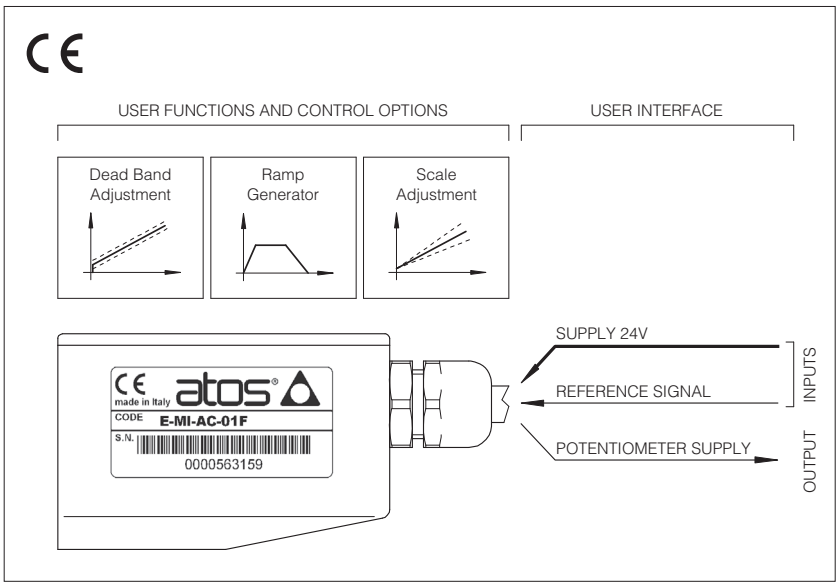


10 OVERALL DIMENSIONS [mm] AND INSTALLATION



Analog electronic E-MI-AC drivers

DIN 43650 plug-in format, for proportional valves without transducer



E-MI-AC

Analog drivers control the current to the solenoid of Atos proportional valves without pressure or LVDT position transducer, regulating the spool position, the flow or the pressure according to the electronic reference signal.

Features:

- bias and scale regulations by potentiometers
- symmetrical (standard) or dissymmetrical (/RR option) rising and falling ramp generator
- factory pre-set
- alluminium box with IP65 protection degree
- electronic filters on input and output lines
- CE mark according to EMC directive

Applications:

Pressure, flow, position open or closed-loop systems, according to the block diagram 2.

1 MODEL CODE

E-MI	-	AC	-	01F	/	*	*	/	*

On-board electronic driver DIN 43650 plug-in format

AC = for proportional valve without transducer

01F = for single solenoid proportional valve

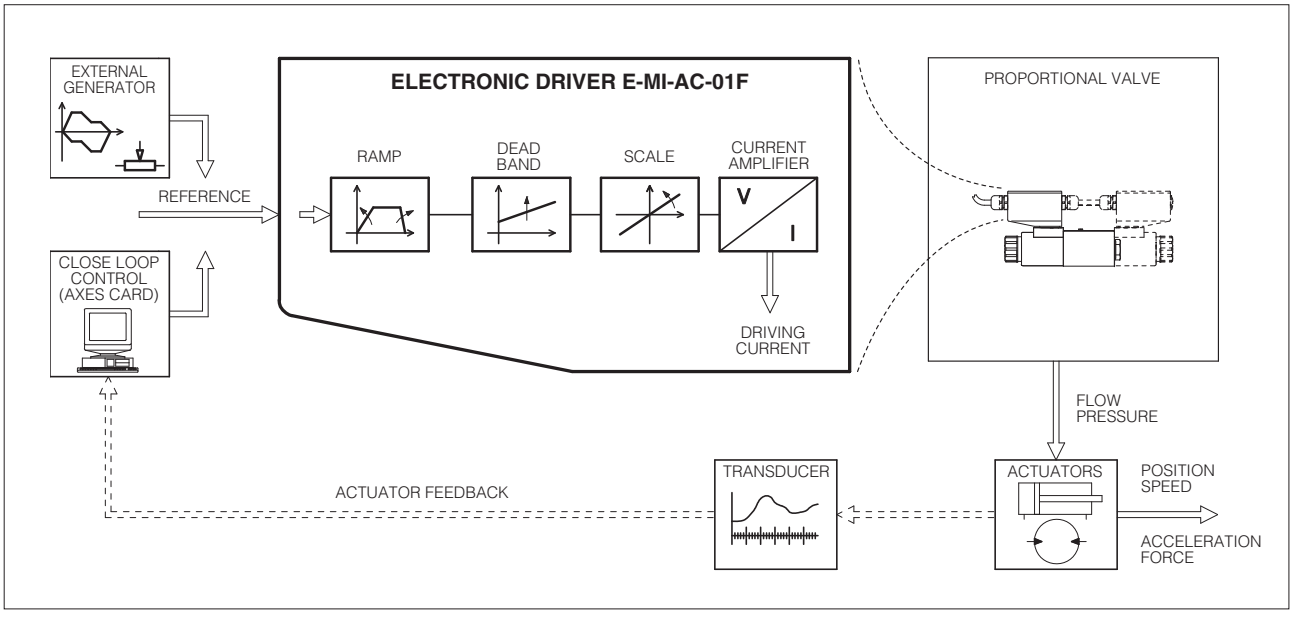
Options:

- = standard symmetrical ramps
RR = adjustable dissimmetrical ramps, adjustable dither, suitable also for current signal 0÷20 mA
7 = pre arranged for double solenoid valves control

Series number

Set code (see 4.4)

2 BLOCK DIAGRAM



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Nominal: +24 VDC Rectified and filtered: VRMS = 21 ÷ 33 VMAX (ripple max 10 % VPP) Nominal: +12 VDC Rectified and filtered: VRMS = 10 ÷ 14 VMAX (ripple max 10 % VPP)
Max power consumption	50 W
Current supplied to solenoid	IMAX= 2,7 A type PWM square wave (with solenoid type ZO(R)-A with resistance 3,2 Ω)
Nominal reference signal (factory preset)	0 ÷ 10 VDC
Reference signal variation range (scale adjustment)	0 ÷ 10 VDC (0 ÷ 5 VMIN) – (0 ÷ 20 mA for current signal)
Input signal impedence	Voltage signal Ri > 50 kΩ – (Ri = 250 Ω for current signal)
Potentiometers supply	+5 V / 10 mA at contact 3
Ramp time	10 sec. max (0 ÷ 10 V of reference signal)
Format	Box equipped with DIN 43650-IP65 plug; VDE 0110 wired on solenoid
Operating temperature	0 ÷ +50 °C (storage -20 ÷ +70 °C)
Mass	190 g
Additional characteristics	Outputs to solenoids protected against accidental short circuits
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Connections	7 contacts – terminal strip
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² up to 1,0 mm² (20 AWG - 18 AWG)

4 GENERAL SPECIFICATIONS

4.1 Power supply and wiring

The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier use a 10000 µF/40V capacitor; if pulse voltage is generated by a three phase rectifier, connect a 4700 µF capacitor (see 11).

Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC), connecting the shield to noiseless earth (TE), see 13. It is suitable to keep the driver and its cables far from any electromagnetic radiation source (like cables where high currents flow, electric motors, transformers, relays, solenoids, portable radio-transmitter, etc.).

The 12 VDC electric voltage supply is allowed only after evaluation of the performances required from the proportional valves, and however after check with our technical office.

According to power supply value, a safety fuse is required in series to each driver:
+24 VDC - 2,5 A time lag fuse
+12 VDC - 4 A time lag fuse

4.2 Reference signal, see 5.

The electronic driver is designed to receive a voltage reference signal according to the following options:
- potentiometers mounted externally and wired according to the application diagrams.
- external reference signals generated by PLC, see 11.
- voltage from 0 to 10V
- current from 0 to 20 mA (only with **/RR** option).

4.3 Monitor signal

This voltage output signal allows to measure the current supplied to the coil, read by a voltmeter between the test point M and pin 2 (see 9).
Reading scale is 1 mV = 10 mA (eg.: if the voltage signal is 70 mV, coil current is 700 mA).
To visualize the signals use voltmeters with impedance >10 KΩ.

4.4 Set code

Basic calibration of the electronic driver is factory pre-set, according to the proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follows:

1 = RZGO (KZGO) 2 = RZMO, AG*ZO, LI*ZO
3 = DHZE, DHZO, DKZOR 4 = DPZO-A-*5
6 = QV*ZO(R), LEQZO 8 = DKZE

4.5 Calibrations available to the user, see 7, 8, 9, 11.

Scale
The relation between driving current and reference signal can be regulated with the Scale adjustment.

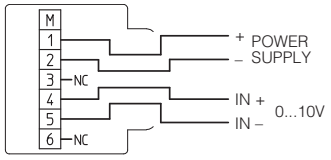
Bias (dead band)
Regulation of dead band adjusts the hydraulic zero of the valve (starting position adjustment) to the corresponding electrical zero. The electronic card is factory pre-set for the valve it is coupled with, according to the set code (see section 4.4). An output current is obtained when the input voltage is 100 mV or greater.

Ramps see 7, 9.
The internal ramp generator circuit converts a step input signal into a slowly increasing output signal (solenoid current).
The rise/fall time of the current is set via internal potentiometer P1 up to a max. time of 10 sec. for 0-10V of reference signal. The **/RR** option provides dissimmetrical ramps, ramp up is set via P1 potentiometer and ramp down is set via P2.

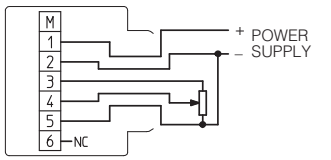
Dither
With the **/RR** option the dither frequency adjust is allowed from 100 Hz to 500 Hz.

5 EXTERNAL REFERENCE SIGNALS

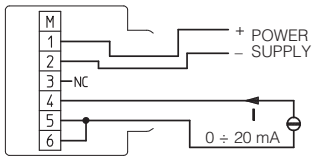
EXTERNAL GENERATOR VOLTAGE SIGNAL



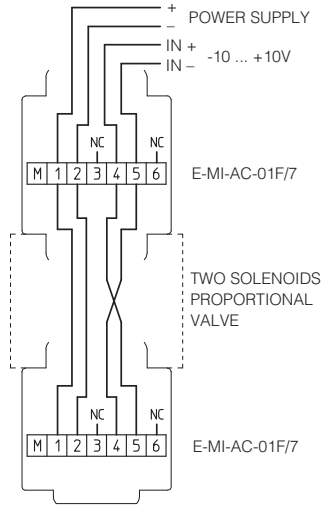
EXTERNAL POTENTIOMETER CONNECTION
POTENTIOMETER



EXTERNAL GENERATOR CURRENT SIGNAL
(**/RR** OPTION)



CONNECTION FOR TWO SOLENOIDS
PROPORTIONAL VALVE
(**/7** OPTION, necessary two /7 drivers)



6 INSTALLATION AND START-UP

It is advisable to perform calibration procedures in the order given below:

6.1 Warning

- Never insert or remove the driver while the electronic system is powered on.
- Refer to [9] to identify components mentioned in calibration procedures.
- The E-MI-AC electronic drivers are designed to work in open loop system, where the coupled proportional valve is not required to work at its limits.

6.2 Start-up

Factory pre-set adjustments might not meet the requirements desired for the specific application. Performances can be optimized by on-site re-adjustments of Bias, Scale and Ramps potentiometers, in sequence.

- Remove the cover and connect the electronic driver according to the desired connection diagram, see [5].

For double solenoid valves two electronic drivers type E-MI-AC-01F/7 must be used connected as shown in [5].

Start-up instructions are the same for each driver.

On the first driver two cable clamps must be mounted, one for the external wirings and one to give power and signal to the second driver which is equipped with one cable clamp and one blind plug.

A differential voltage signal -10 V ÷ +10 V must be supplied to the first driver.

Note that the first driver will work with signal from 0 to 10V while the second driver will work with signal from 0 to -10 V.

- The current supplied to the coil can be measured by a voltmeter connected between pins M and 2 of the screw terminal. The reading range will be: I[mA]=10xV[mV] (for example reading 70 mV the current in the coil will be 700 mA).

Bias adjustment (dead band compensation) see [8], [9].

- Supply electrical power to the driver; supply a reference signal voltage = 0,1 VDC. Gradually turn the P4 bias potentiometer until a movement of the controlled actuator is obtained.
- Turn in the opposite direction until the actuator is stopped.

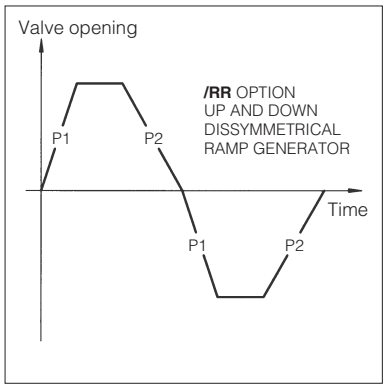
Scale adjustment, see [8], [9].

Supply max. current reference signal; check if the current in the coil reaches the max. value desired, turning P3 clockwise (see the regulation curve of the employed valve used).

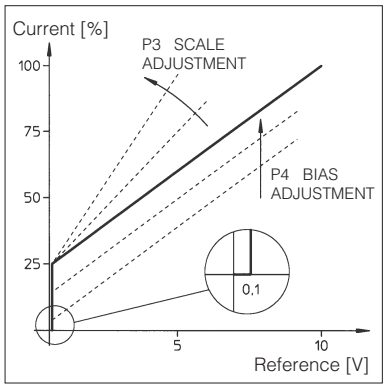
Ramps see [7], [9].

Turning the ramp potentiometer clockwise, acceleration and deceleration time can be increased to obtain the optimization of the complete system.

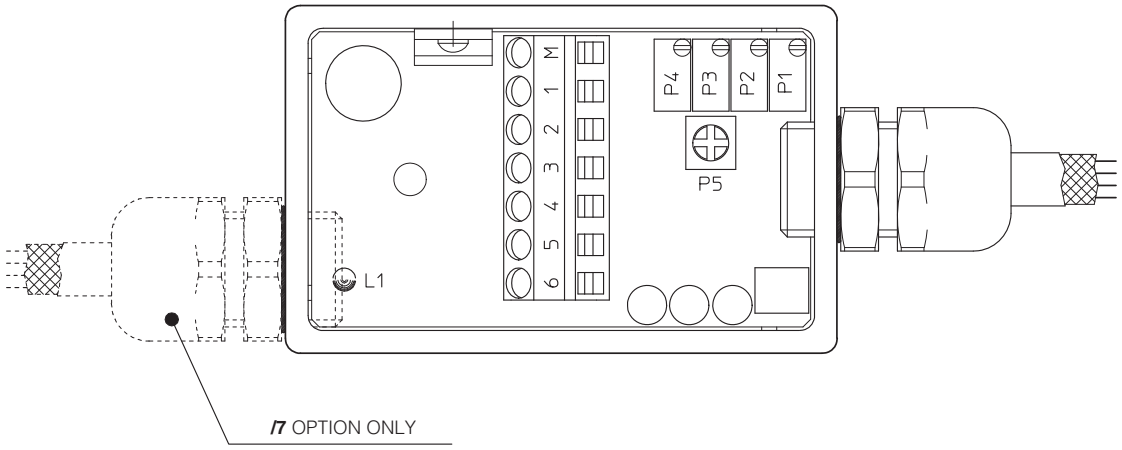
7 RAMPS



8 BIAS AND SCALE



9 REGULATIONS LAYOUT



CONNECTIONS

M = Monitor (driving current)
1 = Power V+ ┐ supply 24 VDC
2 = Power GND ┘
3 = Output +5VDC (10mA)
4 = Reference signal input +
5 = Reference signal input –
6 = Connect to contact 5 for current signal (**/RR** option only)

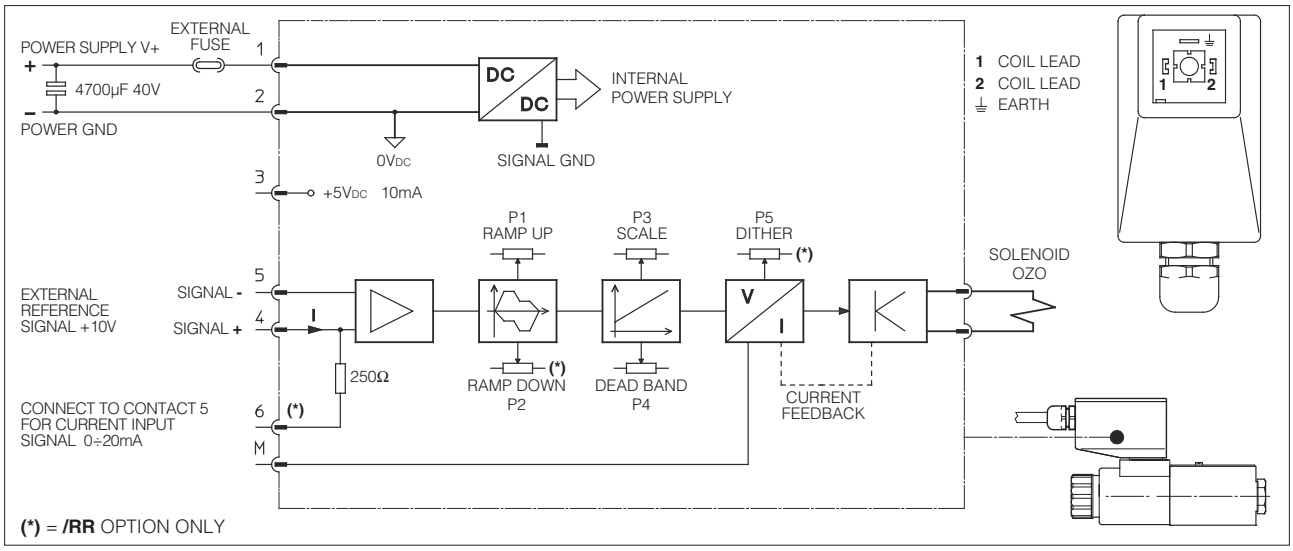
ADJUSTMENTS

P1 = Ramp up
P2 = Ramp down (**/RR** option only)
P3 = Scale
P4 = Bias
P5 = Dither (**/RR** option only)
L1 = Channel enabled led

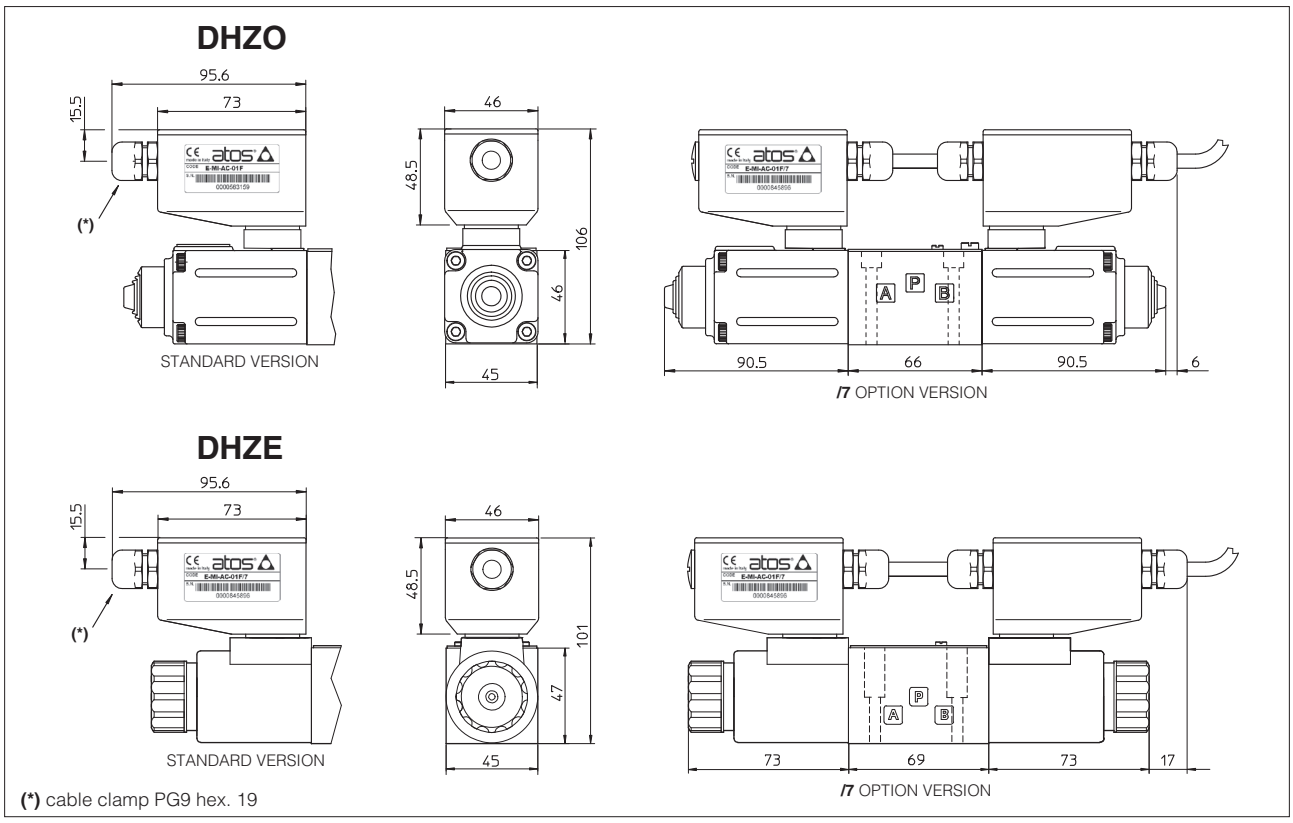
10 IMPORTANT INSTRUCTIONS

ELETTROMAGNETIC COMPATIBILITY
Atos electronic drivers and proportional valves are designed according to the 2014/30/UE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table.
The device must be verified on the machine because the magnetic field may be different from the test conditions.
SAFETY
The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of European directives (Safety requirements of fluid technology systems and components-hydraulics, EN 982). Special attention must be payed to switch-on/switch-off of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.

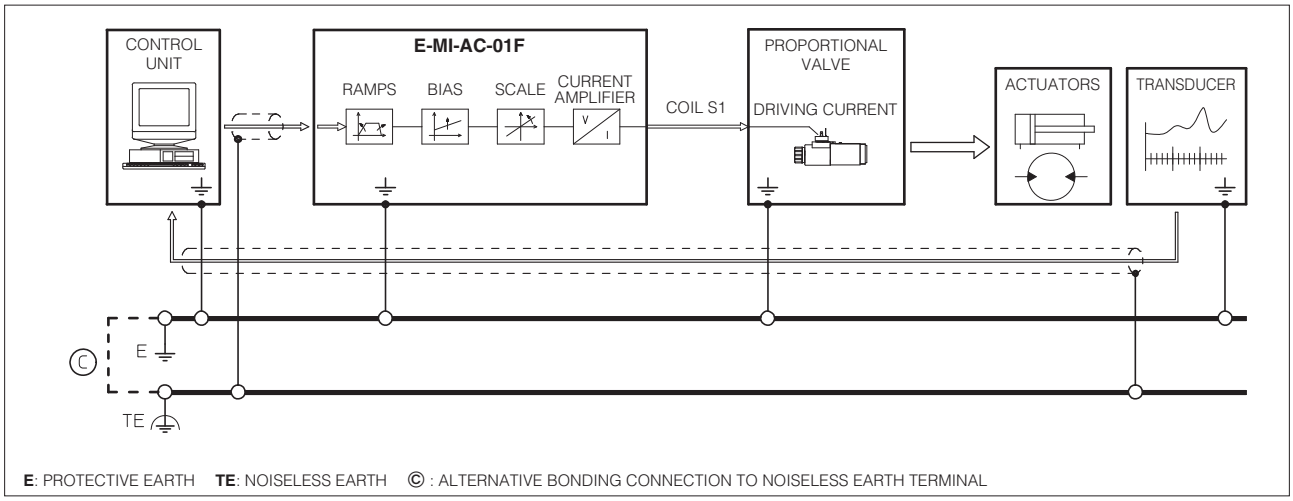
11 WIRING BLOCK DIAGRAM



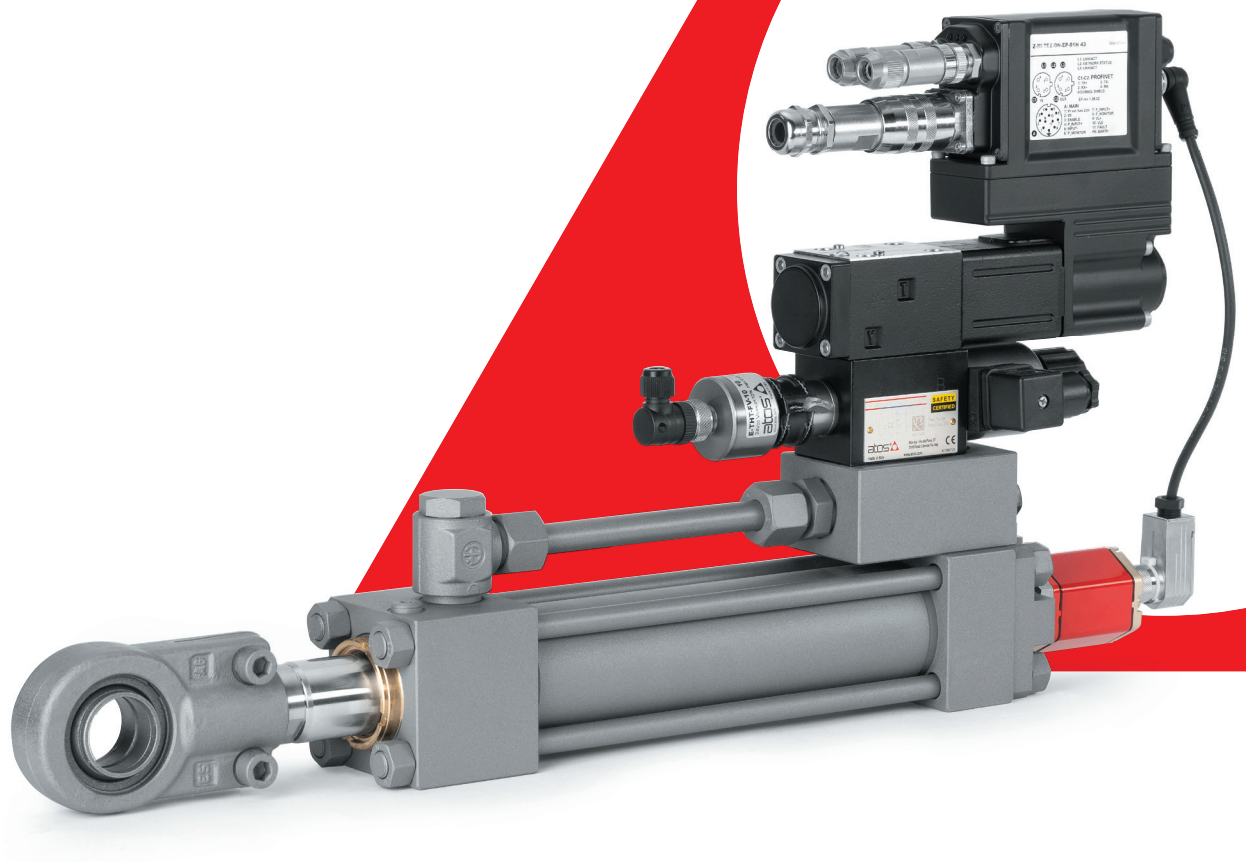
12 OVERALL DIMENSIONS [mm]



13 EARTH CONNECTIONS



2 AXIS & P/Q CONTROLS



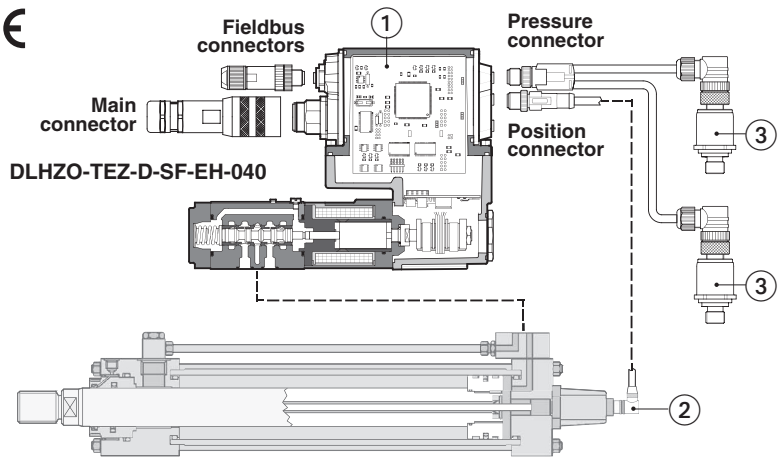
INDEX

AXIS & P/Q CONTROLS

Supplementary components range available on **www.atos.com**

Digital servoproportionals with on-board axis card

direct, single solenoid, sleeve execution, with LVDT transducer and zero spool overlap



① On-board digital driver + axis card
② Transducer to read the axis position feedback
③ Pressure transducers

DLHZO-TEZ, DLKZOR-TEZ

Digital servoproportional directional valves, direct, single solenoid, sleeve execution, with on-board digital driver + axis card, LVDT position transducer and zero spool overlap for best performances in any position closed loop controls of linear or rotative hydraulic actuator. The sleeve execution grants high regulation accuracy and response sensitivity.

The controlled actuator has to be equipped with transducer (analog, potentiometer, SSI or Encoder) to read the axis position feedback.

The valve can be operated via an external reference signal or automatic cycle, see section [2].

Alternated P/Q controls, see [3] :
SF, **SL** = alternated force control added to the basic position one

Safety options TÜV certified, see [7] :
U = safe double power supply
K = safe on/off signals

DLHZO:	**DLKZOR**:
Size: **06** -ISO 4401	Size: **10** -ISO 4401
Max flow: **70 l/min**	Max flow: **160 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

[1] MODEL CODE

DLHZO	- TEZ	- D	- SN	- NP	- 0	40	- L	7	3	/ *	*	/ *

DLHZO
Servoproportional directional valves, direct
DLHZO = size 06
DLKZOR = size 10

TEZ = on-board digital driver + axis card, one LVDT transducer

Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

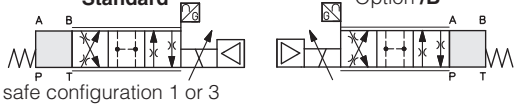
Alternated P/Q controls:
SN = none
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

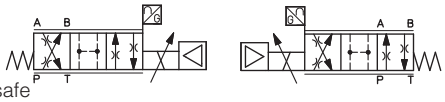
Valve size ISO 4401: **0** = 06 **1** = 10

Configuration: **Standard** / Option **/B**

40 = with fail safe configuration 1 or 3



60 = without fail safe



Spool type, regulating characteristics:

L = linear

V = progressive

T = not linear **(1)**

D = differential-linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

DT = differential-not linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Series number

Seals material, see section [11] :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (2):
B = solenoid with on-board digital driver + axis card and position transducer at side of port A
Y = external drain

Electronics options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only for **SF, SL**
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Safety options TÜV certified **(2)**:
U = safe double power supply
K = safe on/off signals
See section [7]

SAFETY CERTIFIED

Fail safe configuration, see section [13] :
1 = 
3 = 

Note: select **1** for configuration **60** even without fail safe

Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZO =	4	7	8	14	-	20	28	40
DLKZOR =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) Not available for configuration **60** **(2)** For possible combined options, see section [16]

2 POSITION CONTROL

2.1 External reference signal

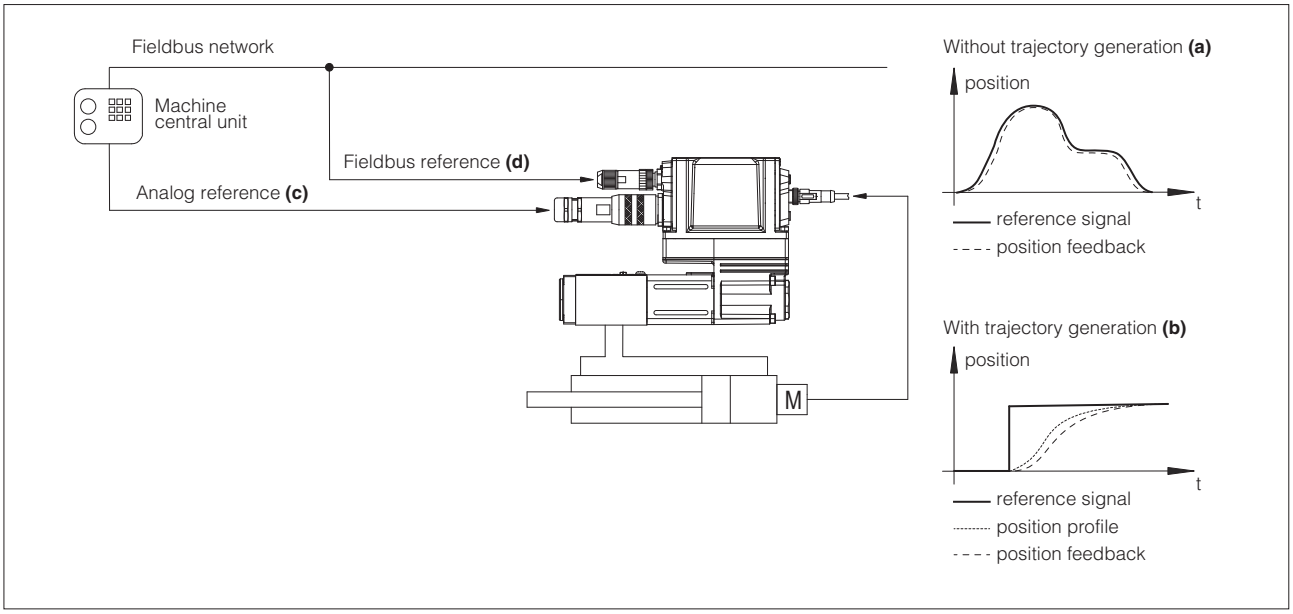
Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

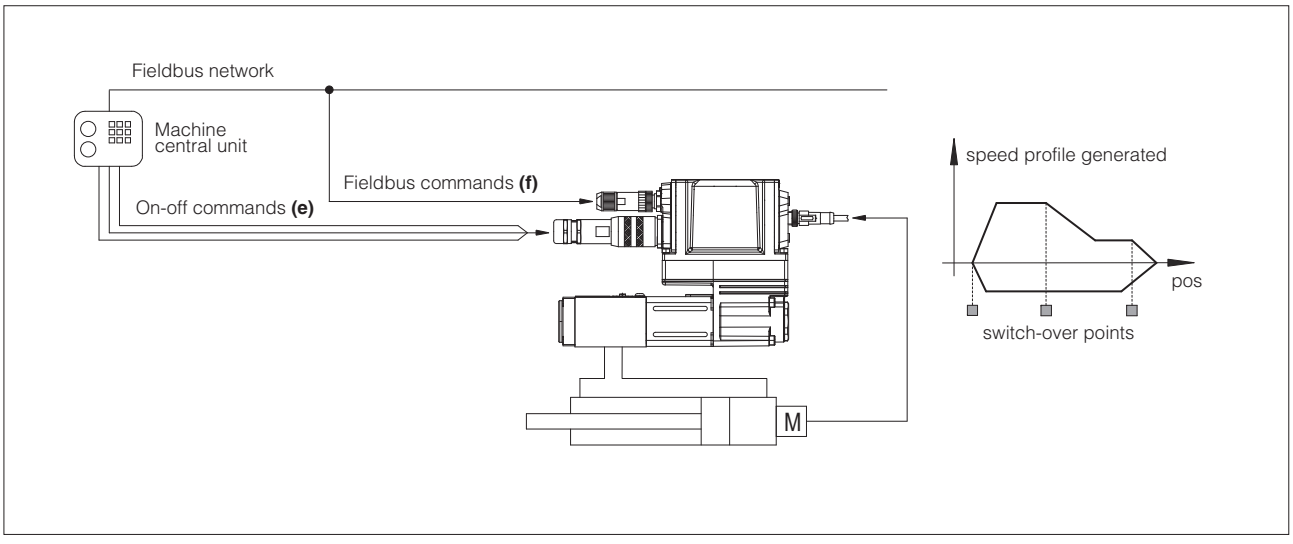
Refer to the axis card user manual for further details on position control features.



2.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



3 ALTERNATED POSITION / FORCE CONTROL

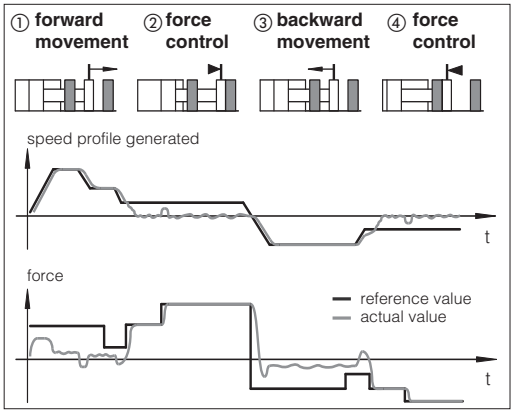
SF and **SL** controls add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

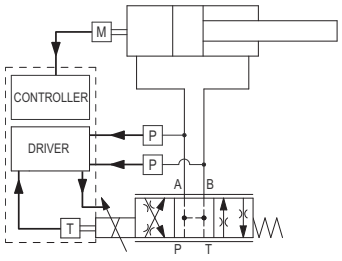
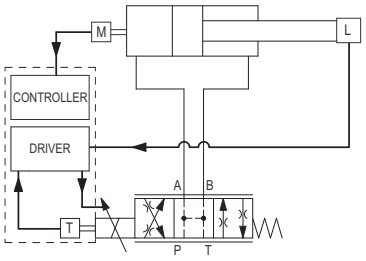
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations

SF	SL
	
two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve spool transducer	M actuator position transducer	P pressure transducer	L load cell

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

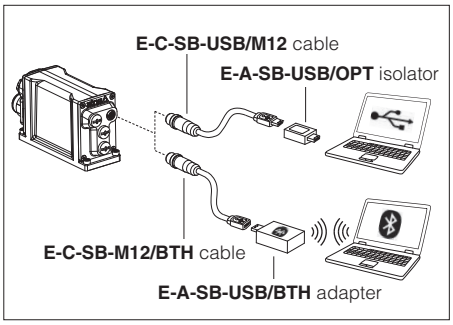
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the axis card (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

Z-SW-FULL support: NP (USB), PS (Serial), BC (CANopen), BP (PROFIBUS DP), EH (EtherCAT), EW (POWERLINK), EI (EtherNet/IP), EP (PROFINET)

Note: Z-SW programming software supports valves with option SF, SL for alternated control

WARNING: axis card USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** , designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the axis card has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the axis card checks the spool position and it provides on-off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (axis card housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DLHZO**												**DLKZOR**						
Pressure limits [bar]		ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10												ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10						
Spool type		**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
	Δp= 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
	Max permissible flow	8	14	16	30	40	50		70			70÷40		90		160			160÷80	
Leakage **(2)** [cm³/min]		<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time **(3)** [ms]		≤ 10												≤ 15						
Hysteresis		≤ 0,1 [% of max regulation]																		
Repeatibility		± 0,1 [% of max regulation]																		
Thermal drift		zero point displacement < 1% at ΔT = 40°C																		

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) Referred to spool in neutral position and 50°C oil temperature
(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**DLHZO** = 2,6 A	**DLKZOR** = 3 A		
Coil resistance R at 20°C	**DLHZO** = 3 ÷ 3,3 Ω	**DLKZOR** = 3,8 ÷ 4,1 Ω		
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Position transducers power supply	+24 VDC @ max 100 mA and +5 VDC @ max 100 mA are software selectable; ±10 VDC @ max 14 mA minimum load resistance 700 Ω			
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 21			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the axis card energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

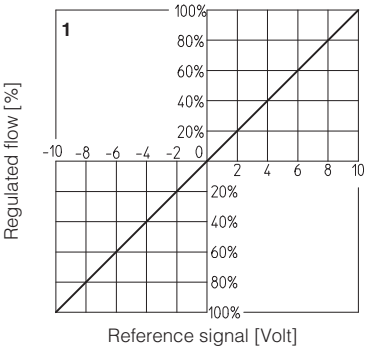
12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

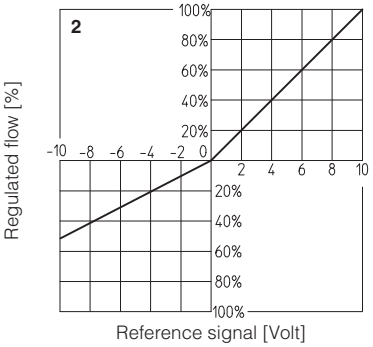
12.1 Regulation diagrams

1 = Linear spools L
2 = Differential - linear spool D7

3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZO)

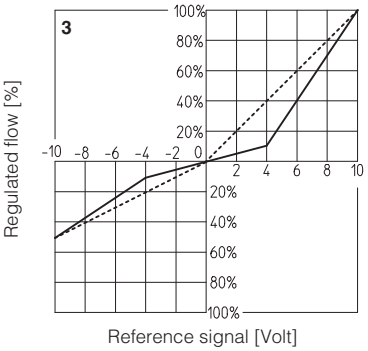
5 = Non linear spool T3 (only for DLHZO) and T7
6 = Progressive spool V

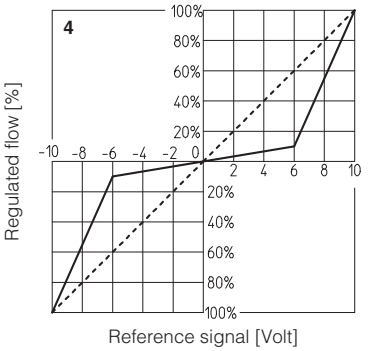




T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the axis card, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2

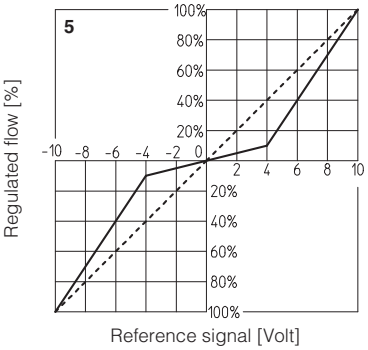


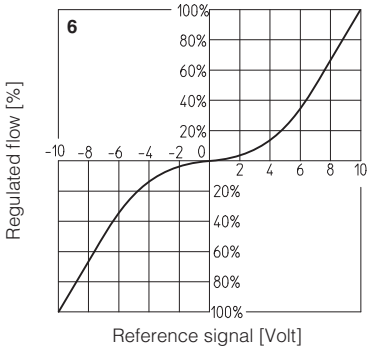


Note:
Hydraulic configuration vs. reference signal:

Standard:
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

option /B:
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → B / A → T
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → A / B → T



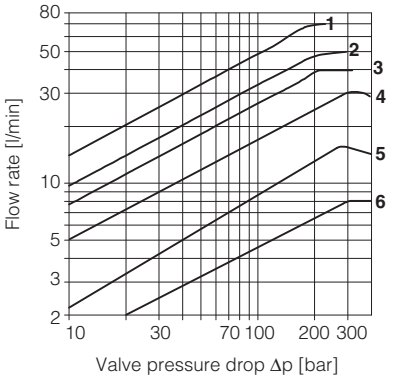


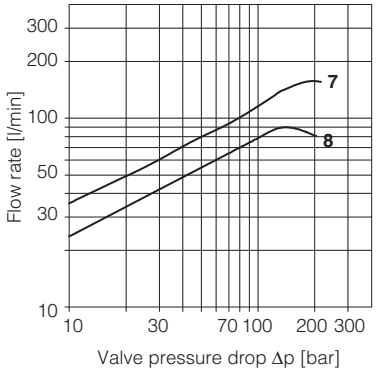
12.2 Flow /Δp diagrams

Stated at 100% of spool stroke

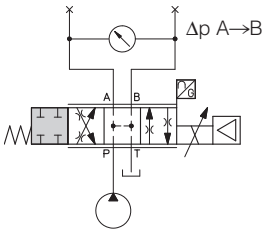
DLHZO:
1 = spool L7, T7, V7, D7, DT7
2 = spool L5, T5
3 = spool V3
4 = spool L3
5 = spool L1, V1
6 = spool L0

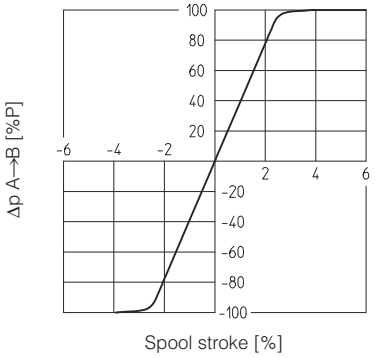
DLKZOR:
7 = spool L7, T7, V7, D7, DT7
8 = spool L3





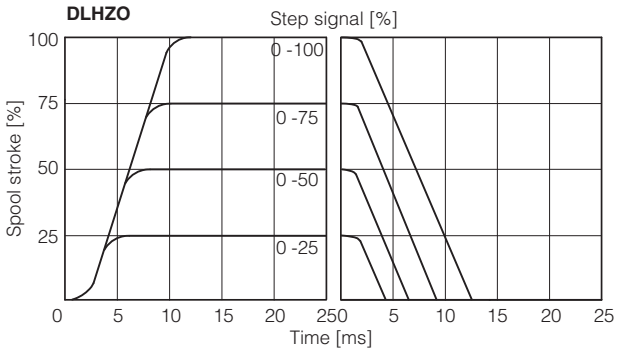
12.3 Pressure gain

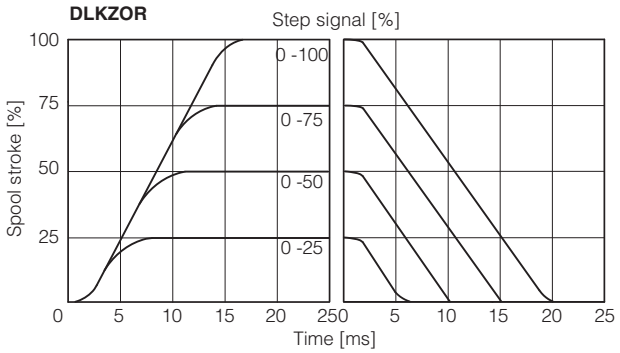




12.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For valves with on-board digital driver + axis card the dynamics performances can be optimized by setting the internal software parameters.



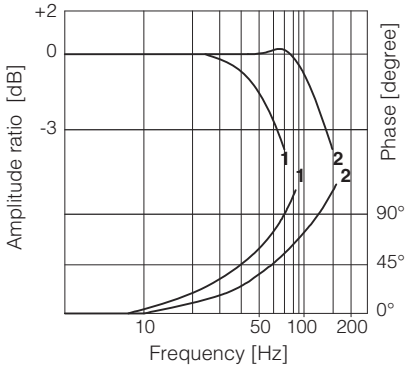


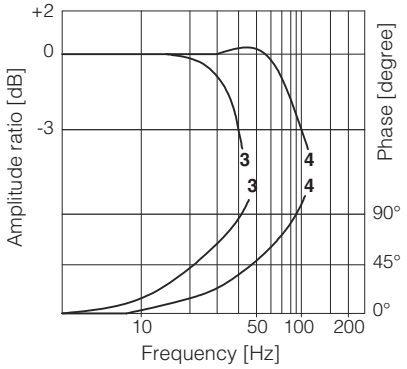
12.5 Bode diagrams

Stated at nominal hydraulic conditions

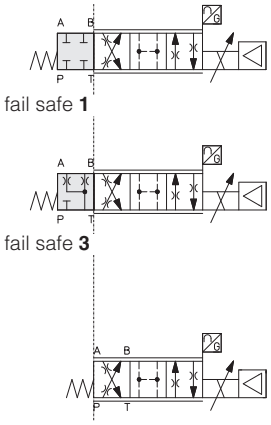
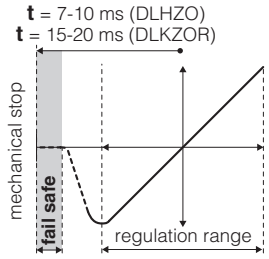
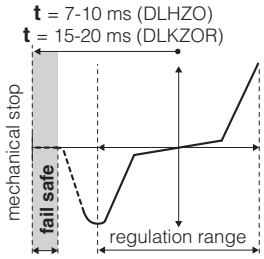
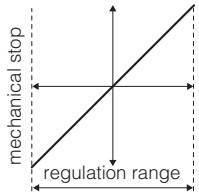
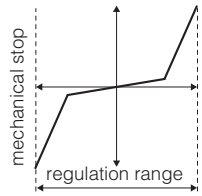
DLHZO:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZOR:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke





13 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
		
	t = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar	
		

Fail safe connections		**P → A**	**P → B**	**A → T**	**B → T**
Leakage [cm³/min] at P = 100 bar **(1)**	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] **(2)** DLHZO	Fail safe 3	-	-	15÷30	10÷20
DLKZOR		-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature **(2)** Referred to spool in fail safe position at Δp = 35 bar per edge

14 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver + axis card and LVDT position transducer at side of port A.
For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

15 ELECTRONICS OPTIONS

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = This option is available to connect pressure/force transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

16 POSSIBLE COMBINED OPTIONS

Standard versions for **D-SN**:
/BI, /BIY, /BY, /IY

Safety certified versions for **D-SN**:
/BIU, /BIUY, /BU, /BUY, /IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Standard versions for **A-SN**, **A-SF**, **A-SL** and **D-SF**, **D-SL**:
/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **A-SN**, **A-SF**, **A-SL** and **D-SF**, **D-SL**:
/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCIK, /BCIKY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for axis card logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

17.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on axis card reference mode, see section 2 :

external analog reference (see 2.1): input is used as reference for control in closed loop the actuator position.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

external fieldbus reference (see 2.1) *or automatic cycle* (see 2.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Force reference input signal (F_INPUT+) - only for **SF, SL**

Functionality of F_INPUT+ signal (pin 7), depends on selected axis card reference mode and alternated control options, see section 3 :

SL, SF controls and external analog reference selected : input is used as reference for the axis card force closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Force monitor output signal (F_MONITOR) - only for **SF, SL**

The axis card generates an analog output signal according to alternated force control option:
SN control: output signal is proportional to the actual valve spool position
SL, SF controls: output signal is proportional to the actual force applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA.
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin 3.
When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

17.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.
Fault output signal can be used as digital output by software selection.

17.9 Position transducer input signal

A position transducer must be always directly connected to the axis card. Select the correct axis card execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).
Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.
Position analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 18.1).

17.10 Remote pressure/force transducer input signals - only for **SF**, **SL**

Analog remote pressure transducers or load cell can be directly connected to the axis card.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 18.2).

18 ACTUATOR'S TRANSDUCER CHARACTERISTICS

18.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.
Transducers with analog interface grant simple and cost effective solutions.

18.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected pressure/force transducer, see section 3 .
Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details).
Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

18.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				**Pressure/Force**
Execution	**A**		**D**		**SF, SL**
Input type	Potentiometer	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	±10 VDC	+24 VDC	+5 VDC / +24 VDC	+5 VDC / +24 VDC	+24 VDC
Axis card interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos axis card **(2)** Percentage of total stroke **(3)** For Balluff BTL7 with SSI interface only special code SA433 is supported

19 ELECTRONIC CONNECTIONS

19.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the axis card, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Gnd - analog signal
6	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to VL0	Output - analog signal **Software selectable**
7	**F_INPUT+**	Force reference input signal (SF, SL controls): ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**
8	**F_MONITOR**	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20mA maximum range, referred to VL0	Output - analog signal **Software selectable**
9	**VL+**	Power supply 24 VDC for axis card logic and communication	Input - power supply
10	**VL0** (1)	Power supply 0 VDC for axis card logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to axis card housing	

(1) Do not disconnect VL0 before VL+ when the axis card is connected to PC USB port

19.2 Communication connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

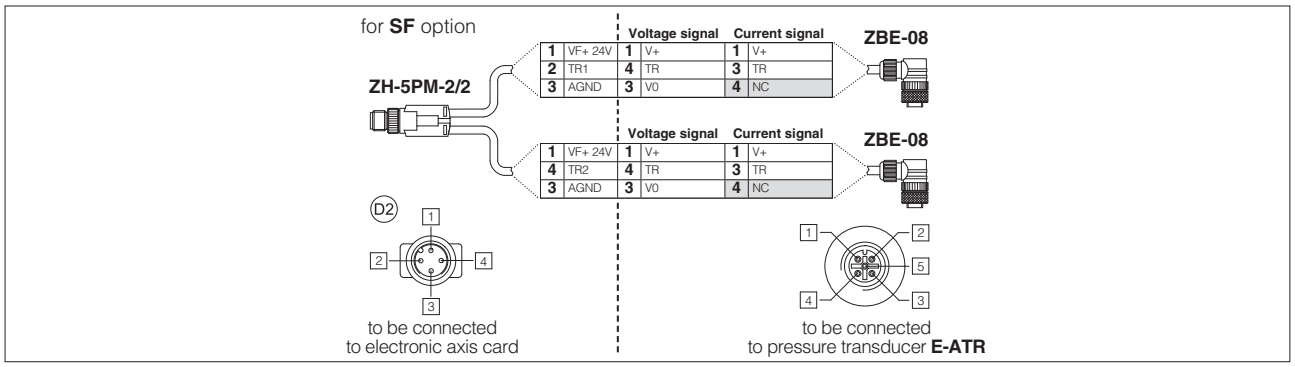
(2) Pin 2 can be fed with external +5V supply of CAN interface

19.3 Remote pressure/force transducer connector - M12 - 5 pin - only for **SF, SL** (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



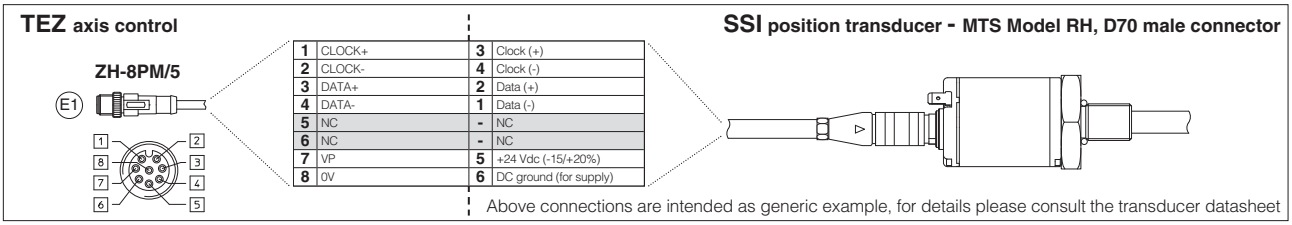
Note: pin layout always referred to axis card view

19.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

	SSI - default transducer (1)			Encoder (1)		
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
1	**CLOCK+**	Serial syncronous clock (+)	Input - digital signal	**R**	Input channel R	Input - digital signal
2	**CLOCK-**	Serial syncronous clock (-)		**/R**	Input channel /R	
3	**DATA+**	Serial position data (+)		**A**	Input channel A	
4	**DATA-**	Serial position data (-)		**/A**	Input channel /A	
5	**NC**	Not connect	Do not connect	**B**	Input channel B	
6	**NC**			**/B**	Input channel /B	
7	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
8	**0 V**	Common gnd for transducer power and signals	Common gnd	**0 V**	Common gnd for transducer power and signals	Common gnd

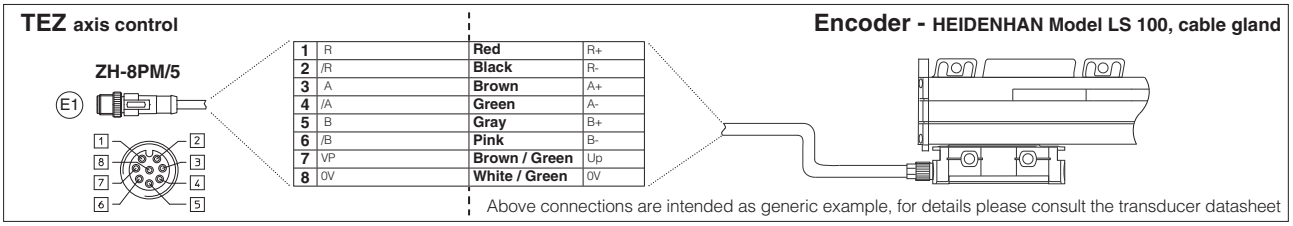
(1) Digital position transducer type is software selectable: Encoder or SSI, see 17.9

SSI connection - example



Note: pin layout referred to axis card view

Encoder connection - example



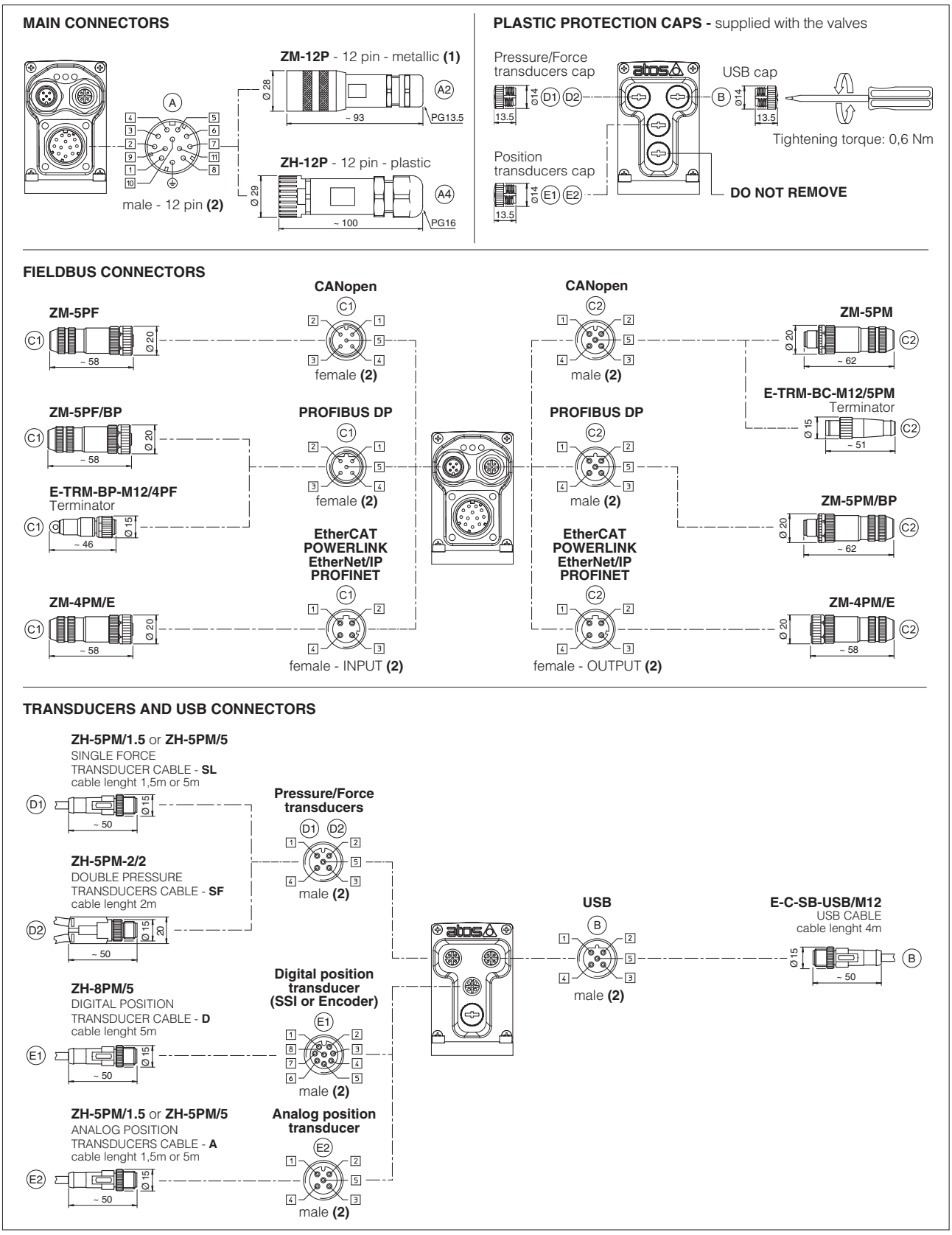
Note: pin layout referred to axis card view

19.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	**VP +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**	/	Connect
2	**VP +10V**	Power supply reference +10VDC (always present)	Output - power supply	Connect	/
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	**TR**	Signal transducer	Input - analog signal	Connect	Connect
5	**VP -10V**	Power supply reference -10VDC (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 17.9

19.6 TEZ connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to axis card view

19.7 Diagnostic LEDs (L)

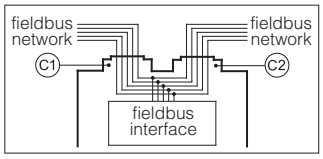
Three leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

20 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital axis card executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-12P**	(A2) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately, see tech table **GS500** **(2)** Internally terminated

21.3 Pressure/Force transducer connectors - only for **SF, SL**

CONNECTOR TYPE	SL - Single transducer		SF - Double transducers
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**	(D2) **ZH-5PM-2/2**
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

21.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 19.4	ANALOG POSITION TRANSDUCER A execution - see 19.5	
CODE	(E1) **ZH-8PM/5**	(E2) **ZH-5PM/1.5**	(E2) **ZH-5PM/5**
Type	8 pin male straight circular	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	M12 coding A – IEC 61076-2-101	
Material	Plastic	Plastic	
Cable gland	Connector moulded on cables 5 m lenght	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	8 x 0,25 mm²	5 x 0,25 mm²	
Connection type	molded cable	molded cable	
Protection (EN 60529)	IP 67	IP 67	

22 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:
Z-MAN-RI-LEZ - user manual for **TEZ** and **LEZ** with **SN**
Z-MAN-RI-LEZ-S - user manual for **TEZ** and **LEZ** with **SF**, **SL**

22.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

22.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

22.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 22.4)

22.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

22.5 Valve characteristics compensation

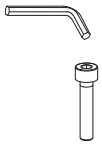
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

22.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

23 FASTENING BOLTS AND SEALS

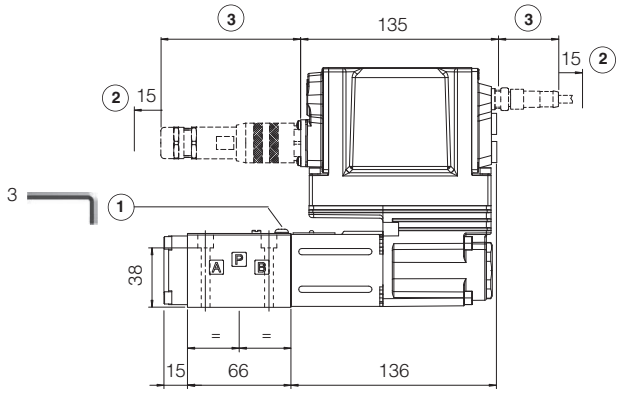
	DLHZO	**DLKZOR**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

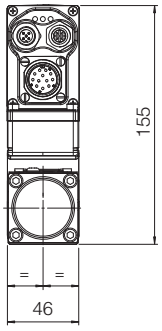
24 INSTALLATION DIMENSIONS [mm]

DLHZO-TEZ

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DLHZO	2,3

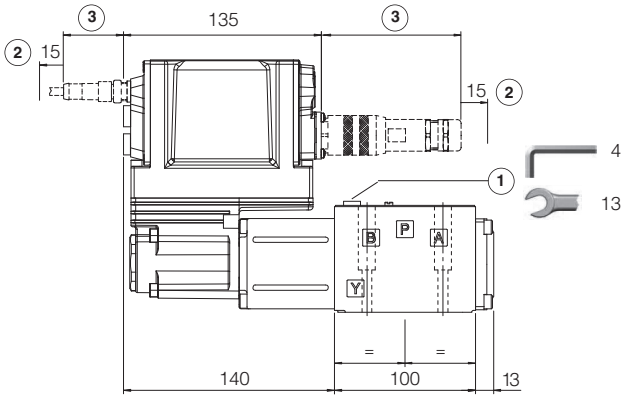


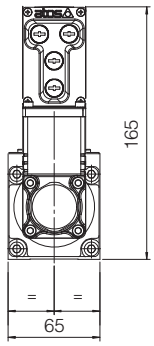


DLKZOR-TEZ

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DLKZOR	4,3





(1) = Air bleeding

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 19.6

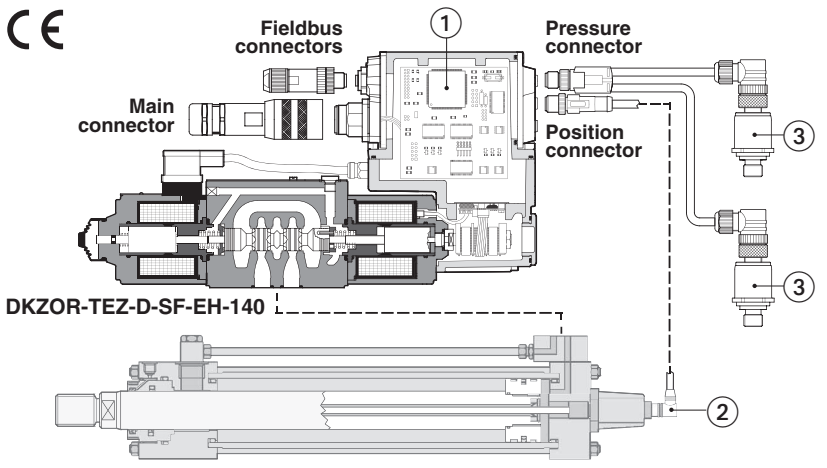
Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port A

25 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS900	Operating and maintenance information for proportional valves	**K800**	Electric and electronic connectors
FY100	Safety proportional valves - option /U	**P005**	Mounting surfaces for electrohydraulic valves
FY200	Safety proportional valves - option /K	**Y010**	Basics for safety components
GS500	Programming tools		

Digital servoproportionals with on-board axis card

direct, double solenoid, with LVDT transducer and zero spool overlap



① On board digital driver + axis card
② Transducer to read the axis position feedback
③ Pressure transducers

DHZO-TEZ, DKZOR-TEZ

Digital servoproportional directional valves, direct, double solenoid, with on-board digital driver + axis card, LVDT position transducer and zero spool overlap for position closed loop controls of linear or rotative hydraulic actuator. The double solenoid execution grants larger flow capacity and central safety rest position.

The controlled actuator has to be equipped with transducer (analog, potentiometer, SSI or Encoder) to read the axis position feedback.

The valve can be operated via an external reference signal or automatic cycle, see section [2].

Alternated P/Q controls option, see [3] :
SF, **SL** = alternated force control added to the basic position one

Safety options TÜV certified, see [7] :
U = safe double power supply
K = safe on/off signals

DHZO:	**DKZOR**:
Size: **06** -ISO 4401	Size: **10** -ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZO	- TEZ	- D	- SN	- NP	- 0	70	- L	5	/ *	*	/ *

DHZO
Servoproportional directional valves, direct
DHZO = size 06
DKZOR = size 10

TEZ = on-board digital driver + axis card, one LVDT transducer

D
Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

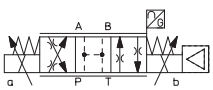
SN
Alternated P/Q controls:
SN = none
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

NP
Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen **EW** = POWERLINK
BP = PROFIBUS DP **EI** = EtherNet/IP
EH = EtherCAT **EP** = PROFINET RT/IRT

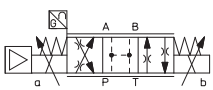
0
Valve size ISO 4401:
0 = 06 **1** = 10

70
Configuration:

70 = **Standard**



Option **/B**



L
Spool type - regulating characteristics:
L = linear

D = differential-progressive

P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

5
Spool size:

	3 (L)	**5** (L,D)
DHZO =	17	28
DKZOR =	45	75

Nominal flow (l/min) at Δp 10bar P-T

*
Hydraulic options (1):
B = solenoid with on-board digital driver + axis card and LVDT transducer at side of port A
Y = external drain

Electronics options (1):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only for **SF, SL**
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Safety options TÜV certified **(1)**:
U = safe double power supply
K = safe on/off signals
See section [7]

SAFETY CERTIFIED

*
Series number

*
Seals material, see section [11] :
- = NBR
PE = FKM
BT = HNBR

(1) For possible combined options, see section [15]

2 POSITION CONTROL

2.1 External reference signal

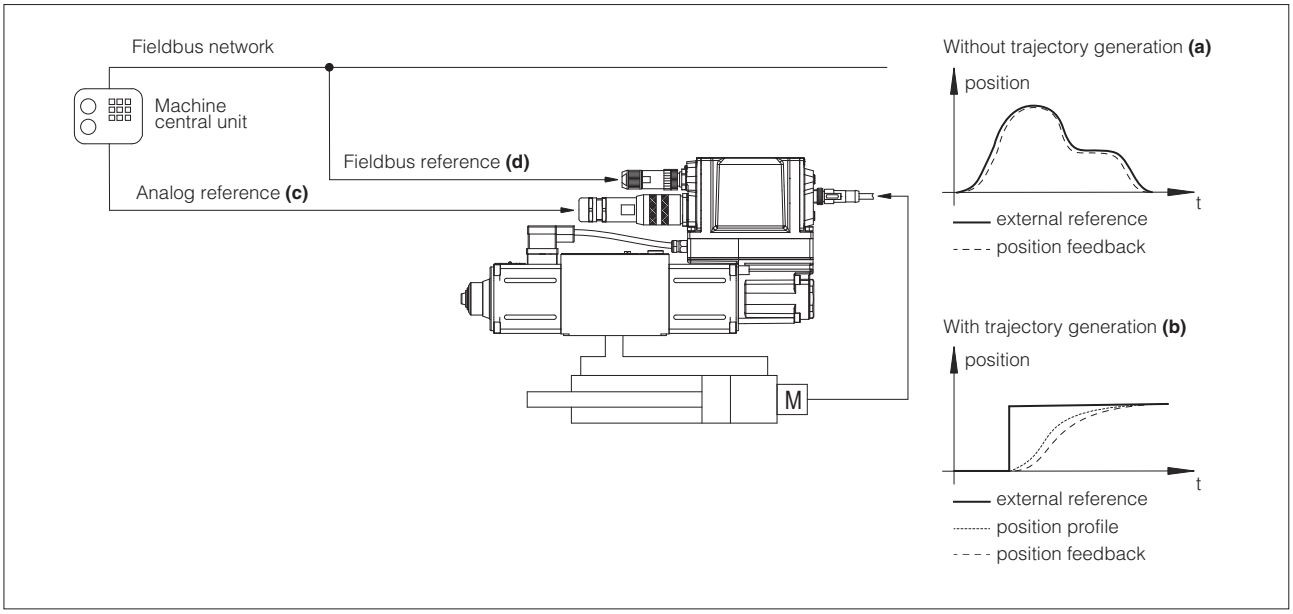
Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

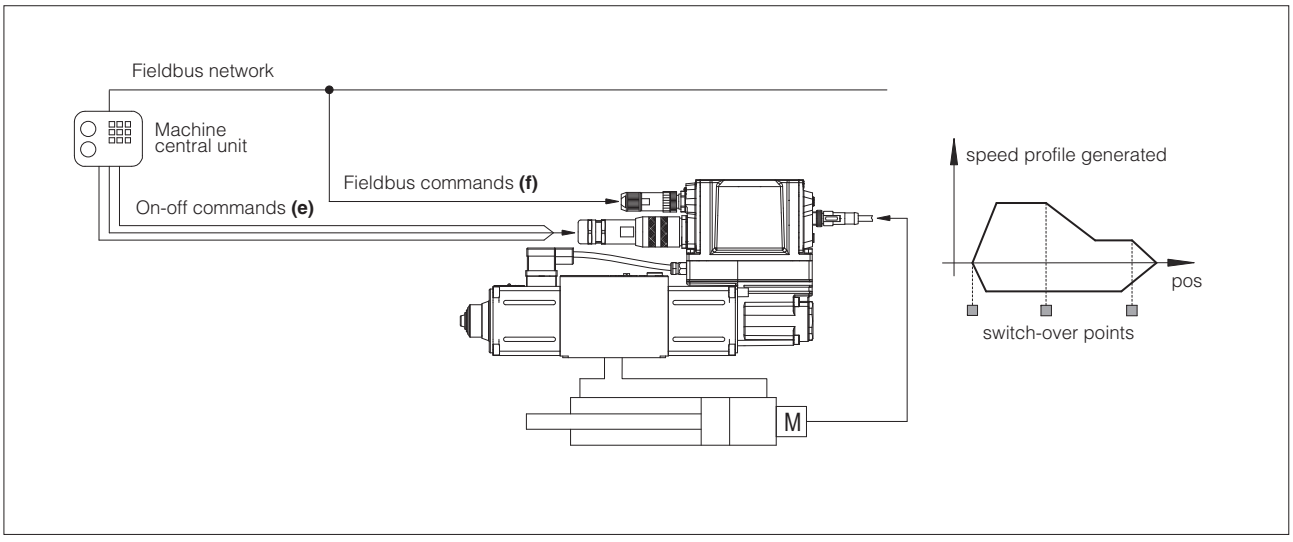
Refer to the axis card user manual for further details on position control features.



2.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



3 ALTERNATED POSITION / FORCE CONTROL

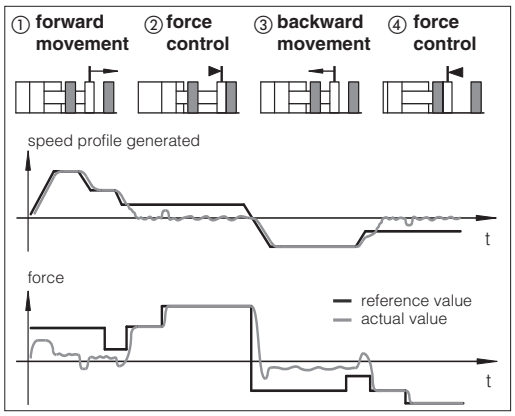
SF and **SL** controls add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

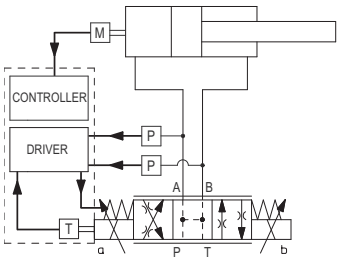
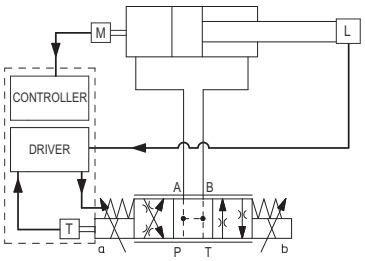
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations

SF	SL
	
two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve spool transducer	M actuator position transducer	P pressure transducer	L load cell

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

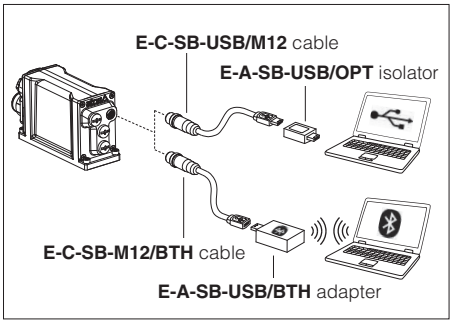
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital axis card (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

Z-SW-FULL support: NP (USB) PS (Serial)
BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

Note: Z-SW programming software supports valves with option SF, SL for alternated control

WARNING: axis card USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** , designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the axis card has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the axis card checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (axis card housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DHZO**			**DKZOR**		
Pressure limits [bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10			ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10		
Spool type	**L3**	**L5**	**D5**	**L3**	**L5**	**D5**
Nominal flow Δp P-T [l/min] **(1)**						
Δp= 10 bar	18	28	28	45	75	75
Δp= 30 bar	30	50	50	80	130	130
Δp= 70 bar	45	75	75	120	170	170
Max permissible flow **(2)**	50	80	80	130	180	180
Leakage [cm³/min]	<500 (at p = 100 bar); <1500 (at p = 350 bar)			<800 (at p = 100 bar); <2500 (at p = 315 bar)		
Response time **(3)** [ms]	≤ 15			≤ 20		
Hysteresis	≤ 0,2 [% of max regulation]					
Repeatibility	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) See detailed diagrams in section 12.3
(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**DHZO** = 2,6 A	**DKZOR** = 3 A		
Coil resistance R at 20°C	**DHZO** = 3 ÷ 3,3 Ω	**DKZOR** = 3,8 ÷ 4,1 Ω		
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Position transducers power supply	+24 VDC @ max 100 mA and +5 VDC @ max 100 mA are software selectable; ±10 VDC @ max 14 mA minimum load resistance 700 Ω			
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

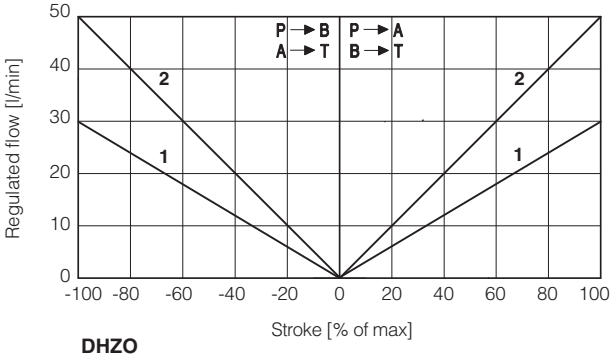
Note: a maximum time of 800 ms (depending on communication type) have be considered between the axis card energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

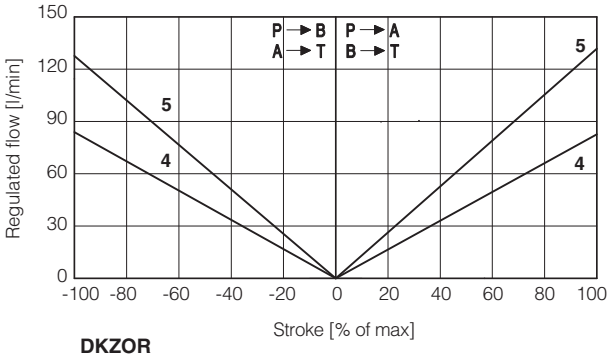
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

12 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

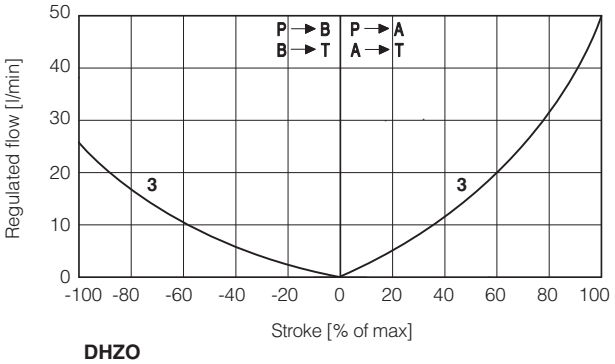
12.1 Regulation diagrams (values measure at Δp 30 bar P-T)



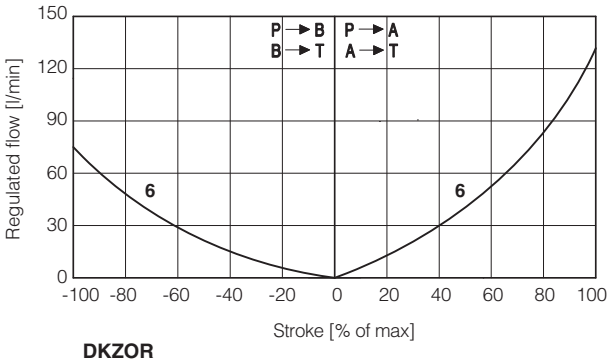
DHZO
1 = L3 **2** = L5



DKZOR
4 = L3 **5** = L5



DHZO
3 = D5



DKZOR
6 = D5

Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B)

Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

12.2 Flow /Δp diagrams

stated at 100% of valve stroke

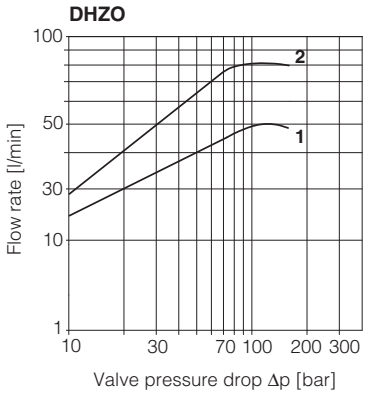
DHZO

1 = spool L3,
2 = spool L5, D5

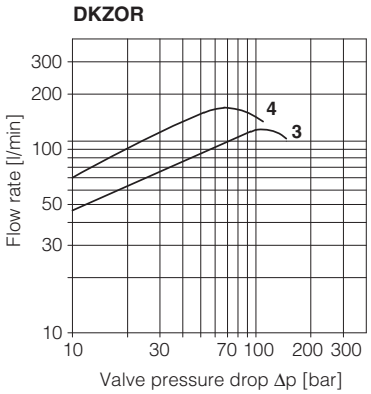
DKZOR

3 = spool L3
4 = spool L5, D5

DHZO



DKZOR



12.3 Operating limits

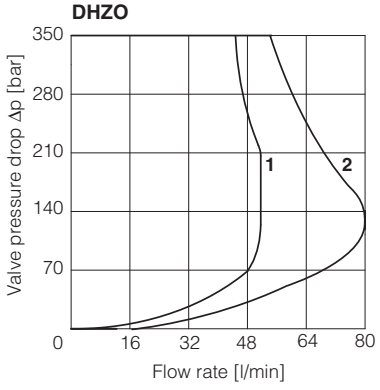
DHZO

1 = spool L3
2 = spool L5, D5

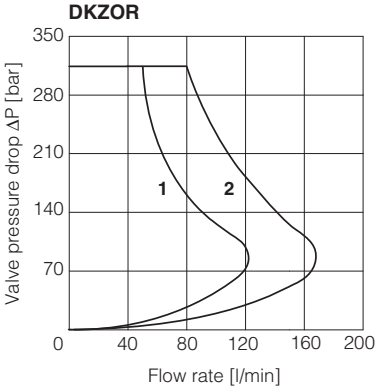
DKZOR

3 = spool L3
4 = spool L5, D5

DHZO

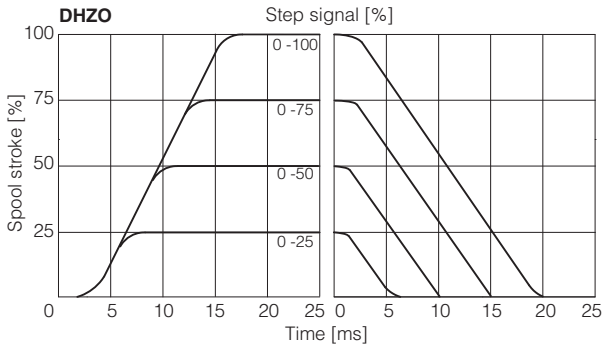


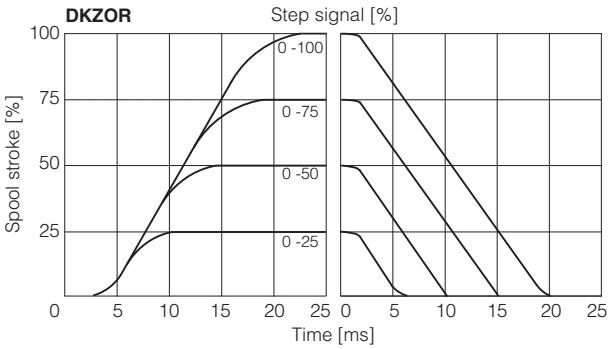
DKZOR



12.4 Response time

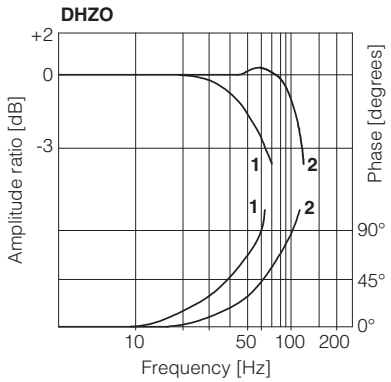
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.
For valves with on-board digital driver + axis card the dynamics performances can be optimized by setting the internal software parameters.

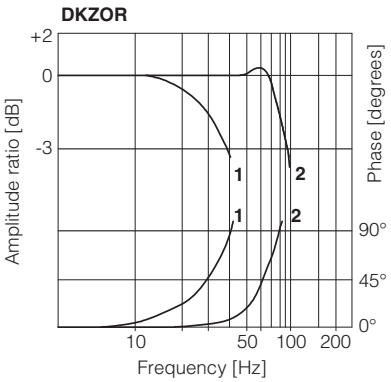




12.5 Bode diagrams

1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke





13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver + axis card and LVDT position transducer at side of port A.
For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

14 ELECTRONICS OPTIONS

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = This option is available to connect pressure/force transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Standard versions for **D-SN**:
/BI, /BIY, /BY, /IY

Safety certified versions for **D-SN**:
/BIU, /BIUY, /BU, /BUY, /IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Standard versions for **A-SN**, **A-SF**, **A-SL** and **D-SF**, **D-SL**:
/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **A-SN**, **A-SF**, **A-SL** and **D-SF**, **D-SL**:
/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCIK, /BCIKY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for axis card logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

16.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on axis card reference mode, see section 2 :

external analog reference (see 2.1): input is used as reference for control in closed loop the actuator position.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

external fieldbus reference (see 2.1) *or automatic cycle* (see 2.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

16.4 Force reference input signal (F_INPUT+) - only for **SF, SL**

Functionality of F_INPUT+ signal (pin 7), depends on selected axis card reference mode and alternated control options, see section 3 :

SL, SF controls and external analog reference selected : input is used as reference for the axis card force closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.6 Force monitor output signal (F_MONITOR) - only for **SF, SL**

The axis card generates an analog output signal according to alternated force control option:
SN control: output signal is proportional to the actual valve spool position
SL, SF controls: output signal is proportional to the actual forcel applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA.
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin 3.
When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

16.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.
Fault output signal can be used as digital output by software selection.

16.9 Position transducer input signal

A position transducer must be always directly connected to the axis card. Select the correct axis card execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).
Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.
Position analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 17.1).

16.10 Remote pressure/force transducer input signals - only for **SF**, **SL**

Analog remote pressure transducers or load cell can be directly connected to the axis card.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 17.2).

17 ACTUATOR'S TRANSDUCER CHARACTERISTICS

17.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.
Transducers with analog interface grant simple and cost effective solutions.

17.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected pressure/force transducer, see section 3 .
Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details).
Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

17.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				Pressure/Force
Execution	A		D		SF, SL
Input type	Potentiometer	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	±10 VDC	+24 VDC	+5 VDC / +24 VDC	+5 VDC / +24 VDC	+24 VDC
Axis card interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos axis card **(2)** Percentage of total stroke **(3)** For Balluff BTL7 with SSI interface only special code SA433 is supported

18 ELECTRONIC CONNECTIONS

18.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the axis card, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Gnd - analog signal
6	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to VL0	Output - analog signal **Software selectable**
7	**F_INPUT+**	Force reference input signal (SF, SL controls): ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**
8	**F_MONITOR**	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20mA maximum range, referred to VL0	Output - analog signal **Software selectable**
9	**VL+**	Power supply 24 VDC for axis card logic and communication	Input - power supply
10	**VL0** (1)	Power supply 0 VDC for axis card logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to axis card housing	

(1) Do not disconnect VL0 before VL+ when the axis card is connected to PC USB port

18.2 Communication connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

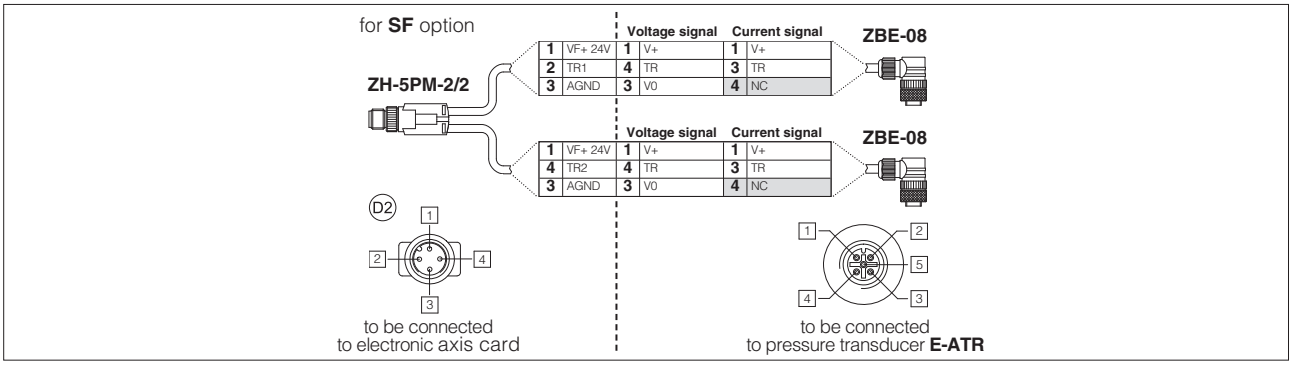
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.3 Remote pressure/force transducer connector - M12 - 5 pin - only for **SF, SL** (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



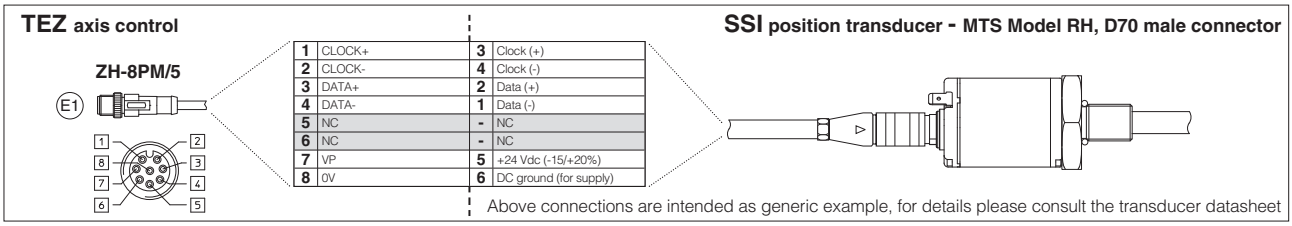
Note: pin layout always referred to axis card view

18.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

SSI - default transducer (1)				Encoder (1)		
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
1	**CLOCK+**	Serial syncronous clock (+)	Input - digital signal	**R**	Input channel R	Input - digital signal
2	**CLOCK-**	Serial syncronous clock (-)		**/R**	Input channel /R	
3	**DATA+**	Serial position data (+)		**A**	Input channel A	
4	**DATA-**	Serial position data (-)		**/A**	Input channel /A	
5	**NC**	Not connect	Do not connect	**B**	Input channel B	
6	**NC**			**/B**	Input channel /B	
7	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
8	**0 V**	Common gnd for transducer power and signals	Common gnd	**0 V**	Common gnd for transducer power and signals	Common gnd

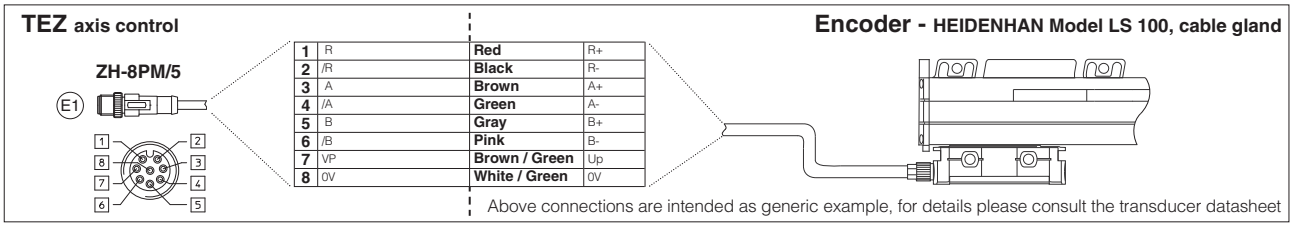
(1) Digital position transducer type is software selectable: Encoder or SSI, see 16.9

SSI connection - example



Note: pin layout referred to axis card view

Encoder connection - example



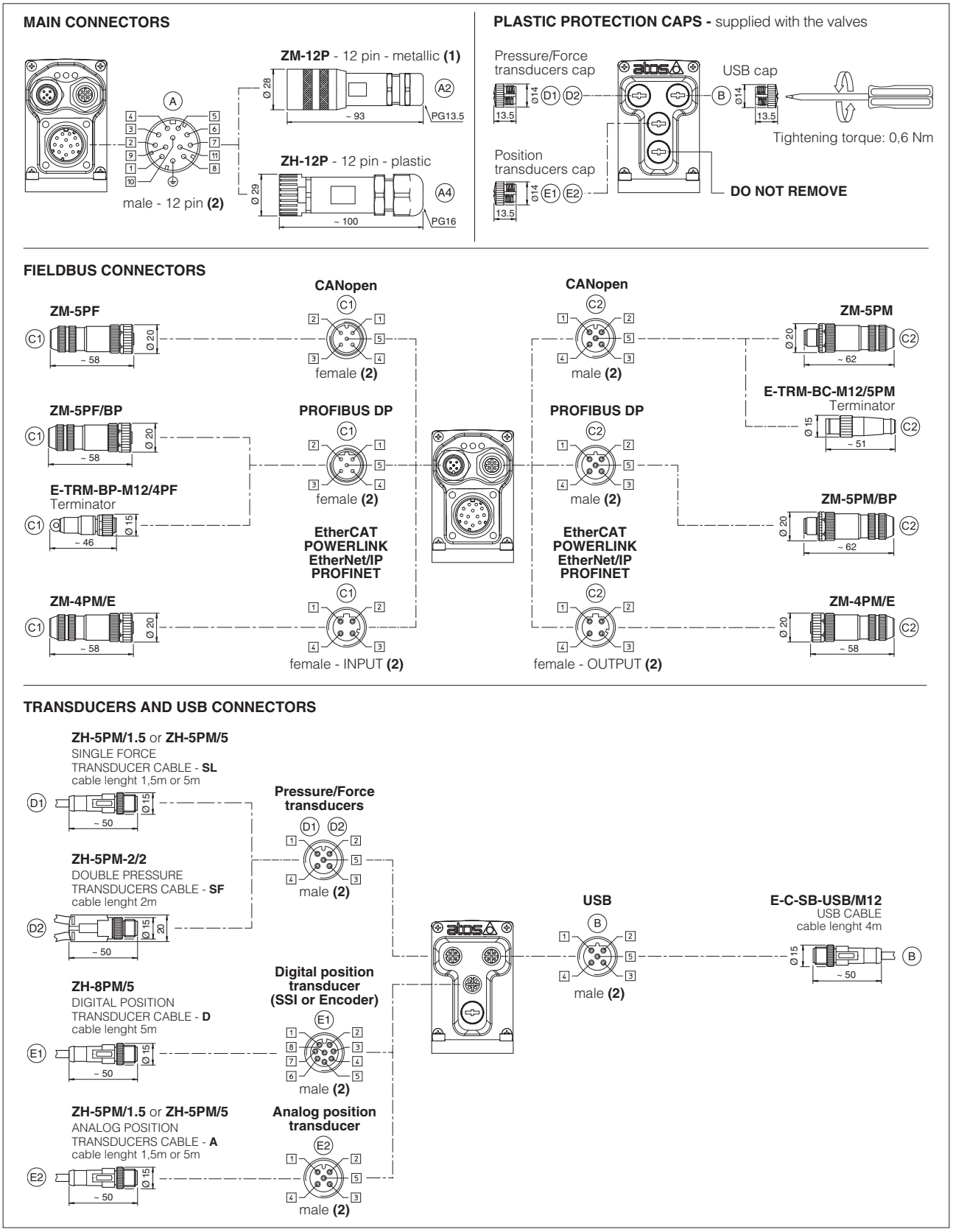
Note: pin layout referred to axis card view

18.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	**VP +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**	/	Connect
2	**VP +10V**	Power supply reference +10VDC (always present)	Output - power supply	Connect	/
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	**TR**	Signal transducer	Input - analog signal	Connect	Connect
5	**VP -10V**	Power supply reference -10VDC (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 16.9

18.6 TEZ connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to axis card view

18.7 Diagnostic LEDs (L)

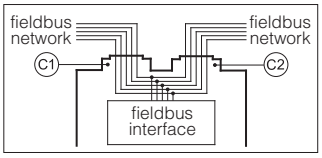
Three leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital axis card executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A1 ZM-12P	A2 ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2 ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately, see tech table **GS500** **(2)** Internally terminated

20.3 Pressure/Force transducer connectors - only for **SF, SL**

CONNECTOR TYPE	SL - Single transducer		SF - Double transducers
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5	D2 ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

20.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 18.4	ANALOG POSITION TRANSDUCER A execution - see 18.5	
CODE	E1 ZH-8PM/5	E2 ZH-5PM/1.5	E2 ZH-5PM/5
Type	8 pin male straight circular	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	M12 coding A – IEC 61076-2-101	
Material	Plastic	Plastic	
Cable gland	Connector moulded on cables 5 m lenght	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	8 x 0,25 mm²	5 x 0,25 mm²	
Connection type	molded cable	molded cable	
Protection (EN 60529)	IP 67	IP 67	

21 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:
Z-MAN-RI-LEZ - user manual for **TEZ** and **LEZ** with **SN**
Z-MAN-RI-LEZ-S - user manual for **TEZ** and **LEZ** with **SF**, **SL**

21.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

21.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

21.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 21.4)

21.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

21.5 Valve characteristics compensation

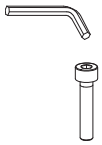
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

21.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

22 FASTENING BOLTS AND SEALS

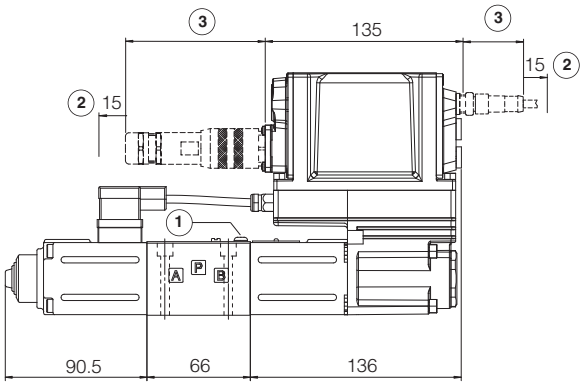
	DHZO	**DKZOR**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

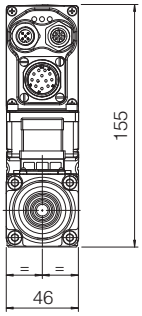
23 INSTALLATION DIMENSIONS [mm]

DHZO-TEZ

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO	3,1



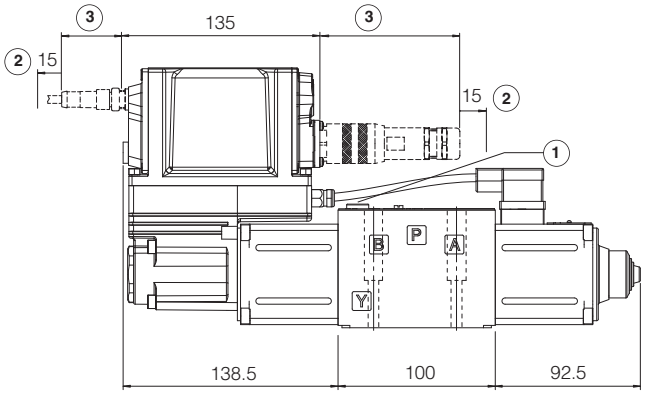


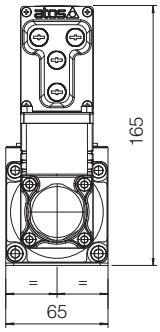
(1) = Air bleeding 3
(2) = Space to remove the connectors
(3) = The dimensions of all connectors must be considered, see section 18.6

DKZOR-TEZ

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR	5,0





(1) = Air bleeding 4 13
(2) = Space to remove the connectors
(3) = The dimensions of all connectors must be considered, see section 18.6

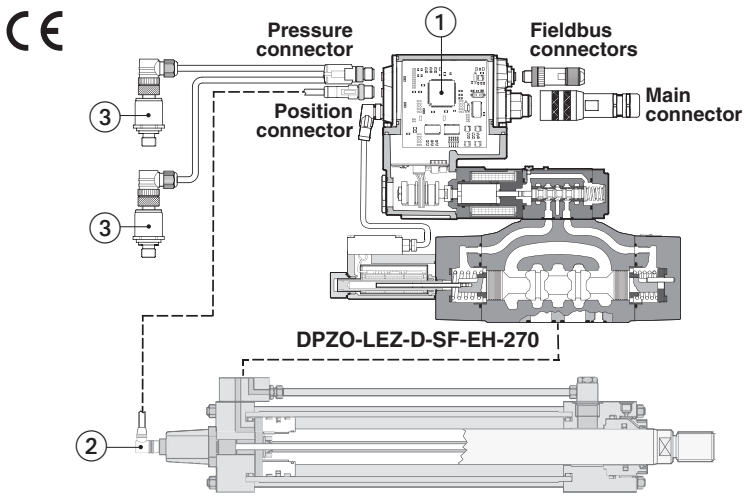
Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port A

24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS900	Operating and maintenance information for proportional valves	**K800**	Electric and electronic connectors
FY100	Safety proportional valves - option /U	**P005**	Mounting surfaces for electrohydraulic valves
FY200	Safety proportional valves - option /K	**Y010**	Basics for safety components
GS500	Programming tools		

Digital servoproportionals with on-board axis card

piloted, single solenoid, with two LVDT transducers and zero spool overlap



① On-board digital driver + axis card
② Transducer to read the axis position feedback
③ Pressure transducers

DPZO-LEZ

Digital servoproportional directional valves, piloted, single solenoid, with on-board digital driver + axis card, two LVDT position transducers and zero spool overlap for position closed loop controls of linear or rotative hydraulic actuator.

The controlled actuator has to be equipped with transducer (analog, potentiometer, SSI or Encoder) to read the axis position feedback.

The valve can be operated via an external reference signal or automatic cycle, see section 2.

Alternated P/Q controls, see 3 :
SF, **SL** = alternated force control added to the basic position one

Safety options TÜV certified, see 7 :
U = safe double power supply
K = safe on/off signals

Size: **10** ÷ **35** - ISO 4401
Max flow: **180** ÷ **3500 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPZO	- LEZ	- D	- SN	- NP	- 2	70	- L	5	/ *	*	/ *

DPZO — Servoproportional directional valves, piloted

LEZ = on-board digital driver + axis card, two LVDT transducers

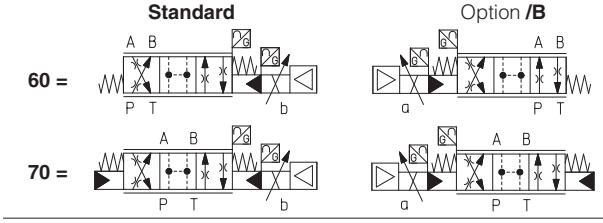
Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

Alternated P/Q controls:
SN = none
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32 **8** = 35

Configuration:



Spool type, regulating characteristics:

L = linear
DL = differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q
T = non linear **(1)**

Series number

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (2):
B = solenoid with on-board digital driver + axis card and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronics options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only for **SF, SL**
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Safety options TÜV certified **(2)**:
U = safe double power supply
K = safe on/off signals
See section 7

SAFETY CERTIFIED

Spool size		3 (L)	5 (L,DL)	5 (L)	5 (T)
DPZO-1	=	-	100	-	-
DPZO-2	=	160	250	-	190
DPZO-4	=	-	480	-	-
DPZO-4M	=	-	550	-	-
DPZO-6	=	-	-	640	-
DPZO-8	=	-	-	1200	-

Nominal flow (l/min) at Δp 10bar P-T

(1) Not available for configuration 60 **(2)** For possible combined options consult Atos technical office

2 POSITION CONTROL

2.1 External reference signal

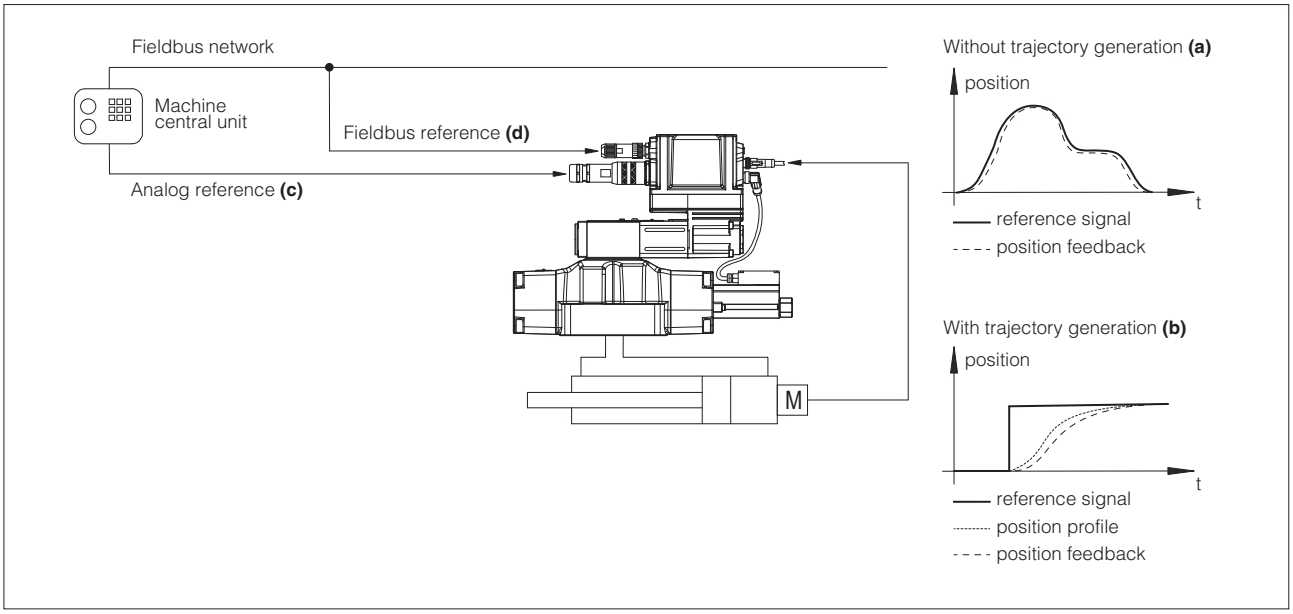
Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

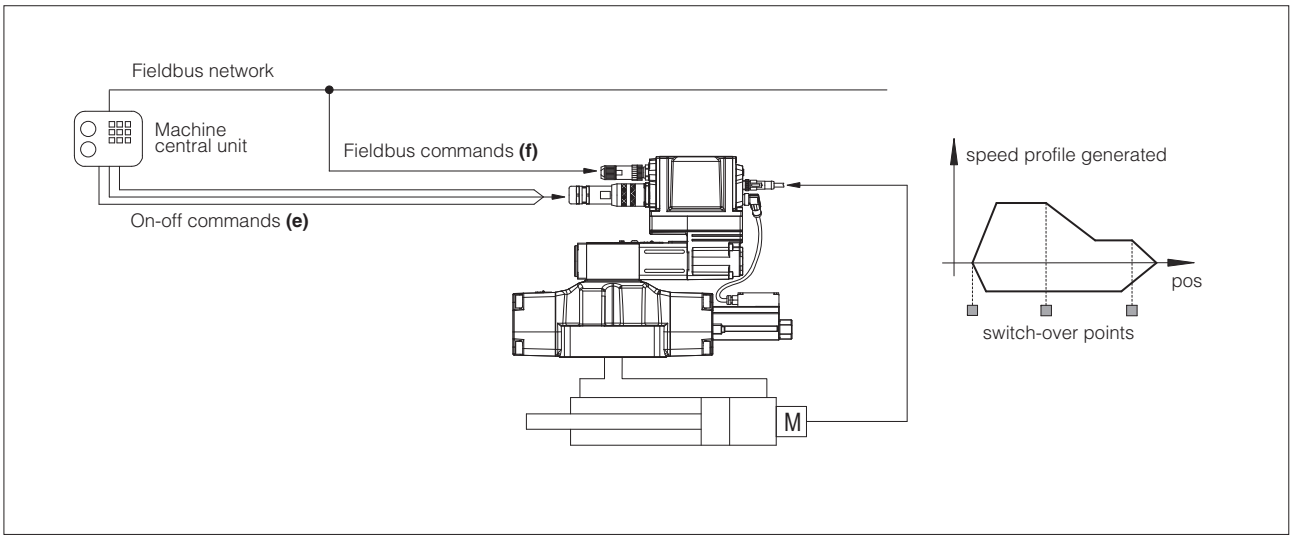
Refer to the axis card user manual for further details on position control features.



2.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



3 ALTERNATED POSITION / FORCE CONTROL

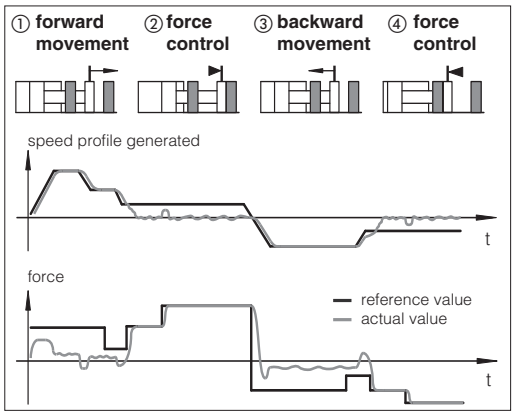
SF and **SL** controls add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

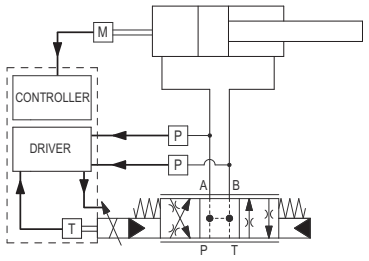
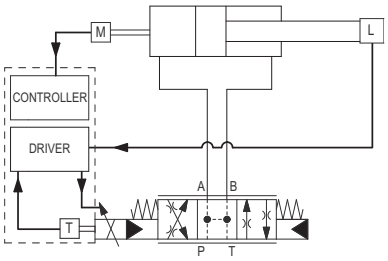
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations

SF	SL
	
two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve spool transducer	M actuator position transducer	P pressure transducer	L load cell

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

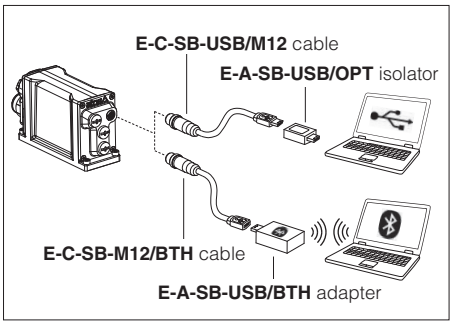
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital axis card (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

Z-SW-FULL support: NP (USB), PS (Serial), BC (CANopen), BP (PROFIBUS DP), EH (EtherCAT), EW (POWERLINK), EI (EtherNet/IP), EP (PROFINET)

Note: Z-SW programming software supports valves with option SF, SL for alternated control

WARNING: axis card USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** , designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the axis card has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the axis card checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (axis card housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DPZO-*-1**	**DPZO-*-2**			**DPZO-*-4**	**DPZO-*-4M**	**DPZO-*-6**	**DPZO-*-8**
Pressure limits [bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;							
Spool type	**L5, DL5**	**L3**	**L5, DL5**	**T5**	**L5, DL5**		**L5**	
Nominal flow Δp P-T [l/min] **(1)**								
Δp= 10 bar	100	160	250	190	480	550	640	1200
Δp= 30 bar	160	270	430	330	830	950	1100	2000
Max permissible flow [l/min]	180	400	550	550	1000	1100	1600	3500
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)							
Piloting volume [cm³/min]	1,4	3,7			9	11,3	21,6	39,8
Piloting flow **(2)** [l/min]	3,5	9			18	20	19	24
Leakage **(3)** Pilot [cm³/min]	100 / 300	150 / 450			200 / 600	200 / 600	900 / 2800	900 / 2800
Main stage [l/min]	0,4 / 1,2	0,6 / 2,5			1,0 / 4,0	1,0 / 4,0	3,0 / 9,0	6,0 / 20
Response time **(4)** [ms]	≤ 25	≤ 25			≤ 30	≤ 35	≤ 80	≤ 100
Hysteresis	≤ 0,1 [%of max regulation]							
Repeatability	± 0,1 [%of max regulation]							
Thermal drift	zero point displacement < 1% at ΔT = 40°C							

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal, see detailed diagrams in section 12.3

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Position transducers power supply	+24 VDC @ max 100 mA and +5 VDC @ max 100 mA are software selectable; ±10 VDC @ max 14 mA minimum load resistance 700 Ω			
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control, force control (SF, SL) by axis P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

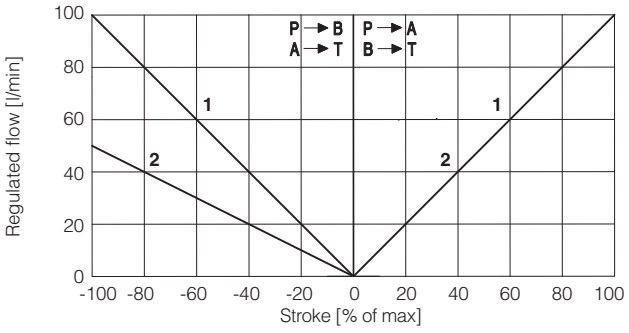
Note: a maximum time of 800 ms (depending on communication type) have be considered between the axis card energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

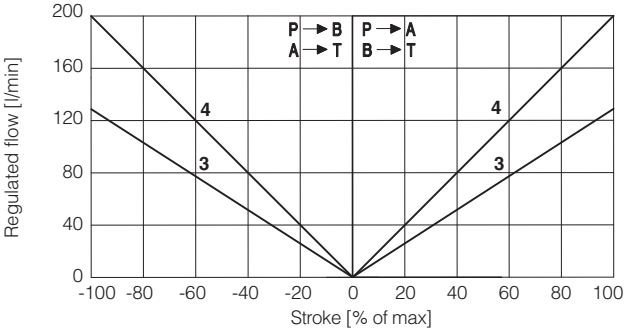
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

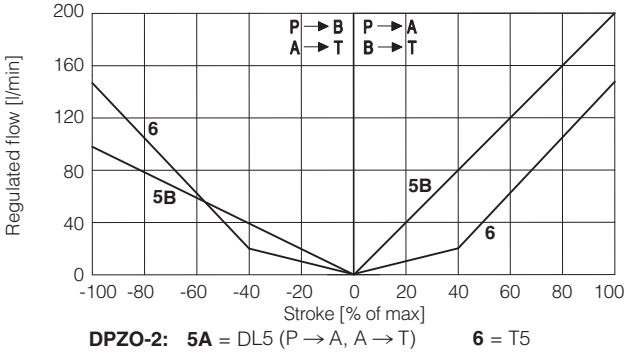
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



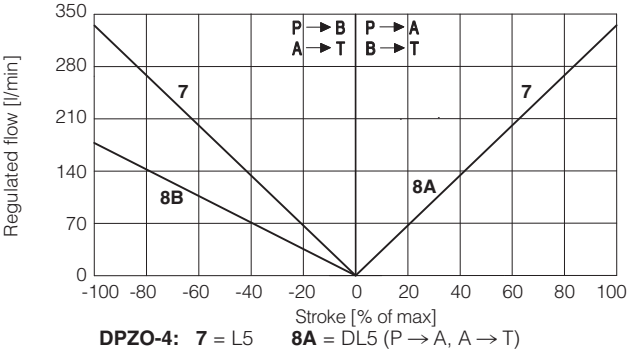
DPZO-1: **1** = L5 **2** = DL5



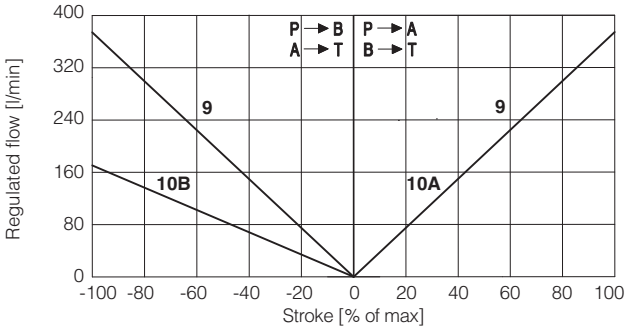
DPZO-2: **3** = L3 **4** = L5



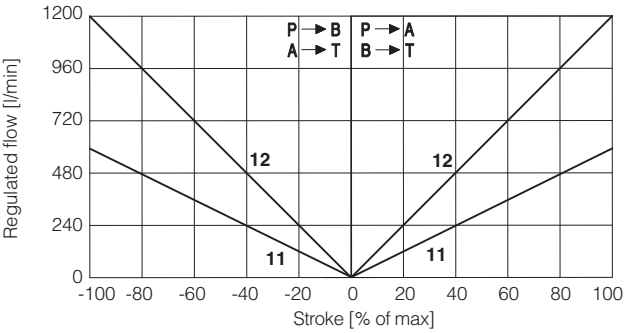
DPZO-2: **5A** = DL5 (P → A, A → T) **6** = T5
5B = DL5 (P → B, B → T)



DPZO-4: **7** = L5 **8A** = DL5 (P → A, A → T)
8B = DL5 (P → B, B → T)

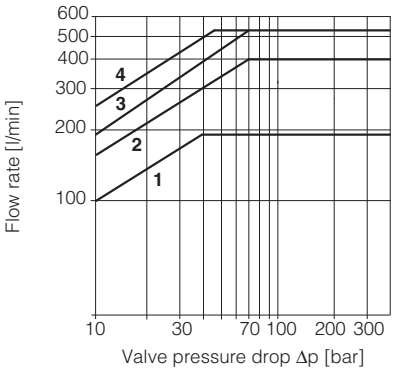


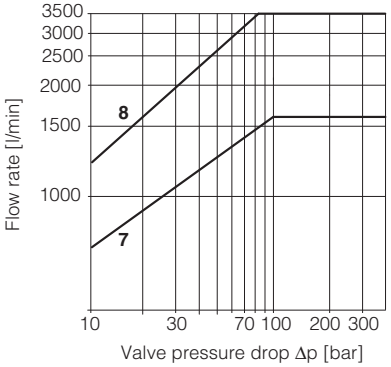
DPZO-4M: **9** = L5 **10A** = DL5 (P → A, A → T)
10B = DL5 (P → B, B → T)

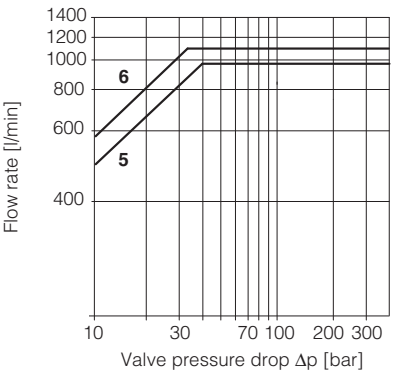


DPZO-6: **11** = L5
DPZO-8: **12** = L5

12.2 Flow /Δp diagram - stated at 100% of spool stroke







DPZO-1:
1 = spools L5, DL5
DPZO-2:
2 = spools L3
3 = spool T5
4 = spools L5, DL5
DPZO-4:
5 = spools L5, DL5
DPZO-4M:
6 = spools L5, DL5
DPZO-6:
7 = L5
DPZO-8:
8 = L5

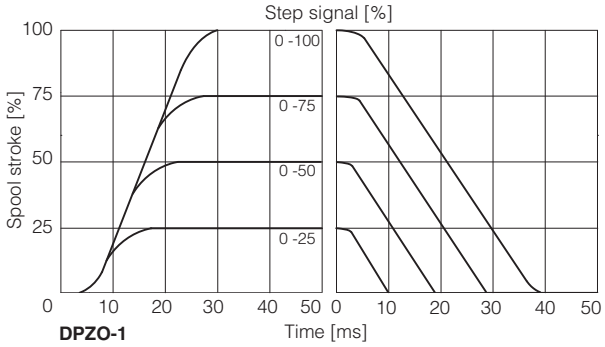
Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option /B)

Reference signal $\begin{matrix}0 \div +10\ V \\ 12 \div 20\ mA\end{matrix}\Big\}$ P → A / B → T

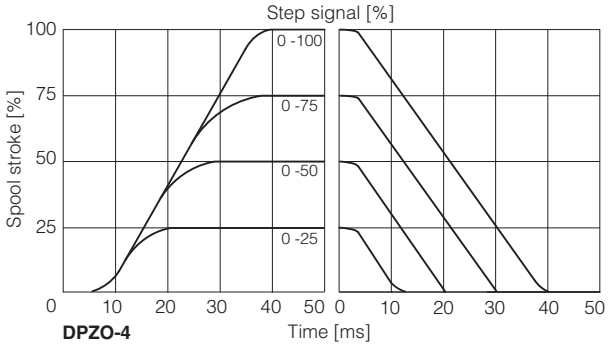
Reference signal $\begin{matrix}0 \div -10\ V \\ 4 \div 12\ mA\end{matrix}\Big\}$ P → B / A → T

12.3 Response time

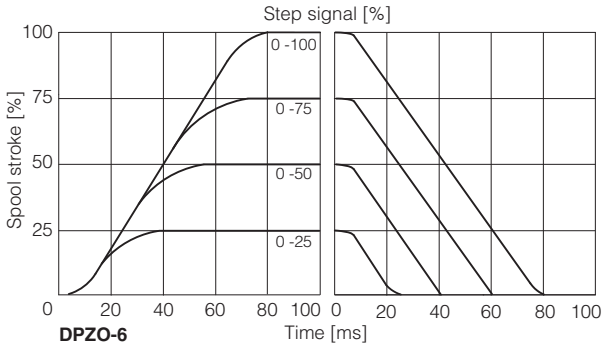
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For valves with on-board digital driver + axis card the dynamics performances can be optimized by setting the internal software parameters.



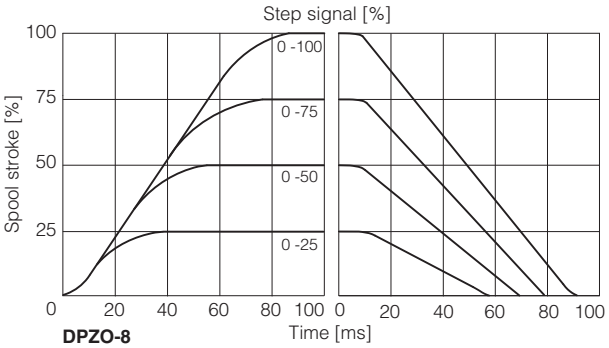
DPZO-1
DPZO-2



DPZO-4
DPZO-4M



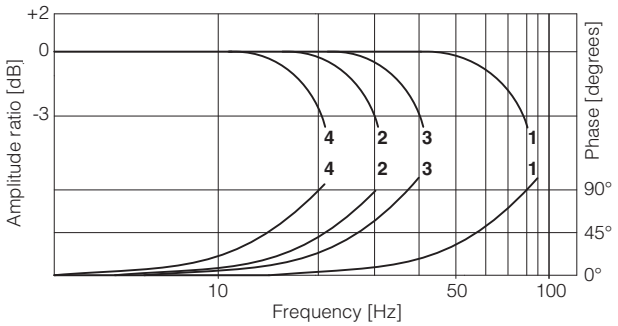
DPZO-6

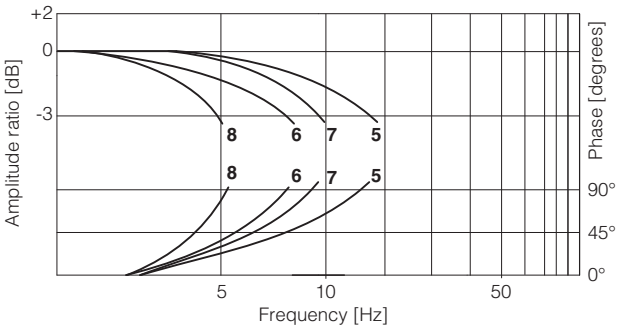


DPZO-8

12.4 Bode diagrams

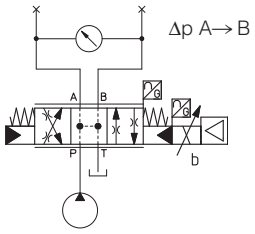
Stated at nominal hydraulic conditions.





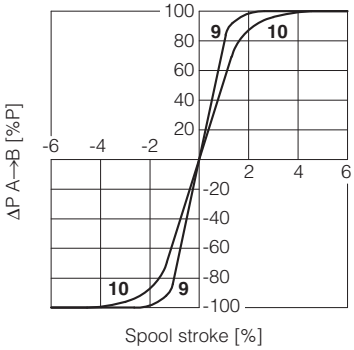
1 = DPZO-1 / DPZO-2 } ± 5%
2 = DPZO-1 / DPZO-2 } ± 100%
3 = DPZO-4 / DPZO-4M } ± 5%
4 = DPZO-4 / DPZO-4M } ± 100%
5 = DPZO-6 ± 5%
6 = DPZO-6 ± 100%
7 = DPZO-8 ± 5%
8 = DPZO-8 ± 100%

12.5 Pressure gain



9 = DPZO-1

10 = DPZO-2
DPZO-4
DPZO-4M
DPZO-6
DPZO-8



13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver + axis card and LVDT position transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 12.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 22
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 22
The valve's standard configuration provides internal pilot and external drain.

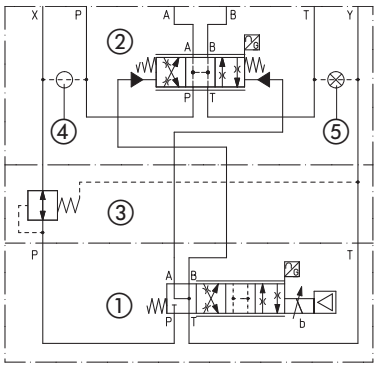
G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = **28 bar**

DPZO-1, DPZO-2, DPZO-4(M), DPZO-6 and DPZO-8 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 70



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

14 ELECTRONICS OPTIONS

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = This option is available to connect pressure/force transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for axis card logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

15.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on axis card reference mode, see section 2 :

external analog reference (see 2.1): input is used as reference for control in closed loop the actuator position.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

external fieldbus reference (see 2.1) *or automatic cycle* (see 2.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

15.4 Force reference input signal (F_INPUT+) - only for **SF, SL**

Functionality of F_INPUT+ signal (pin 7), depends on selected axis card reference mode and alternated control options, see section 3 :

SL, SF controls and external analog reference selected : input is used as reference for the axis card force closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

15.6 Force monitor output signal (F_MONITOR) - only for **SF, SL**

The axis card generates an analog output signal according to alternated force control option:
SN control: output signal is proportional to the actual valve spool position
SL, SF controls: output signal is proportional to the actual forcel applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA.
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

15.7 Enable input signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin 3.
When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

15.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.
Fault output signal can be used as digital output by software selection.

15.9 Position transducer input signal

A position transducer must be always directly connected to the axis card. Select the correct axis card execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).
Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.
Position analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 16.1).

15.10 Remote pressure/force transducer input signals - only for **SF**, **SL**

Analog remote pressure transducers or load cell can be directly connected to the axis card.
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 16.2).

16 ACTUATOR'S TRANSDUCER CHARACTERISTICS

16.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.
Transducers with analog interface grant simple and cost effective solutions.

16.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section 3 .
Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

16.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				Pressure/Force
Execution	A		D		SF, SL
Input type	Potentiometer	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	±10 VDC	+24 VDC	+5 VDC / +24 VDC	+5 VDC / +24 VDC	+24 VDC
Axis card interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos axis card **(2)** Percentage of total stroke **(3)** For Balluff BTL7 with SSI interface only special code SA433 is supported

17 ELECTRONIC CONNECTIONS

17.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the axis card, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Gnd - analog signal
6	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to VL0	Output - analog signal **Software selectable**
7	**F_INPUT+**	Force reference input signal (SF, SL controls): ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**
8	**F_MONITOR**	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20mA maximum range, referred to VL0	Output - analog signal **Software selectable**
9	**VL+**	Power supply 24 VDC for axis card logic and communication	Input - power supply
10	**VL0** (1)	Power supply 0 VDC for axis card logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to axis card housing	

(1) Do not disconnect VL0 before VL+ when the axis card is connected to PC USB port

17.2 Communication connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

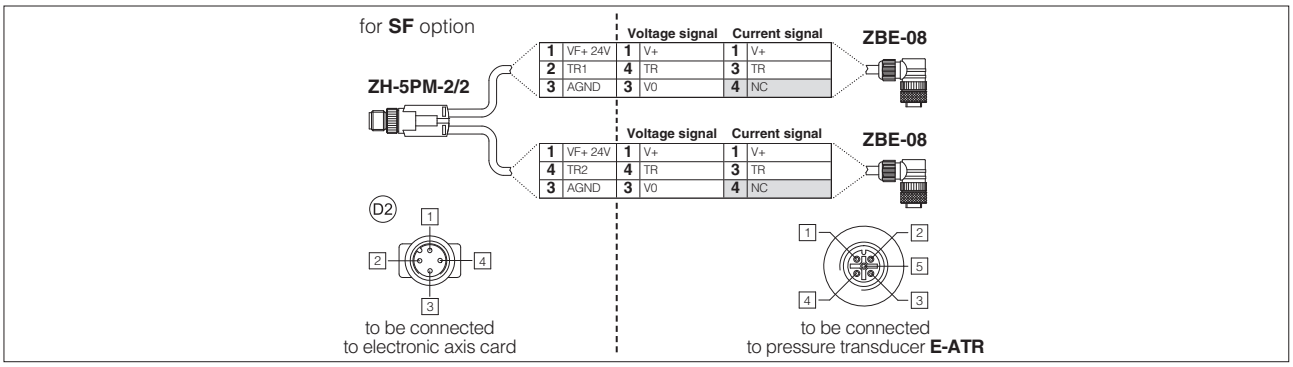
(2) Pin 2 can be fed with external +5V supply of CAN interface

17.3 Remote pressure/force transducer connector - M12 - 5 pin - only for **SF, SL** (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



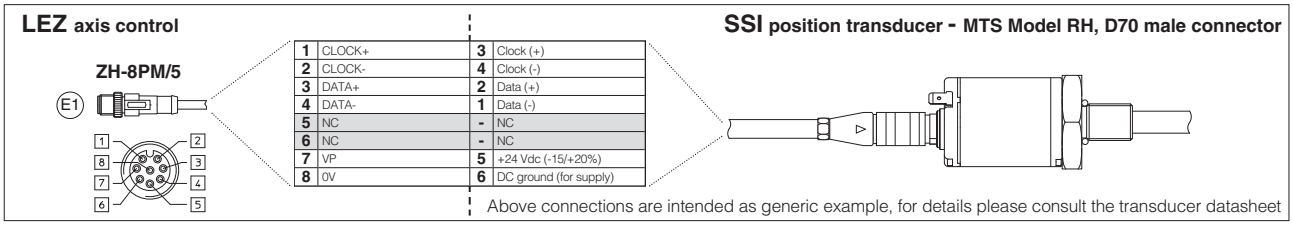
Note: pin layout always referred to axis card view

17.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

	SSI - default transducer (1)			Encoder (1)		
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
1	**CLOCK+**	Serial syncronous clock (+)	Input - digital signal	**R**	Input channel R	Input - digital signal
2	**CLOCK-**	Serial syncronous clock (-)		**/R**	Input channel /R	
3	**DATA+**	Serial position data (+)		**A**	Input channel A	
4	**DATA-**	Serial position data (-)		**/A**	Input channel /A	
5	**NC**	Not connect	Do not connect	**B**	Input channel B	
6	**NC**			**/B**	Input channel /B	
7	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
8	**0 V**	Common gnd for transducer power and signals	Common gnd	**0 V**	Common gnd for transducer power and signals	Common gnd

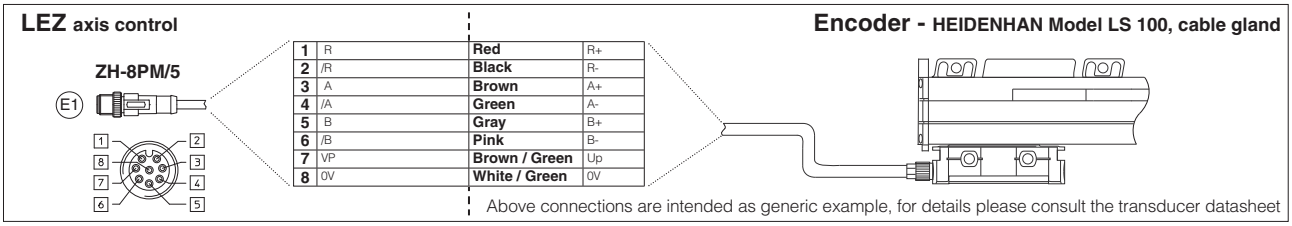
(1) Digital position transducer type is software selectable: Encoder or SSI, see 15.9

SSI connection - example



Note: pin layout referred to axis card view

Encoder connection - example



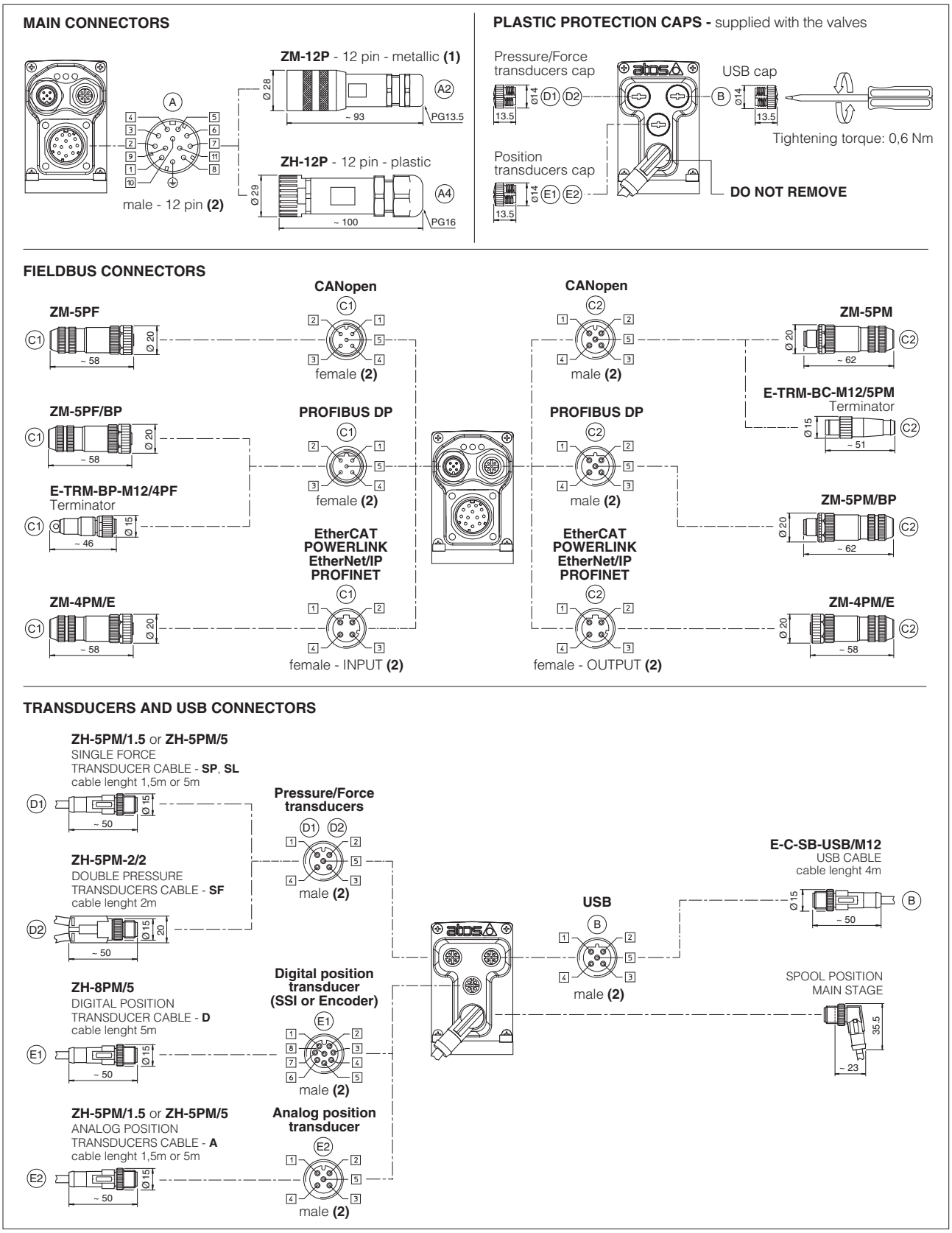
Note: pin layout referred to axis card view

17.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	**VP +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**	/	Connect
2	**VP +10V**	Power supply reference +10VDC (always present)	Output - power supply	Connect	/
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	**TR**	Signal transducer	Input - analog signal	Connect	Connect
5	**VP -10V**	Power supply reference -10VDC (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 15.9

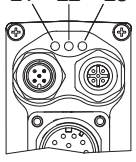
17.6 LEZ connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to axis card view

17.7 Diagnostic LEDs (L)

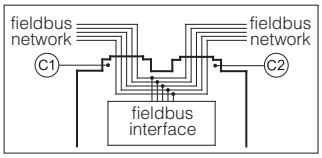
Three leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital axis card executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-12P**	(A2) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately, see tech table **GS500**

(2) Internally terminated

19.3 Pressure/Force transducer connectors - only for **SF, SL**

CONNECTOR TYPE	SL - Single transducer		SF - Double transducers
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**	(D2) **ZH-5PM-2/2**
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

19.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 17.4	ANALOG POSITION TRANSDUCER A execution - see 17.5	
CODE	(E1) **ZH-8PM/5**	(E2) **ZH-5PM/1.5**	(E2) **ZH-5PM/5**
Type	8 pin male straight circular	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	M12 coding A – IEC 61076-2-101	
Material	Plastic	Plastic	
Cable gland	Connector moulded on cables 5 m lenght	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	8 x 0,25 mm²	5 x 0,25 mm²	
Connection type	molded cable	molded cable	
Protection (EN 60529)	IP 67	IP 67	

20 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:
Z-MAN-RI-LEZ - user manual for **TEZ** and **LEZ** with **SN**
Z-MAN-RI-LEZ-S - user manual for **TEZ** and **LEZ** with **SF**, **SL**

20.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

20.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

20.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 20.4)

20.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

20.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

20.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

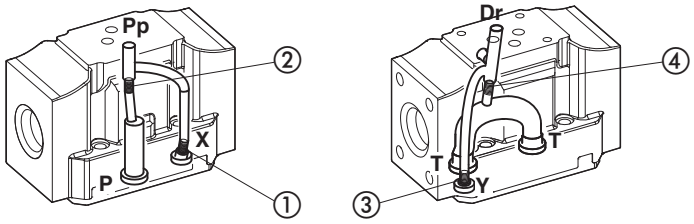
21 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156; Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

22 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

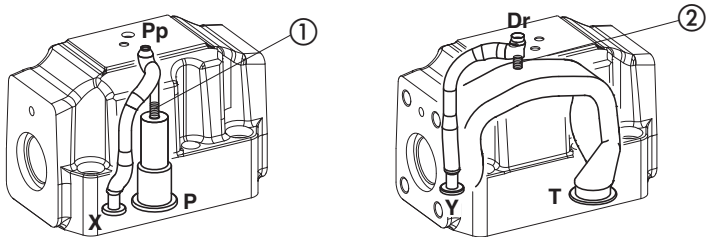
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain.

DPZO-1 **Pilot channels** **Drain channels**



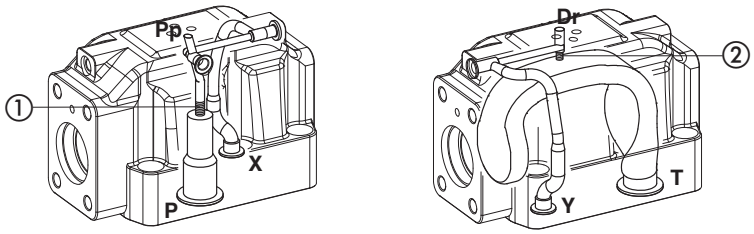
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels** **Drain channels**



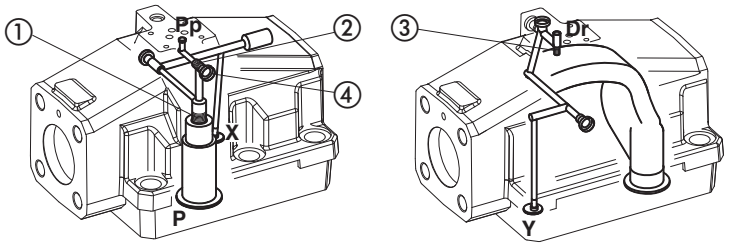
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels** **Drain channels**



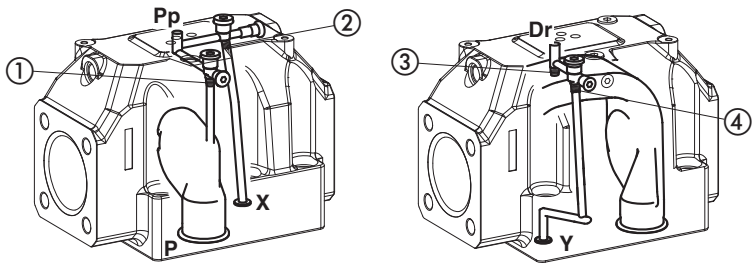
Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels** **Drain channels**



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-8 **Pilot channels** **Drain channels**

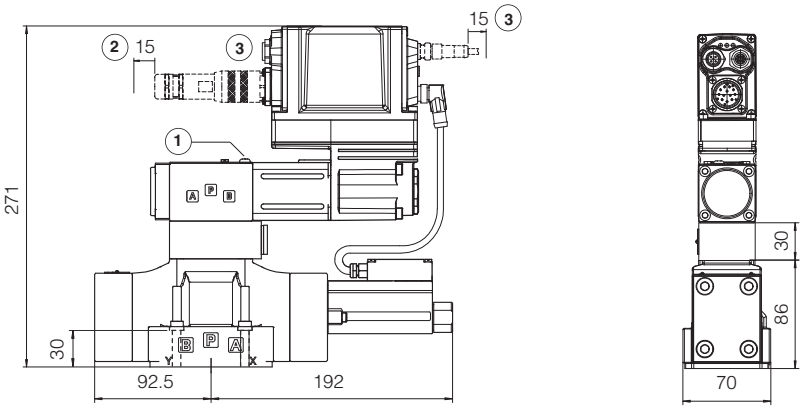


Internal piloting: Without plug ①;
External piloting: Add NPTF 1/8 in pos ①;
plug NPTF 1/8 in pos ②;
Internal drain: Without plug NPTF 1/8 in pos ③;
Add plug NPTF 1/8 in pos ④;
External drain: Add plug NPTF 1/8 in pos ③.

DPZO-LEZ-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

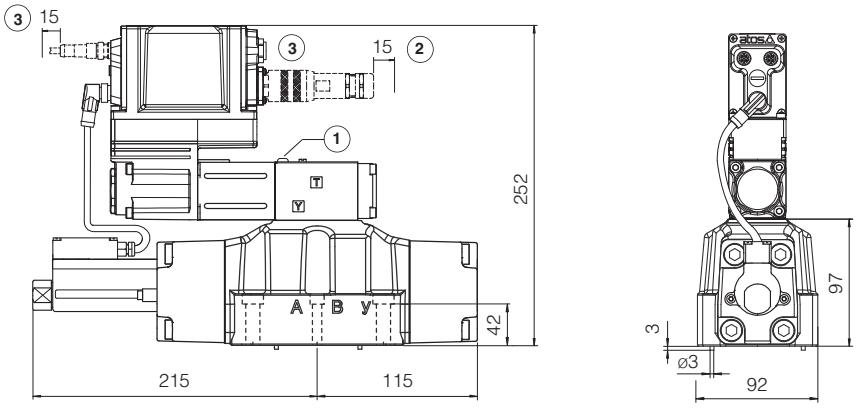
Mass [kg]	
DPZO-*-1	9,5



DPZO-LEZ-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-*-2	14



(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port B of the main stage

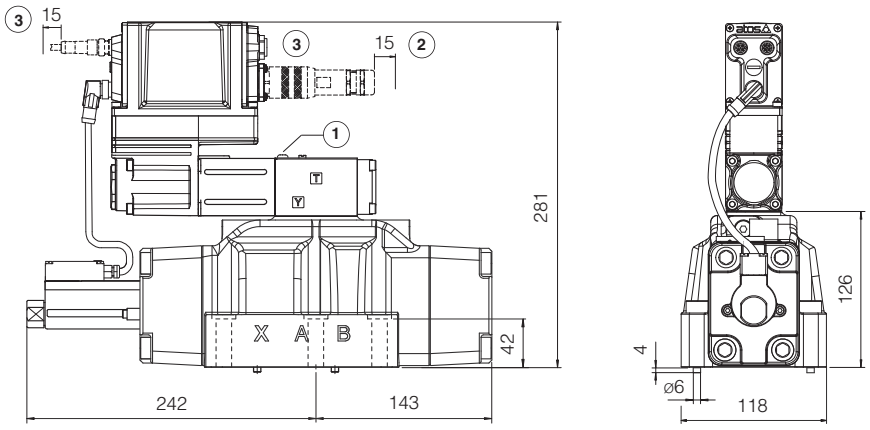
DPZO-LEZ-*-4

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

Mass [kg]	
DPZO-*-4*	19

DPZO-LEZ-*-4M

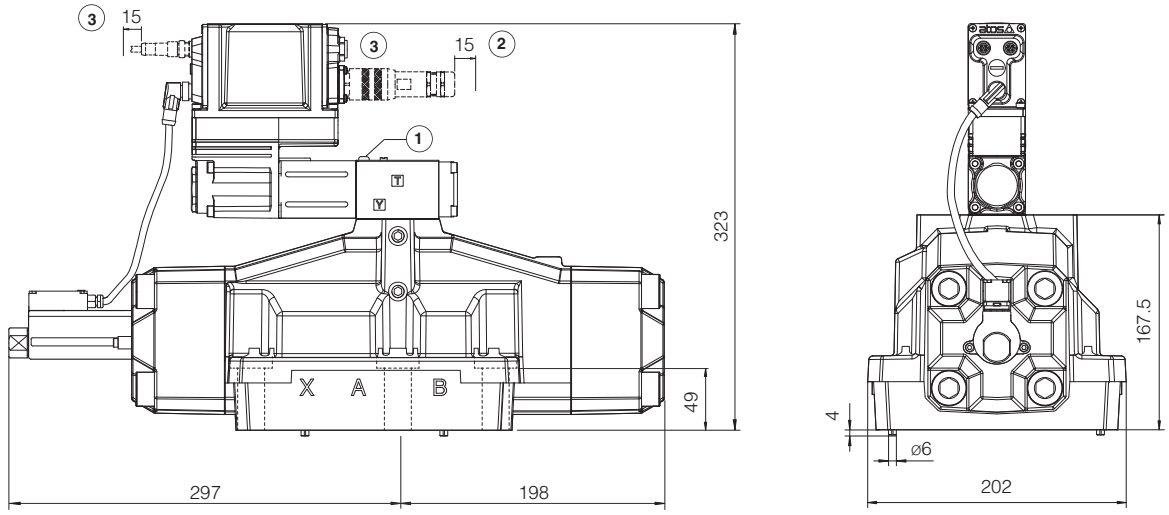
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm



DPZO-LEZ-*-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-6	43



(1) = Air bleeding 3

(2) = Space to remove the connectors

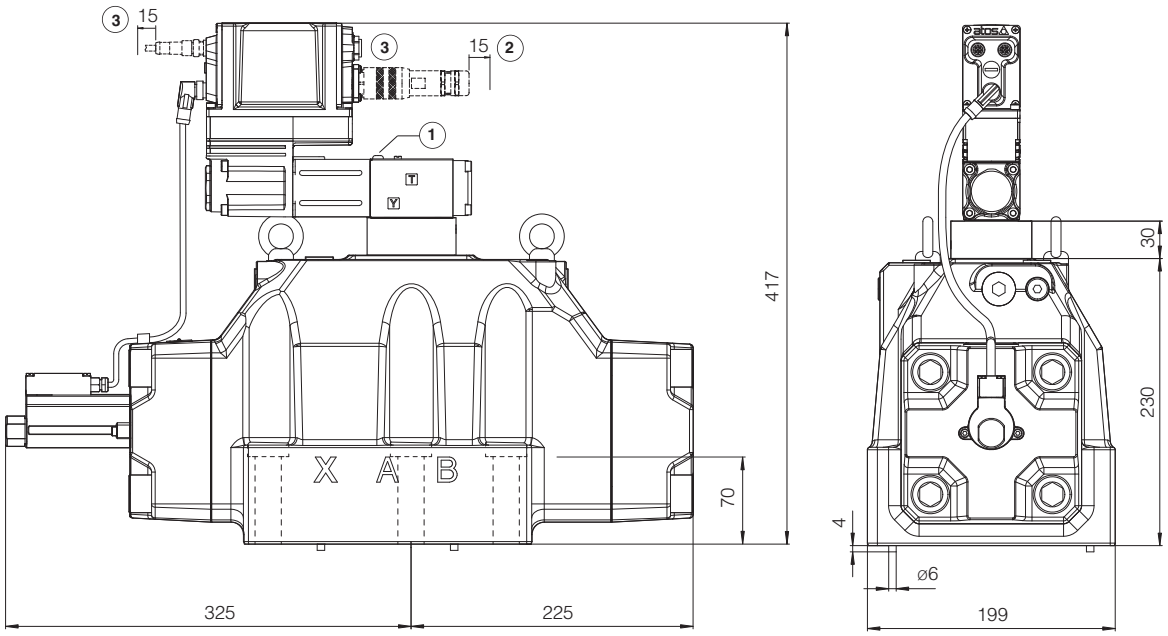
(3) = The dimensions of all connectors must be considered, see section 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port B of the main stage

DPZO-LEZ-*-8

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-8	80



(1) = Air bleeding 3

(2) = Space to remove the connectors

(3) = The dimensions of all connectors must be considered, see section 18.6

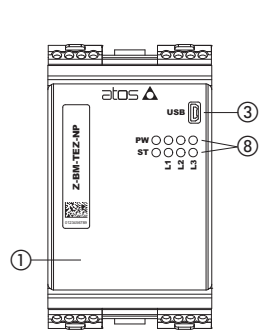
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port B of the main stage

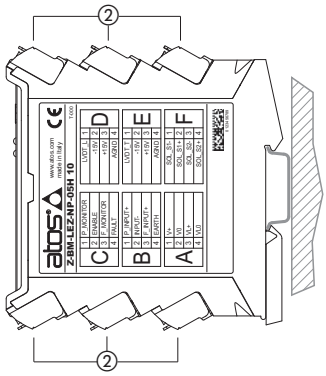
24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS900	Operating and maintenance information for proportional valves	**K800**	Electric and electronic connectors
FY100	Safety proportional valves - option /U	**P005**	Mounting surfaces for electrohydraulic valves
FY200	Safety proportional valves - option /K	**Y010**	Basics for safety components
GS500	Programming tools		

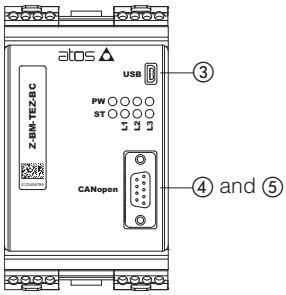
Digital Z-BM-TEZ/LEZ axis cards with driver functionality

DIN-rail format, for position and force controls

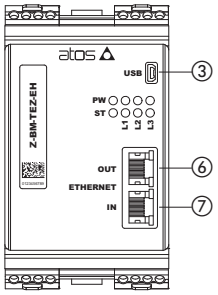




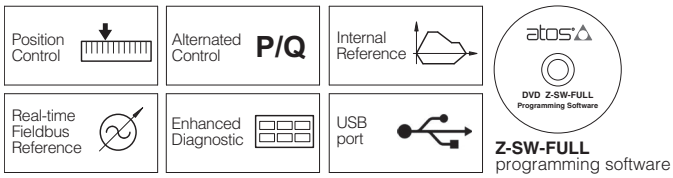
Z-BM-TEZ- **NP** Not Present



Z-BM-TEZ- **BC** CANopen
BP PROFIBUS DP



Z-BM-TEZ- **EH** EtherCAT
EW POWERLINK
EI EtherNet/IP
EP PROFINET RT/IRT



Z-SW-FULL
programming software

Connectors ② included

Z-BM-TEZ/LEZ

Digital axis cards ① perform the driver functions for proportional valves plus the position closed loop control of the linear or rotative actuator to which the proportional valve is connected.
Z-BM-TEZ execution controls direct and pilot operated directional valves with one LVDT transducer.
Z-BM-LEZ execution controls directional pilot operated valves with two LVDT transducers.
The controlled actuator has to be equipped with transducer (analog, SSI or Encoder) to read the axis position feedback.
The axis card can be operated via an external reference signal or automatic cycle, see section 4.
A force alternated control may be set by software additionally to the position control: a pressure/force transducer has to be assembled into the actuator and connected to the axis card; a second pressure/force reference signal is required.
Atos PC software allows to customize the axis card configuration to the specific application requirements.

Electrical Features:

- up to 11 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 8.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Internal generation of motion cycle
- Setting of axis dynamic response (PID) to optimize the application performances
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Complete diagnostics of axis status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

Z-BM	-	TEZ	-	NP	-	01H	/	*	*	/	*

Z-BM — Off-board electronic axis card in DIN rail format

TEZ = digital full driver + axis card, for valves with one LVDT transducer
LEZ = digital full driver + axis card, for valves with two LVDT transducers

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

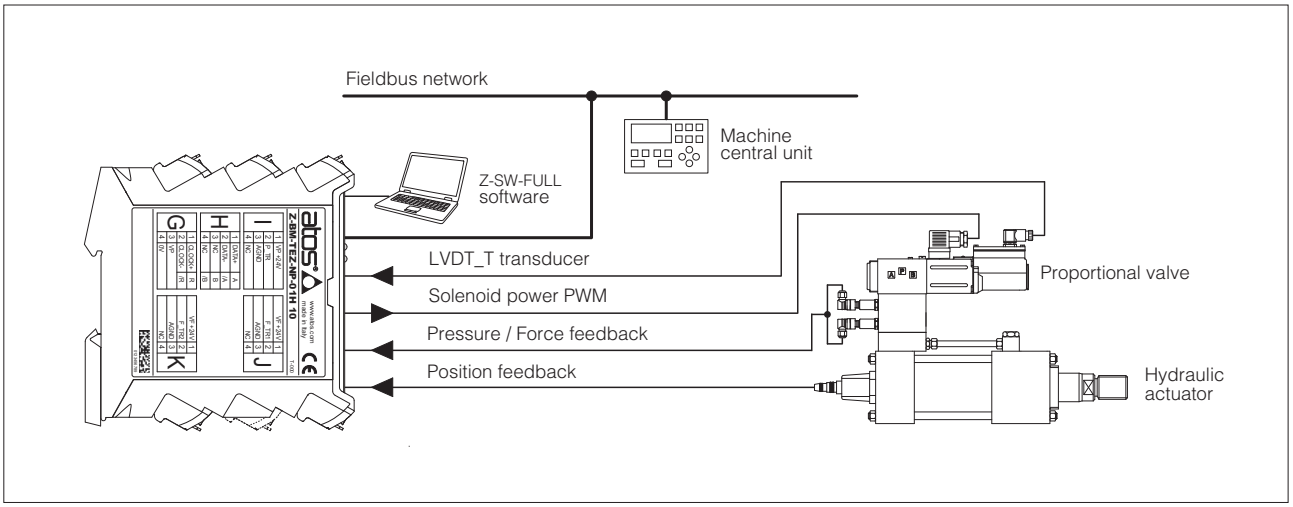
01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TEZ**)

Options, see section 3 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for LVDT transducers, only in combination with option A

Series number

Set code (see section 9)

2 BLOCK DIAGRAM EXAMPLE



Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

Valves	Directional		
Industrial Tech table	**DHZO-T, DKZOR-T** F168	**DLHZO-T, DLKZOR-T** F180	**DPZO-L** F178
Ex-proof Tech table	-	**DLHZA-T, DLKZA-T** FX140	-
Axis card model	**Z-BM-TEZ**		**Z-BM-LEZ**

4 POSITION CONTROL

4.1 External reference signal

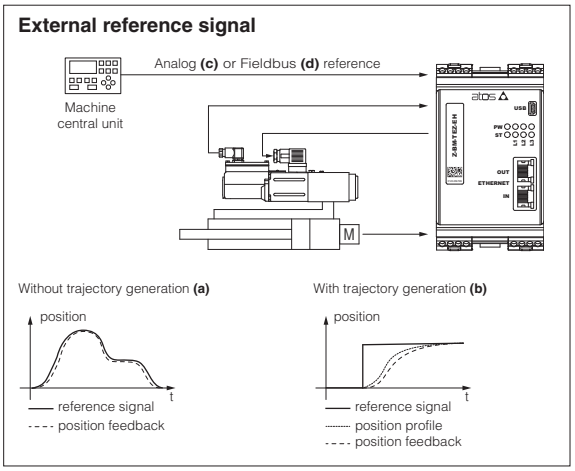
Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

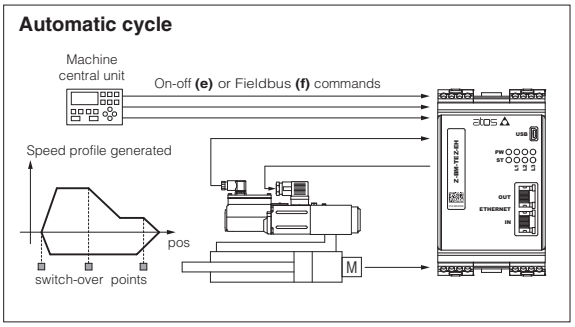
Refer to the axis card user manual for further details on position control features.



4.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



5 ALTERNATED POSITION / FORCE CONTROL

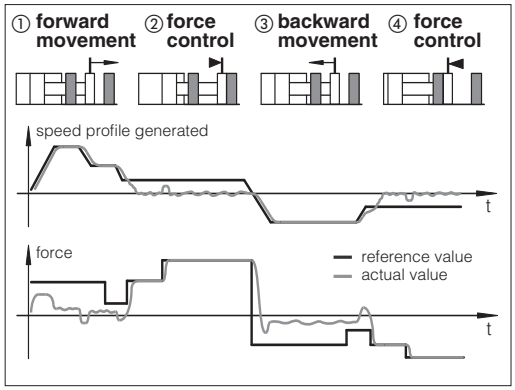
The alternated pressure or force closed loop control can be added to the actuator standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

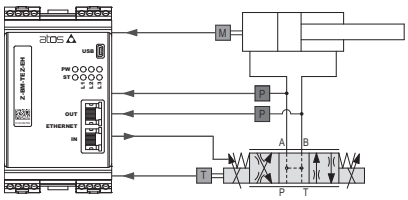
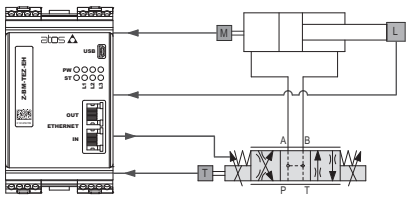
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations - software selectable

SF	SL
	
two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve's spool transducer M actuator's position transducer P pressure transducer L load cell

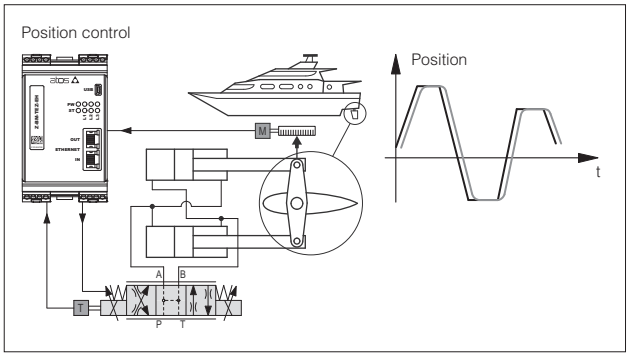
SF – position/force control
Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

SL – position/force control
Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

General Notes:

- servoproportional type DLHZO, DLKZOR and DPZO-L are strongly recommended for high accuracy applications see tech tables **F180**, **F175**
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault, see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **FS500**
- Atos technical service is available for additional evaluations related to specific applications usage

6 APPLICATION EXAMPLES

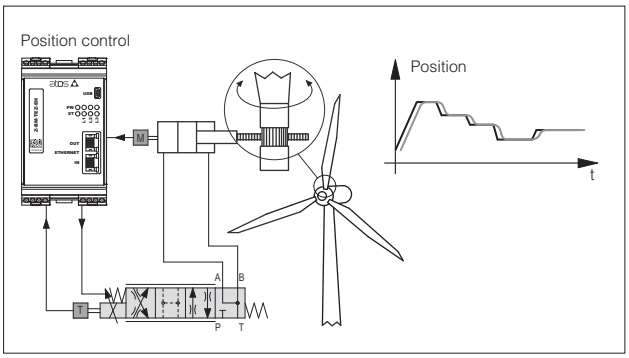


Hydraulic steering wheel in marine applications

Rudder controls on motor yachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-TEZ/LEZ axis cards perform the rudder position control system, ensuring accurate and repetitive regulations for a comfortable ride, thanks to:

- analog position reference mode for real time controls
- analog position transducer for simple and compact solution
- position PID control parameters to optimize the system response
- complete diagnostic information for advanced system monitoring

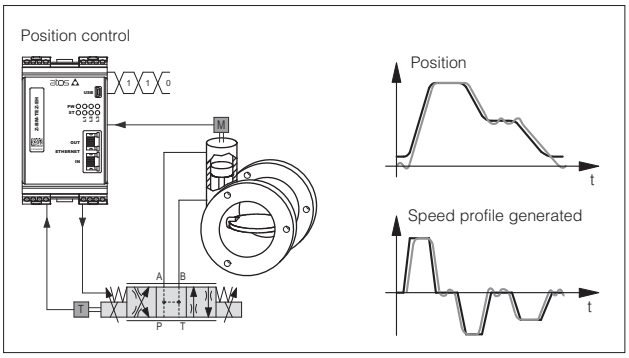


Wind turbines

The pitch control of the rotor blades is required to maximize the energy production. Accurate positioning, decentralized intelligence as well as long service life and reliability are required.

Z-BM-TEZ/LEZ axis cards perform high quality regulation of the blade pitch simplifying the system architecture, thanks to:

- SSI digital position transducer for high precision control
- complete remote system management with fieldbus interface
- position PID selection to adapt the position control to the different wind conditions

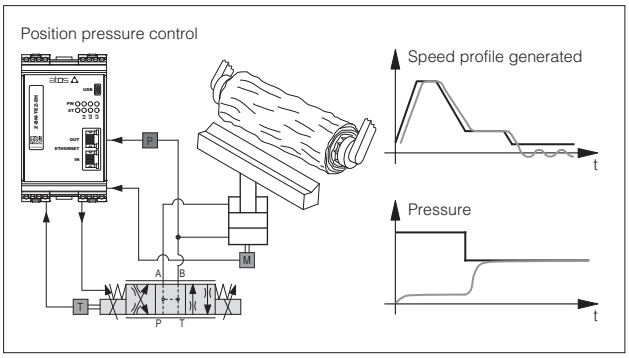


Process valves

Process valves motion regulation requires smooth and remote controls due to wide distributed applications.

Z-BM-TEZ/LEZ axis cards allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings for standing alone axis control
- potentiometer position transducer for compact and cost effective solution
- fieldbus connection for easy parameterization and remote commands

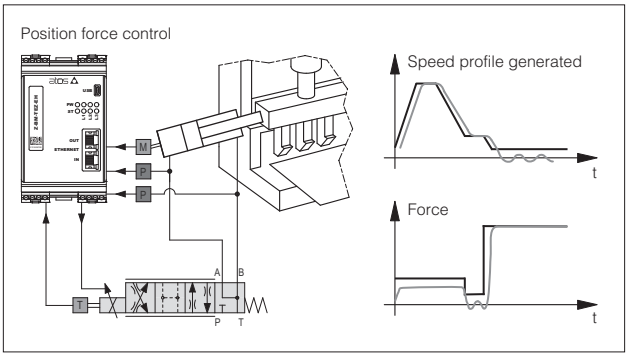


Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

Z-BM-TEZ/LEZ axis cards allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings
- analog position transducer for simple and reliable solution
- pressure transducer for alternated pressure control
- fieldbus connection for remote parameterization, commands, and axis card state indication

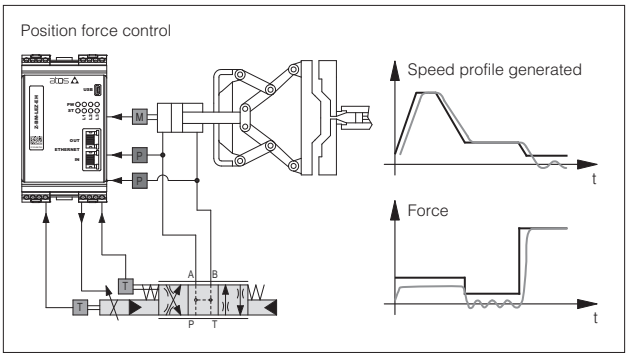


Bending Machines

Machine tools for cold-forming flat sheets require complete, automatic, programmable and flexible machine control to produce sheet metal panels from punched blank.

Z-BM-TEZ/LEZ axis cards combine high level position regulation with accurate force control to provide in a single device a complete and dedicated solution, thanks to:

- internal reference generation to simplify the machine control cycle
- digital position sensor for high resolution measurement system
- two pressure transducers for alternated force control
- fieldbus interface for easy machine control integration
- auxiliary digital outputs for system status indication (target reached, force control active)



Die-casting machinery

Clamp movements in die-casting phases involve fast/slow motion cycle with accurate and repetitive alternated position/force controls for the mould safety functions.

Z-BM-TEZ/LEZ axis cards, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:

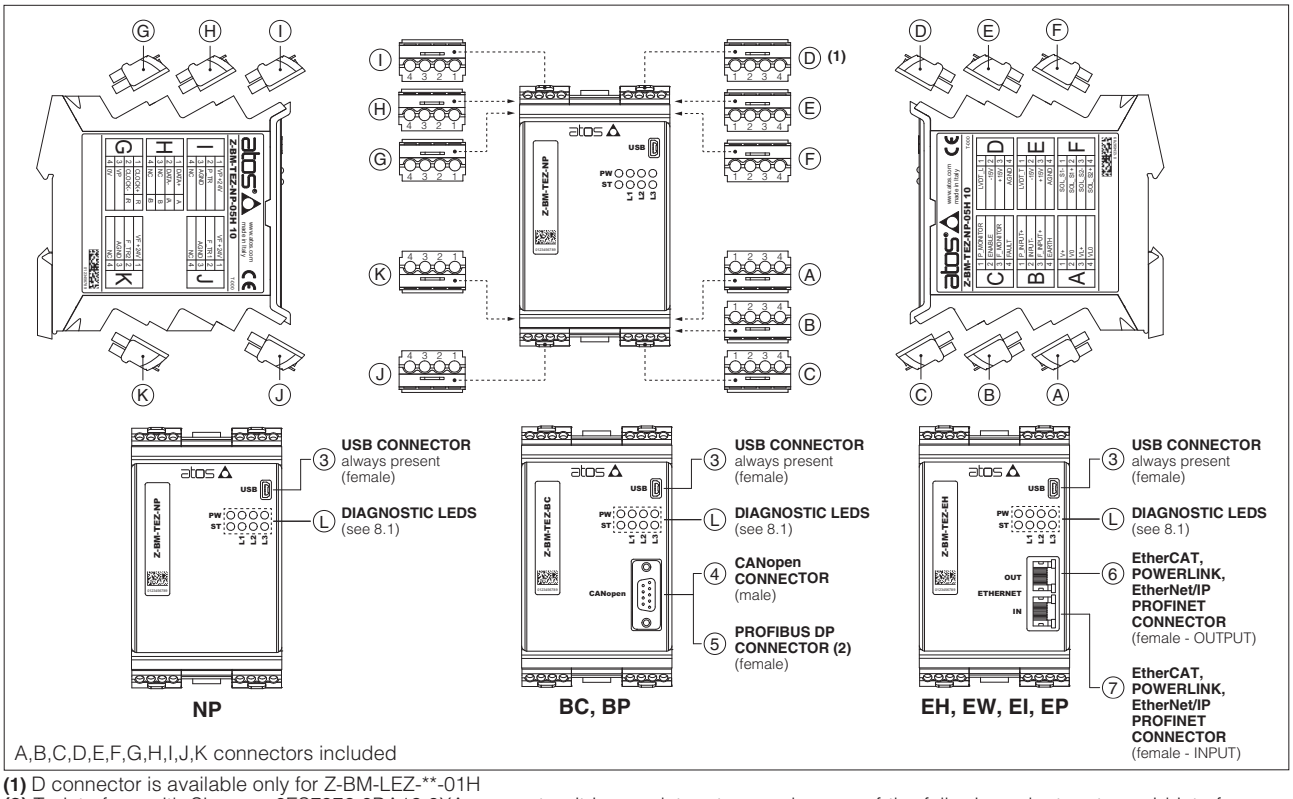
- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics

7 MAIN CHARACTERISTICS

Power supplies (see 10.1, 10.2)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Current supplied to solenoids	IMAX = 3.0 A for standard axis card IMAX = 2.5 A for ex-proof axis card (**/A option**)			
Analog input signals (see 10.3, 10.4)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs (see 10.5, 10.6)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input (see 10.7)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output (see 10.8)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, position control monitoring, valve spool transducer malfunctions, alarms history storage function			
Position transducers power supply	+24 VDC @ max 100 mA or +5 VDC @ max 100 mA are software selectable			
Pressure/Force transducers power supply	+24 VDC @ max 100 mA			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +50 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 450 g			
Additional characteristics	8 leds for diagnostic; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet			
Max conductor size (see 15)	2,5 mm²			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the axis card energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

8 CONNECTIONS AND LEDS



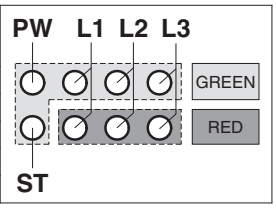
(1) D connector is available only for Z-BM-LEZ-**-01H

(2) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector: DG909MF1 - the connector will be oriented upwards; DG909MF3 - the connector will be oriented downwards

8.1 Diagnostic LEDs (L)

Eight leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET
L1	VALVE STATUS			LINK/ACT			
L2	NETWORK STATUS			NETWORK STATUS			
L3	SOLENOID STATUS			LINK/ACT			
PW	OFF = Power supply OFF		ON = Power supply ON				
ST	OFF = Fault present		ON = No fault				



8.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 10.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 10.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 VDC for axis card logic and communication (see 10.2)	Input - power supply
	A4	**VL0**	Power supply 0 VDC for axis card logic and communication (see 10.2)	Gnd - power supply
B	B1	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range. default is ±10 VDC (see 10.3)	Input - analog signal **Software selectable**
	B2	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	B3	**F_INPUT+**	Force reference input signal (SF, SL controls): ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 10.4)	Input - analog signal **Software selectable**
	B4	**EARTH**	Connect to system ground	
C	C1	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND; default is ±10 VDC (see 10.5)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the axis card, referred to VL0 (see 10.7)	Input - on/off signal
	C3	**F_MONITOR**	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND; default is ±10 VDC (see 10.6)	Output - analog signal **Software selectable**
	C4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 10.8)	Output - on/off signal
D (1)	D1	**LVDT_L**	Main stage valve LVDT position transducer signal (see 10.11)	Input - analog signal
	D2	**-15V**	Main stage valve LVDT position transducer power supply -15V	Output power supply
	D3	**+15V**	Main stage valve LVDT position transducer power supply +15V	Output power supply
	D4	**AGND**	Common gnd for transducer power supply and monitor outputs	Common gnd
E	E1	**LVDT_T**	Direct valve or pilot valve LVDT position transducer signal (see 10.11)	Input - analog signal
	E2	**-15V**	Direct valve or pilot valve LVDT position transducer power supply -15V	Output power supply
	E3	**+15V**	Direct valve or pilot valve LVDT position transducer power supply +15V	Output power supply
	E4	**AGND**	Common gnd for transducer power supply and monitor outputs	Common gnd
F	F1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	F2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	F3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	F4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM
G	G1	Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4		
	G2			
	G3			
	G4			
H	H1	Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4		
	H2			
	H3			
	H4			
I	I1	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	I2	**P_TR1**	Analog position transducer input signal ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 10.9)	Input - analog signal **Software selectable**
	I3	**AGND**	Common gnd for transducer power supply and signals	Common gnd
	I4	**NC**	Do not connect	
J	J1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	J2	**F_TR1**	1st signal pressure/force transducer: ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 10.10)	Input - analog signal **Software selectable**
	J3	**AGND**	Common gnd for transducer power supply and signals	Common gnd
	J4	**NC**	Do not connect	
K	K1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	K2	**F_TR2**	2nd signal pressure transducer (only for SF): ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 10.10)	Input - analog signal **Software selectable**
	K3	**AGND**	Common gnd for transducer power supply and signals	Common gnd
	K4	**NC**	Do not connect	

(1) D connector is available only for Z-BM-LEZ-**-01H

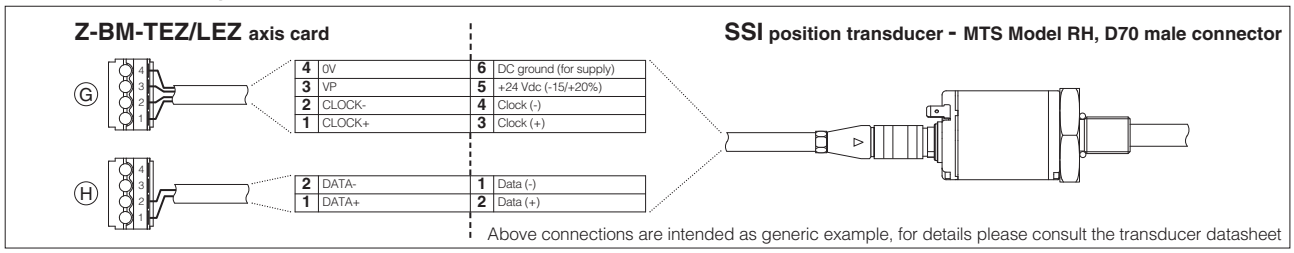
8.3 SSI connectors signals - 4 pin

G	G1	**CLOCK+**	Serial synchronous clock (+)	Output - on/off signal
	G2	**CLOCK-**	Serial synchronous clock (-)	Output - on/off signal
	G3	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power and signals	Common gnd

H	H1	**DATA+**	Serial position data (+)	Input - on/off signal
	H2	**DATA-**	Serial position data (-)	Input - on/off signal
	H3	**NC**	Do not connect	
	H4	**NC**	Do not connect	

Note: for Balluff BTL7 with SSI interface only special code SA433 is supported

SSI connection - example

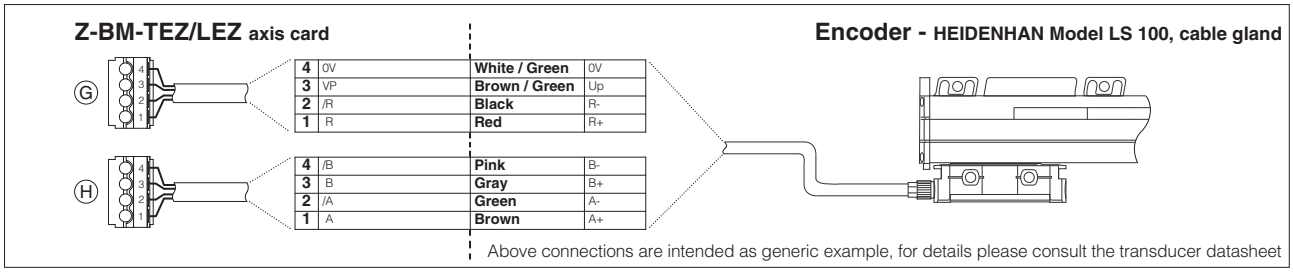


8.4 Encoder connectors signals - 4 pin

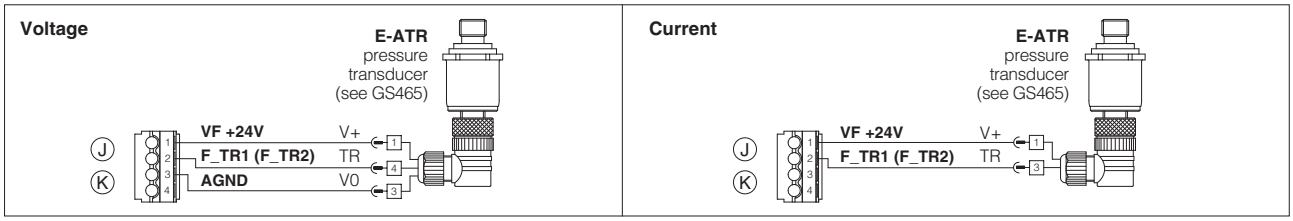
G	G1	**R**	Input channel R	Input - on/off signal
	G2	**/R**	Input channel /R	Input - on/off signal
	G3	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power and signals	Common gnd

H	H1	**A**	Input channel A	Input - on/off signal
	H2	**/A**	Input channel /A	Input - on/off signal
	H3	**B**	Input channel B	Input - on/off signal
	H4	**/B**	Input channel /B	Input - on/off signal

Encoder connection - example



8.5 Pressure/force transducers connection - example



8.6 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥ ⑦ **EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**TX-**	Transmitter - orange
3	**RX+**	Receiver - white/green
6	**RX-**	Receiver - green

(1) Shield connection on connector's housing is recommended

9 SET CODE

The basic calibration of axis card is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of axis card model code (see section 1). For correct set code selection, please include in the axis card order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

10 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital axis card are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

10.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

10.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for axis card logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

10.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on axis card reference mode, see section 4 :
external analog reference (see 4.1): input is used as reference for control in closed loop the actuator position.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC

external fieldbus reference (see 4.1) *or automatic cycle* (see 4.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

10.4 Force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected axis card reference mode and alternated control options, see section 5 :
SL, SF controls and external analog reference selected : input is used as reference for the axis card pressure/force closed loop.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC

10.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal (pin C1) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA; default is ±10 VDC

10.6 Force monitor output signal (F_MONITOR)

The axis card generates an analog output signal (pin C3) according to alternated force control option:
SN control: output signal is proportional to the actual valve spool position
SL, SF controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA; default is ±10 VDC

10.7 Enable Input Signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin C2
When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

10.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signalcable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC
Fault status is not affected by the status of the Enable input signal.
Fault output signal can be used as digital output by software selection.

10.9 Position transducer input signals

A position transducer must be always directly connected to the axis card. Position digital input signals are factory preset to binary SSI, they can be reconfigured via software selecting between binary/gray SSI, Encoder or generic transducer with analog interface.
Input signals can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC
Refer to position transducer characteristics to select the transducer type according to specific application requirements, see section 11 .

10.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the axis card.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements, see section 11 .

10.11 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the axis card using ±15 VDC supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the axis card set code).

10.12 Possible combined options: /AC

11 ACTUATOR'S TRANSDUCER CHARACTERISTICS

11.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: analog signal (analog), SSI or Encoder (digital).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

11.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer (see section 5).
Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

11.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position			Pressure/Force
Input type	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	+24 VDC	+5 VDC or +24 VDC	+5 VDC or +24 VDC	+24 VDC
Axis card interface	0 ÷ 10V or 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC or 4 ÷ 20 mA
Max speed	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by Atos axis card **(2)** percentage of total stroke **(3)** for Balluff BTL7 with SSI interface only special code SA433 is supported

12 VALVE SETTINGS AND PROGRAMMING TOOLS

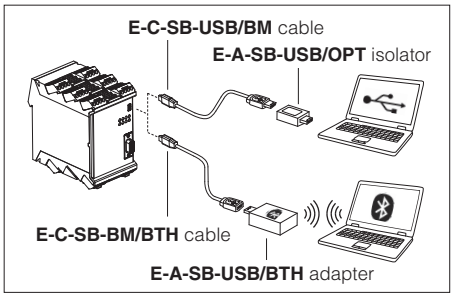
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital axis card (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

The software is available in different versions according to the axis card options (see table **GS500**):

Z-SW-FULL support: NP (USB) PS (Serial)
BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

WARNING: axis card USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

DVD programming software, to be ordered separately:

Z-SW-FULL DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

Z-SW-FULL-N DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of Z-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

13 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:
Z-MAN-BM-LEZ - user manual for **Z-BM-LEZ** and **Z-BM-TEZ**

13.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:
- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

13.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:
- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

13.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:
- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 13.4)

13.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:
- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

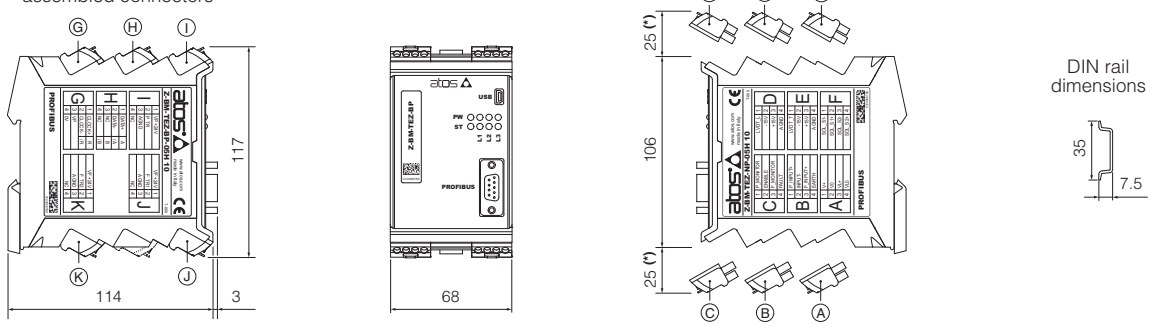
13.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:
- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

13.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 4.2).

14 OVERALL DIMENSIONS [mm]



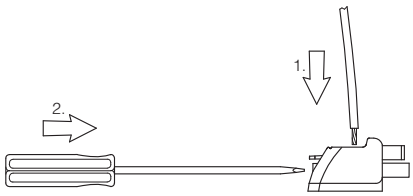
A,B,C,D,E,F,G,H,I,J,K connectors included

(*) Space to remove the connectors

(1) D connector is available only for Z-BM-LEZ-**-01H

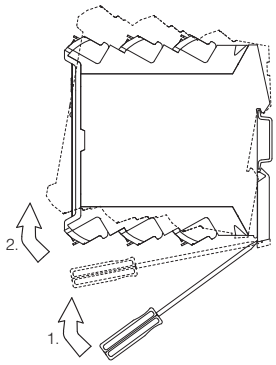
15 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the axis card from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the axis card



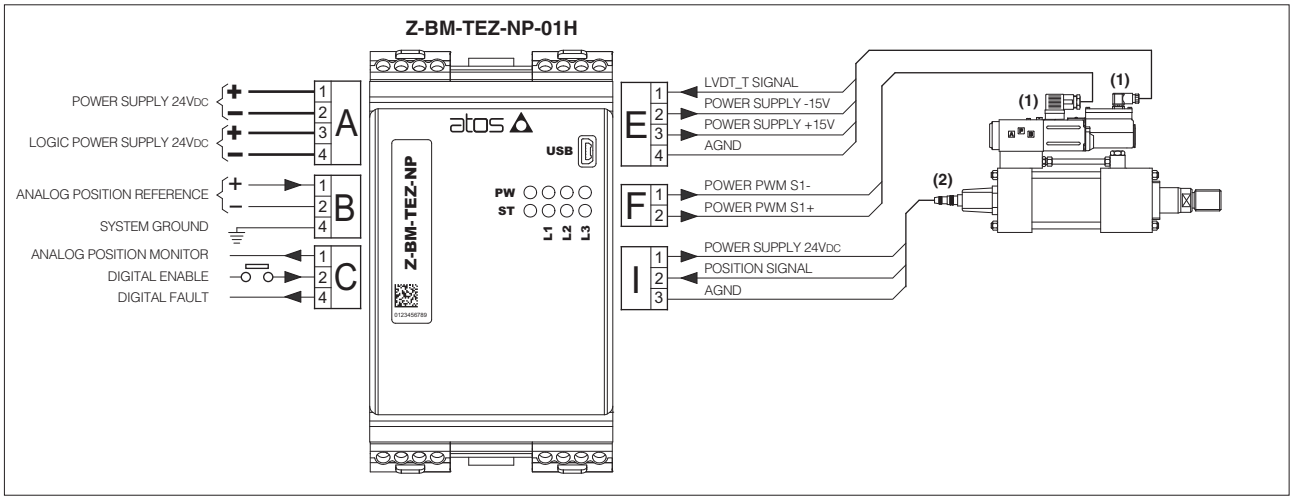
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(eg. connector A can not be inserted into connector slot of B,C,D,E,F,G,H,I,J,K)

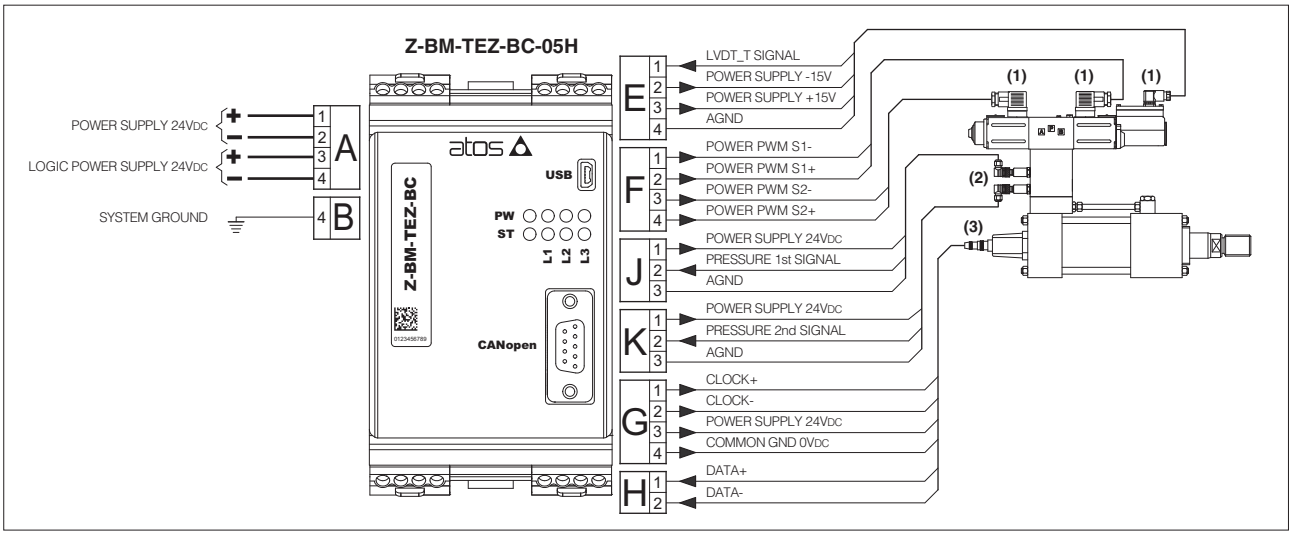
16 WIRING EXAMPLES

16.1 Position control - analog reference - analog position transducer



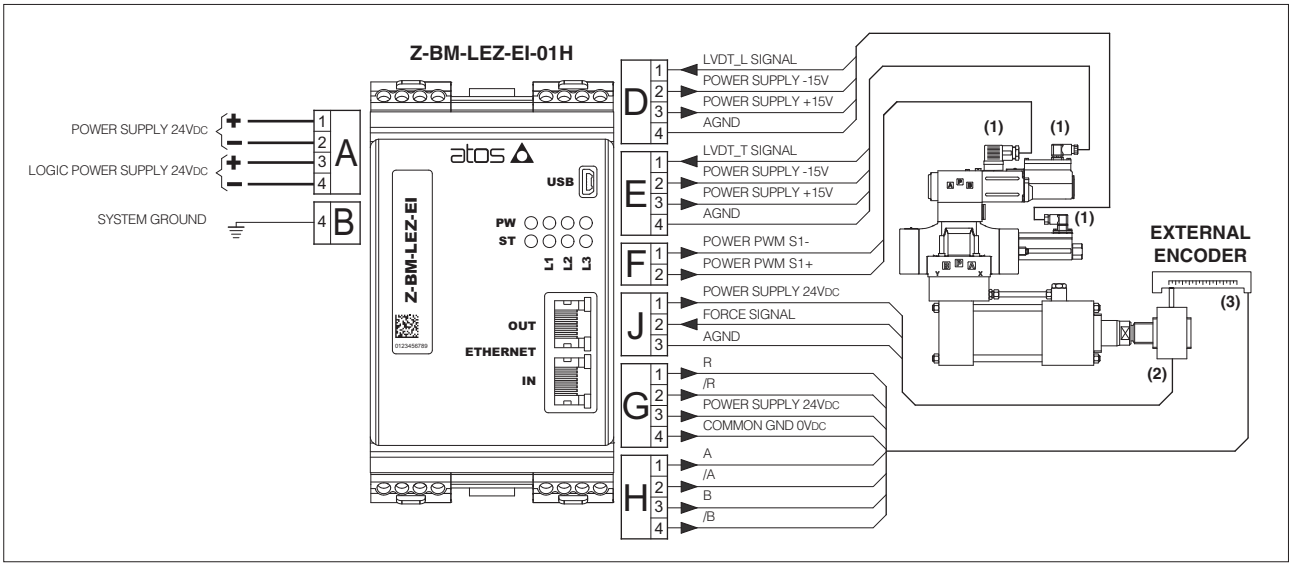
(1) For valve electrical connections please refer to the specific technical table
(2) The analog position transducer connections are intended as generic example, for details please consult the transducer datasheet

16.2 Alternated position/force control - CANopen reference - SSI position transducer - 2 analog pressure transducers



(1) For valve electrical connections please refer to the specific technical table
(2) Pressure transducers connections are shown with voltage signal output; for connections with current signal output see 8.5
(3) The SSI position transducer connections are intended as generic example, for details please consult the transducer datasheet

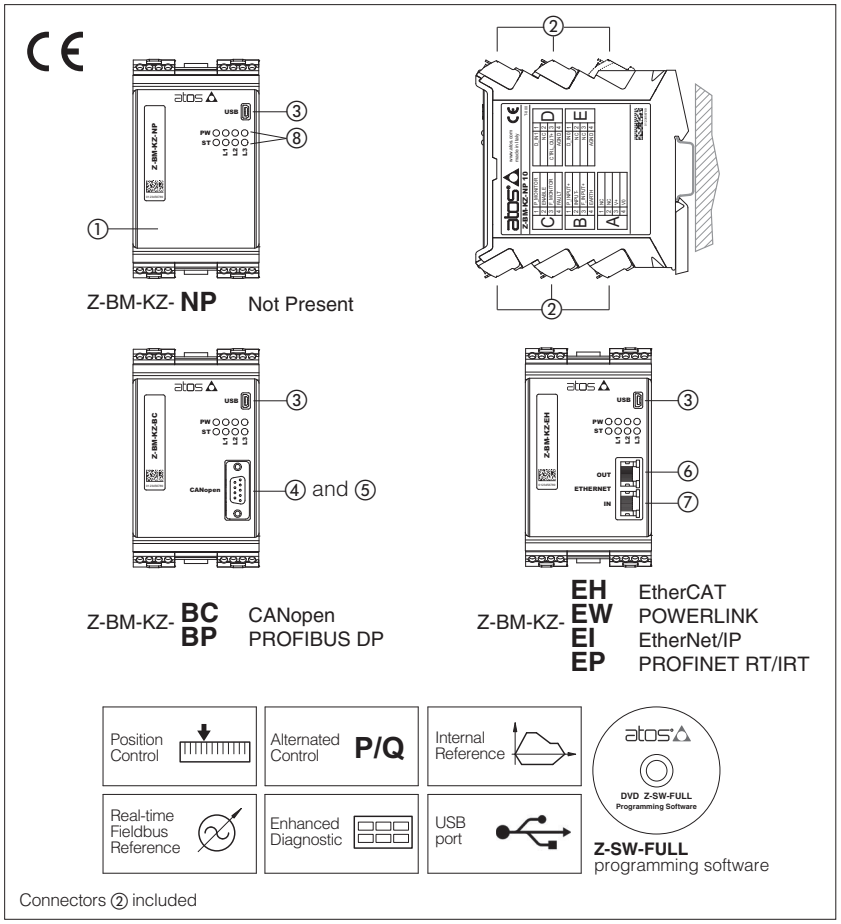
16.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



(1) For valve electrical connections please refer to the specific technical table
(2) Load cell connections is shown with voltage signal output; please consult the load cell datasheet for details about connections
(3) The Encoder position transducer connections are intended as generic example, for details please consult the transducer datasheet

Digital Z-BM-KZ axis cards

DIN-rail format, for position and force controls



Z-BM-KZ

Digital axis cards ① perform the position closed loop of linear or rotative hydraulic axes.

The axis card generates a reference signal to the proportional valve which regulates the hydraulic flow to the actuator.

The controlled actuator has to be equipped with transducer (analog, SSI or Encoder) to read the axis position feedback.

The axis card can be operated via an external reference signal or automatic cycle, see section 4.

A force alternated control may be set by software additionally to the position control: a pressure/force transducer has to be assembled into the actuator and connected to the axis card; a second pressure/force reference signal is required.

Atos PC software allows to customize the axis card configuration to the specific application requirements.

Electrical Features:

- 10 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 8.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

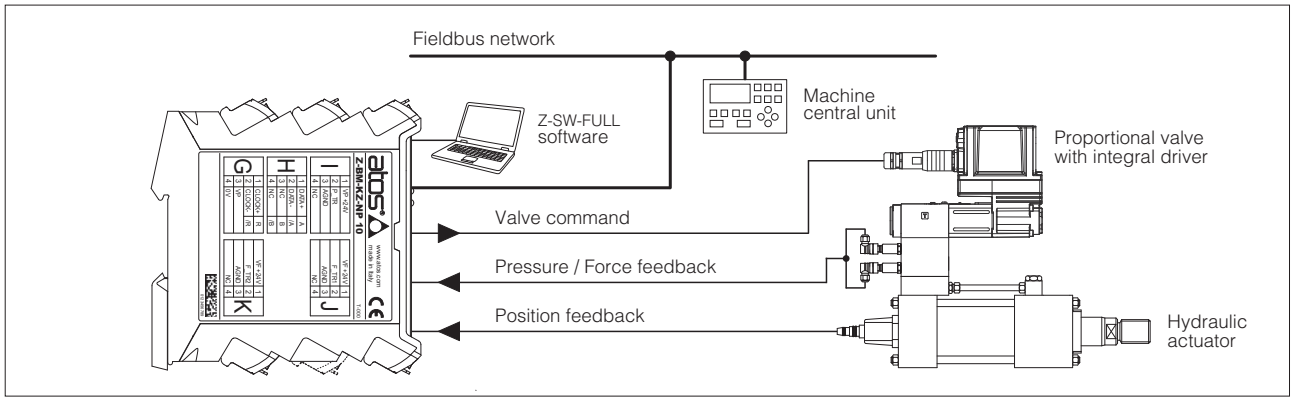
Software Features:

- Intuitive graphic interface
- Internal generation of motion cycle
- Setting of axis's dynamic response (PID) to optimize the application performances
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Complete diagnostics of axis status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

Z-BM	-	KZ	-	NP	*
Off-board electronic axis card in DIN rail format		Alternated position / force (or position / pressure) control module		**Fieldbus interface**, USB port always present: **NP** = Not Present **BC** = CANopen **BP** = PROFIBUS DP **EH** = EtherCAT **EW** = POWERLINK **EI** = EtherNet/IP **EP** = PROFINET RT/IRT	Series number

2 BLOCK DIAGRAM EXAMPLE



Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

Valves	Directional					
Industrial Tech table	**DHZO-TEB, DKZOR-TEB** FS168	**DHZO-TES, DKZOR-TES** FS168	**DLHZO-TEB, DLKZOR-TEB** FS180	**DLHZO-TES, DLKZOR-TES** FS180	**DPZO-LEB** FS178	**DPZO-LES** FS178
Ex-proof Tech table	-	**DHZA-TES, DKZA-TES** FX135	-	**DLHZA-TES, DLKZA-TES** FX150	-	**DPZA-LES** FX235

4 POSITION CONTROL

4.1 External reference signal

Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

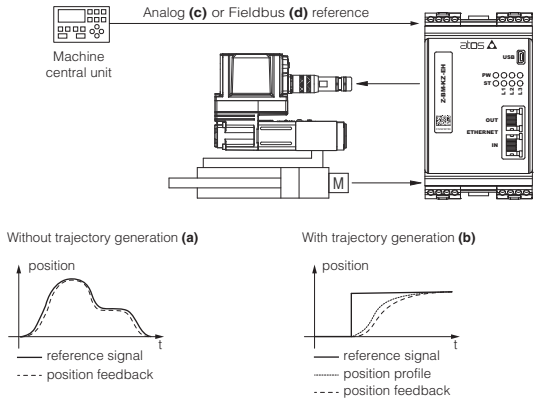
Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

Refer to the axis card user manual for further details on position control features.

External reference signal

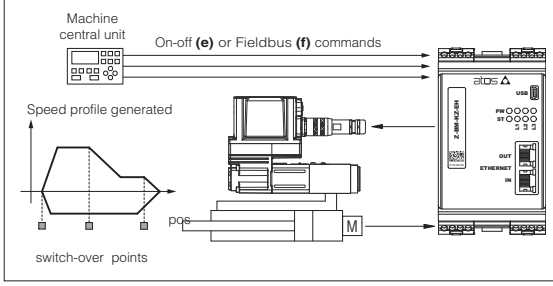


4.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.

Automatic cycle



5 ALTERNATED POSITION / FORCE CONTROL

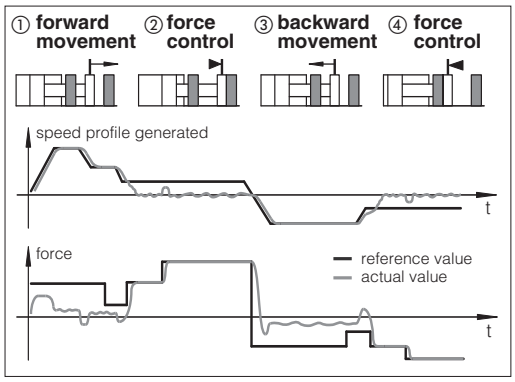
The alternated force closed loop control can be added to the actuator standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

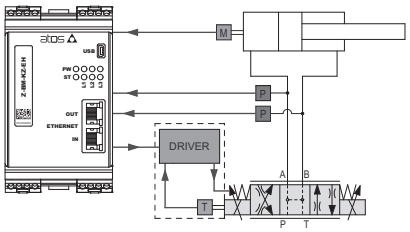
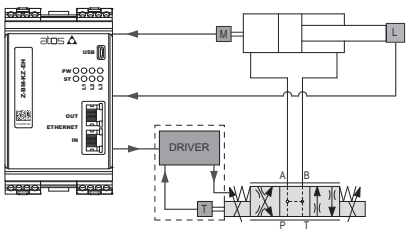
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



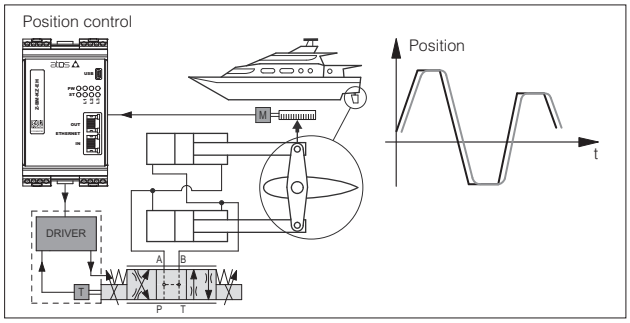
Alternated control configurations - software selectable

SF	SL
	
two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve's spool transducer | M actuator's position transducer | P pressure transducer | L load cell

SF – position/force control
Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.
SL – position/force control
Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.
General Notes:
- servoproportional type DLHZO, DLKZOR, DPZO-L are strongly recommended for high accuracy applications - see tech tables **FS180**, **FS178**
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **FS500**
- Atos technical service is available for additional evaluations related to specific applications usage

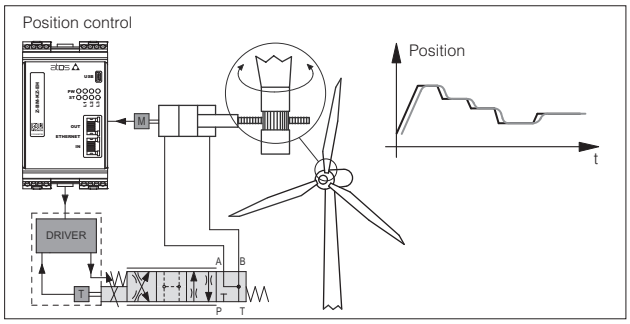
6 APPLICATION EXAMPLES



Hydraulic steering wheel in marine applications

Rudder axis card on motor yachts and sail boats requires smooth control for precise and reliable operations.

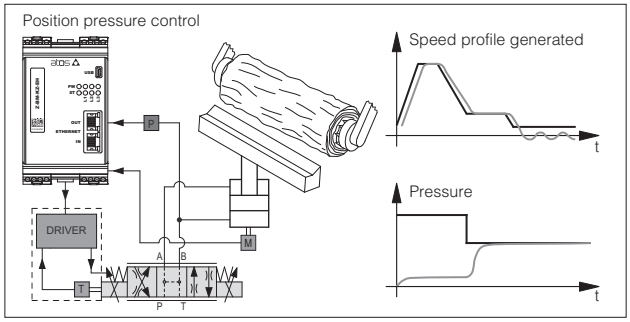
Z-BM-KZ axis cards perform the rudder position control system, ensuring accurate and repetitive regulations for a comfortable ride, thanks to:
- analog position reference mode for real time controls
- analog position transducer for simple and compact solution
- position PID control parameters to optimize the system response
- complete diagnostic information for advanced system monitoring



Wind turbines

The pitch control of the rotor blades is required to maximize the energy production. Accurate positioning, decentralized intelligence as well as long service life and reliability are required.

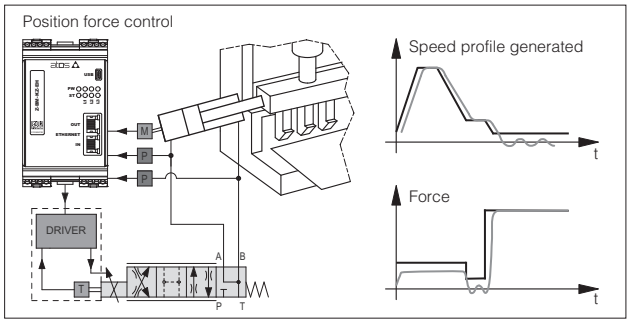
Z-BM-KZ axis cards perform high quality regulation of the blade pitch simplifying the system architecture, thanks to:
- SSI digital position transducer for high precision control
- complete remote system management with fieldbus interface
- position PID selection to adapt the position control to the different wind conditions



Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

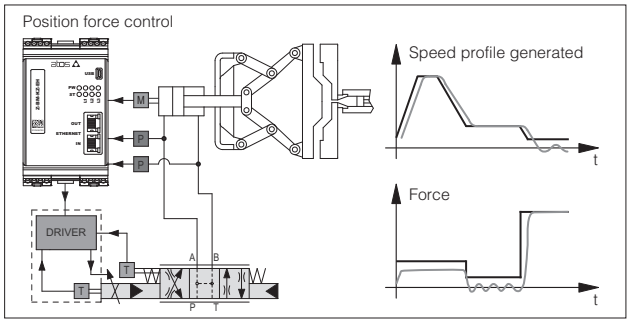
Z-BM-KZ axis cards allow remote control, thanks to:
- internal reference generation with maximum speed and acceleration settings
- analog position transducer for simple and reliable solution
- pressure transducer for alternated pressure control
- fieldbus connection for remote parameterization, commands, and axis card state indication



Bending Machines

Machine tools for cold-forming flat sheets require complete, automatic, programmable and flexible machine control to produce sheet metal panels from punched blank.

Z-BM-KZ axis cards combine high level position regulation with accurate force control to provide in a single device a complete and dedicated solution, thanks to:
- internal reference generation to simplify the machine control cycle
- digital position sensor for high resolution measurement system
- two pressure transducers for alternated force control
- fieldbus interface for easy machine control integration
- auxiliary digital outputs for system status indication (target reached, force control active)



Die-casting machinery

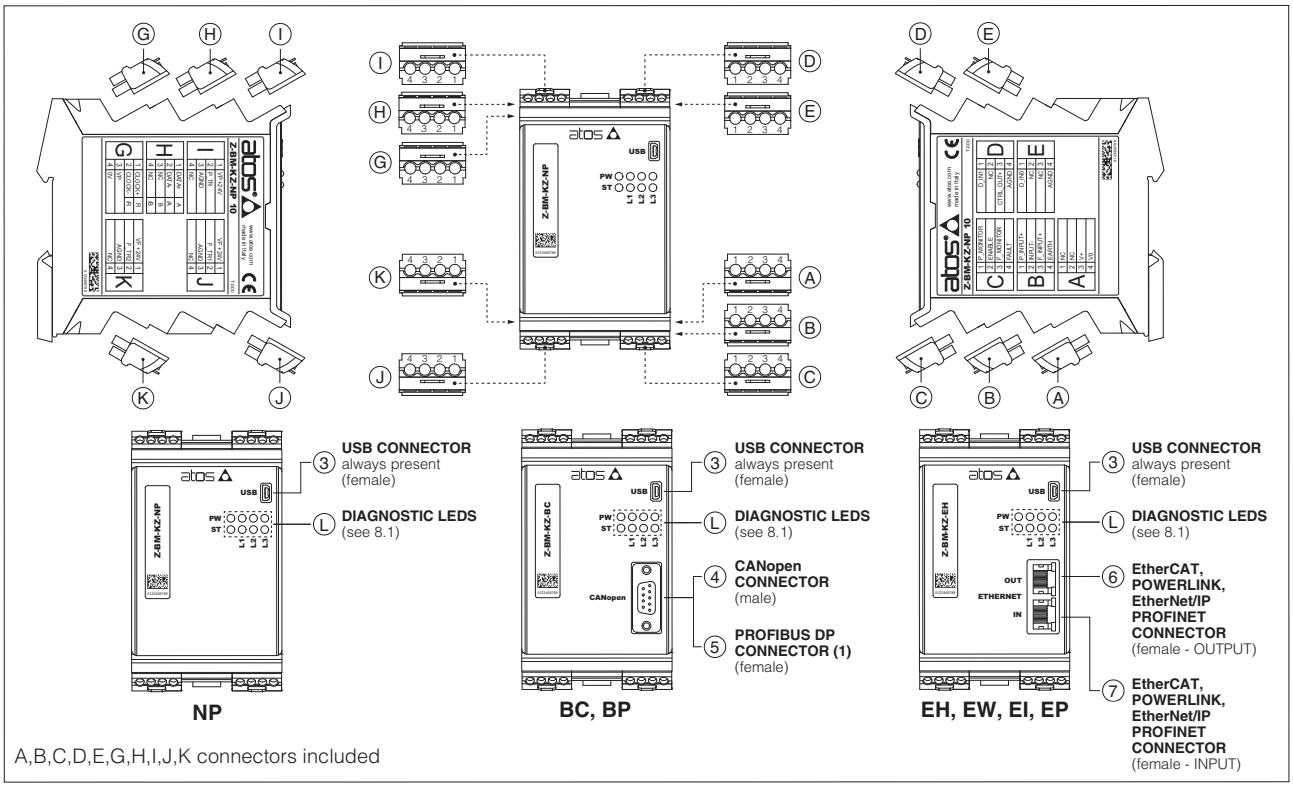
Clamp movements in die-casting phases involve fast/slow motion cycle with accurate and repetitive alternated position/force controls for the mould safety functions.

Z-BM-KZ axis cards, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:
- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics

7 MAIN CHARACTERISTICS

Power supply	(see 9.1)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption		10 W			
Analog input signals	(see 9.2, 9.3)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs Control output	(see 9.4, 9.5) (see 9.10)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input Digital inputs	(see 9.6) (see 9.11)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	(see 9.7)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms		Cable break with current reference signal, over/under temperature, position control monitoring			
Position transducers power supply		+24 VDC @ max 100 mA or +5 VDC@ max 100 mA are software selectable			
Pressure/Force transducers power supply		+24 VDC @ max 100 mA			
Format		Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature		-20 ÷ +50 °C (storage -25 ÷ +85 °C)			
Mass		Approx. 450 g			
Additional characteristics		8 leds for diagnostic; protection against reverse polarity of power supply			
Compliance		CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface		USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer		not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable		LiYCY shielded cables: 0,5 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet			
Max conductor size	(see 14)	2,5 mm²			

8 CONNECTIONS AND LEDS

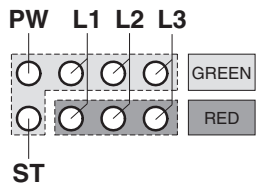


(1) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector: DG909MF1 - the connector will be oriented upwards; DG909MF3 - the connector will be oriented downwards

8.1 Diagnostic LEDs (L)

Eight leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET
L1	VALVE STATUS			LINK/ACT			
L2	NETWORK STATUS			NETWORK STATUS			
L3	ALARM STATUS			LINK/ACT			
PW	OFF = Power supply OFF		ON = Power supply ON				
ST	OFF = Fault present		ON = No fault				



8.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**NC**	Do not connect	
	A2	**NC**	Do not connect	
	A3	**V+**	Power supply 24 VDC (see 9.1)	Input - power supply
	A4	**V0**	Power supply 0 VDC (see 9.1)	Gnd - power supply
B	B1	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.2)	Input - analog signal **Software selectable**
	B2	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	B3	**F_INPUT+**	Force reference input signal (SF, SL controls): ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.3)	Input - analog signal **Software selectable**
	B4	**EARTH**	Connect to system ground	
C	C1	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND; default is ±10 VDC (see 9.4)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the axis card, referred to V0 (see 9.6)	Input - on/off signal
	C3	**F_MONITOR**	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND; default is ±10 VDC (see 9.5)	Output - analog signal **Software selectable**
		NC	For EW, EI, EP executions the F_MONITOR is not available: do not connect	
	C4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to V0 (see 9.7)	Output - on/off signal
D	D1	**D_IN1**	Digital input 0 ÷ 24VDC, referred to AGND (see 9.11)	Input - on/off signal
	D2	**NC**	Do not connect	
	D3	**CTRL_OUT+**	Control output signal for external valve driver, referred to AGND (see 9.10)	Output - analog signal **Software selectable**
	D4	**AGND**	Common gnd for digital input and control output	Common gnd
E	E1	**D_IN0**	Digital input 0 ÷ 24VDC, referred to AGND (see 9.11)	Input - on/off signal
	E2	**NC**	Do not connect	
	E3	**NC**	Do not connect	
	E4	**AGND**	Common gnd for digital input and monitor outputs	Common gnd
G	G1	Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4		
	G2			
	G3			
	G4			
H	H1	Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4		
	H2			
	H3			
	H4			
I	I1	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	I2	**P_TR1**	Analog position transducer input signal ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.8)	Input - analog signal **Software selectable**
	I3	**AGND**	Common gnd for transducer power supply and signals	Common gnd
	I4	**NC**	Do not connect	
J	J1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	J2	**F_TR1**	1st signal pressure/force transducer: ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.9)	Input - analog signal **Software selectable**
	J3	**AGND**	Common gnd for transducer power supply and signals	Common gnd
	J4	**NC**	Do not connect	
K	K1	**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	K2	**F_TR2**	2nd signal pressure transducer (only for SF): ±10 VDC / ±20 mA maximum range; default is ±10 VDC (see 9.9)	Input - analog signal **Software selectable**
	K3	**AGND**	Common gnd for transducer power supply and signals	Common gnd
	K4	**NC**	Do not connect	

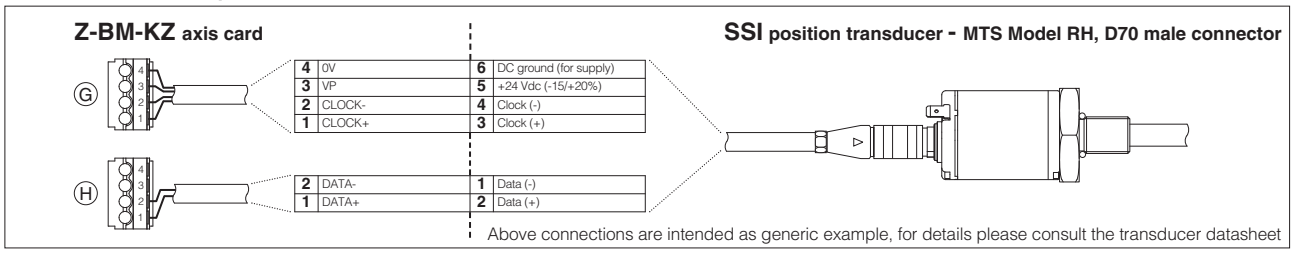
8.3 SSI connectors signals - 4 pin

G	G1	**CLOCK+**	Serial synchronous clock (+)	Output - on/off signal
	G2	**CLOCK-**	Serial synchronous clock (-)	Output - on/off signal
	G3	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power supply and signals	Common gnd

H	H1	**DATA+**	Serial position data (+)	Input - on/off signal
	H2	**DATA-**	Serial position data (-)	Input - on/off signal
	H3	**NC**	Do not connect	
	H4	**NC**	Do not connect	

Note: for Balluff BTL7 with SSI interface only special code SA433 is supported

SSI connection - example

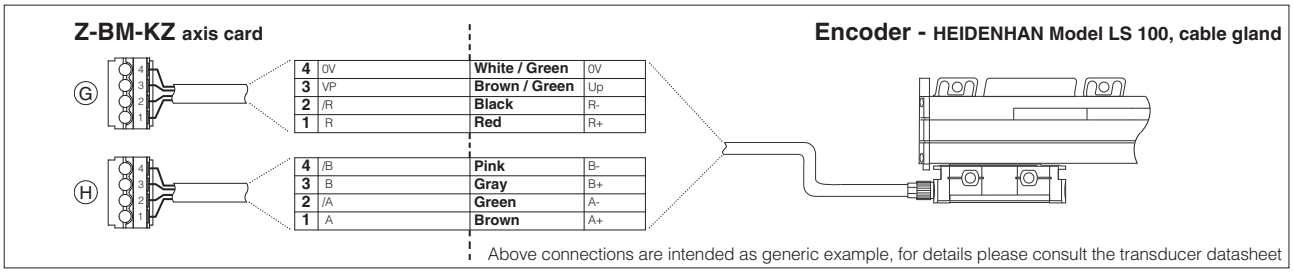


8.4 Encoder connectors signals - 4 pin

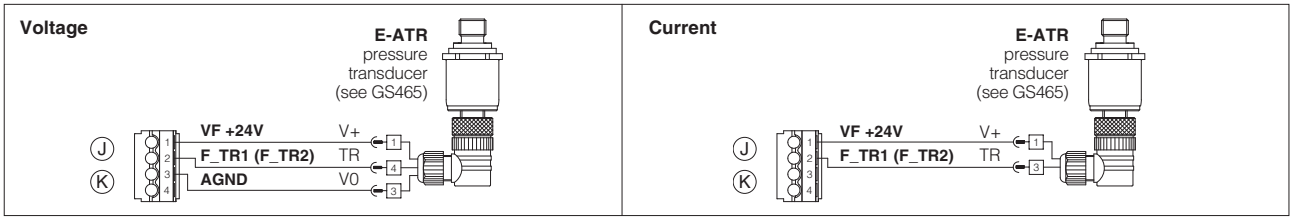
G	G1	**R**	Input channel R	Input - on/off signal
	G2	**/R**	Input channel /R	Input - on/off signal
	G3	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power and signals	Common gnd

H	H1	**A**	Input channel A	Input - on/off signal
	H2	**/A**	Input channel /A	Input - on/off signal
	H3	**B**	Input channel B	Input - on/off signal
	H4	**/B**	Input channel /B	Input - on/off signal

Encoder connection - example



8.5 Pressure/force transducers connection - example



8.6 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥ ⑦ **EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

(1) Shield connection on connector's housing is recommended

9 SIGNALS SPECIFICATIONS

Atos digital axis card are CE marked according to the applicable directives (e.g. Immunity/Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

9.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 500 mA fast fuse.

9.2 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on axis card reference mode, see section 4 :
external analog reference (see 4.1): input is used as reference for control in closed loop the actuator position.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC

external fieldbus reference (see 4.1) *or automatic cycle* (see 4.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

9.3 Force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected axis card reference mode and alternated control options, see section 5 :
SL, SF controls and external analog reference selected : input is used as reference for the axis card pressure/force closed loop.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC

9.4 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal (pin C1) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA; default is ±10 VDC

9.5 Force monitor output signal (F_MONITOR)

The axis card generates an analog output signal (pin C3) according to alternated force control option:
SN control: output signal is proportional to the actual valve spool position
SL, SF controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).
The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA; default is ±10 VDC

9.6 Enable Input Signal (ENABLE)

To enable the axis card, a 24 VDC voltage has to be applied on pin C2.
When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

9.7 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC
Fault status is not affected by the status of the Enable input signal.
Fault output signal can be used as digital output by software selection.

9.8 Position transducer input signals

A position transducer must be always directly connected to the axis card. Position digital input signals are factory preset to binary SSI, they can be reconfigured via software selecting between binary/gray SSI, Encoder or generic transducer with analog interface.
Input signals can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC
Refer to position transducer characteristics to select the transducer type according to specific application requirements, see section 10 .

9.9 Remote pressure/force transducer input signals (F_TR1 and F_TR2) -SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the axis card.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA; default is ±10 VDC
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements, see section 10 .

9.10 Control output signal (CTRL_OUT+)

The error signal processed by the control algorithms generates the control output signal (pin D3) for the external driver of the proportional valve which operates the hydraulic flow to the actuator.
The output range and polarity are software selectable within ±10 VDC (for voltage) or ± 20 mA (for current) maximum range referred to the analog ground AGND on pin D4; default setting is ±10 VDC

9.11 Digital input signals (D_IN0 and D_IN1)

Two on-off input signals are available on the pin E1 and D1. For each input by the Z-SW software, it is possible to set the polarity and to match a proper condition within the following:
- pressure/force PID selection (default)
- start/stop/switch-over command in case of internal reference generation (see 4.2)
- specific operative command for hydraulic axis mode (referencing mode, jog mode, automatic mode)
- jog command
- disable force alternated control

	PID SET SELECTION			
PIN	SET 1	SET 2	SET 3	SET 4
E1	0	24 VDC	0	24 VDC
D1	0	0	24 VDC	24 VDC

10 ACTUATOR'S TRANSDUCER CHARACTERISTICS

10.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis card, depending to the system requirements: analog signal (analog), SSI or Encoder (digital).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

10.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer (see section 5).
Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details).
Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

10.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position			Pressure/Force
Input type	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	+24 VDC	+5 VDC or +24 VDC	+5 VDC or +24 VDC	+24 VDC
Axis card interface	0 ÷ 10V or 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC or 4 ÷ 20 mA
Max speed	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by Atos axis card **(2)** percentage of total stroke **(3)** for Balluff BTL7 with SSI interface only special code SA433 is supported

11 VALVE SETTINGS AND PROGRAMMING TOOLS

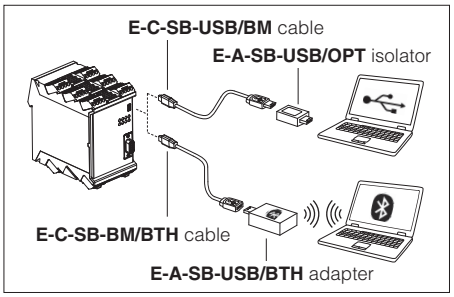
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital axis card (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

The software is available in different versions according to the axis card options (see table **GS500**):

Z-SW-FULL support: NP (USB) PS (Serial)
BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

WARNING: axis card USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

DVD programming software, to be ordered separately:

Z-SW-FULL DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

Z-SW-FULL-N DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of Z-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

12 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:
Z-MAN-BM-KZ - user manual for **Z-BM-KZ**

12.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:
- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

12.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:
- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

12.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:
- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 12.4)

12.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:
- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

12.5 Valve characteristics compensation

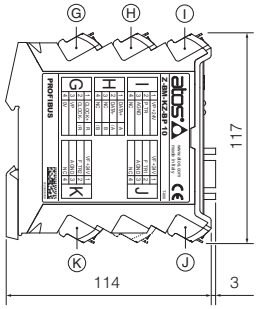
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:
- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

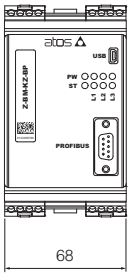
12.6 Motion phases parameters

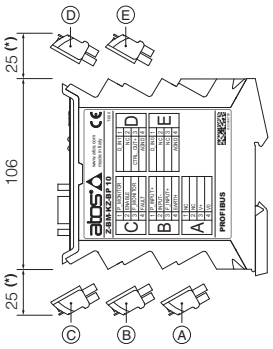
When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 4.2).

13 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors







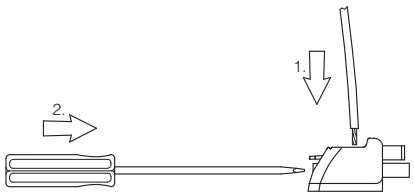
DIN rail dimensions

A,B,C,D,E,G,H,I,J,K connectors included

(*) Space to remove the connectors

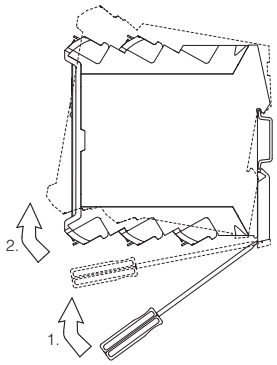
14 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the axis card from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the axis card



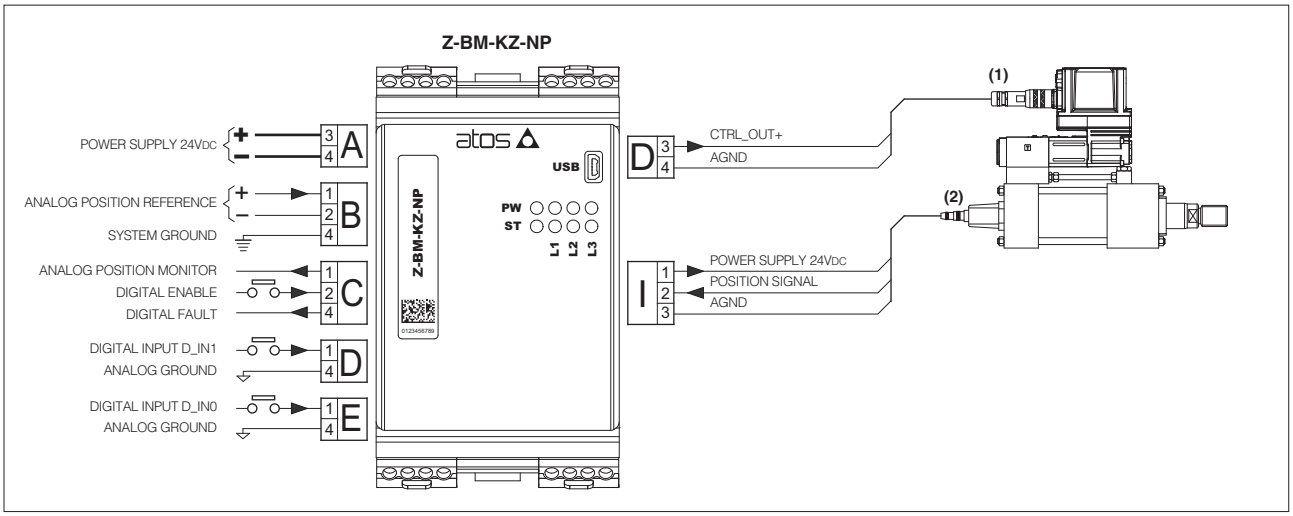
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B,C,D,E,G,H,I,J,K)

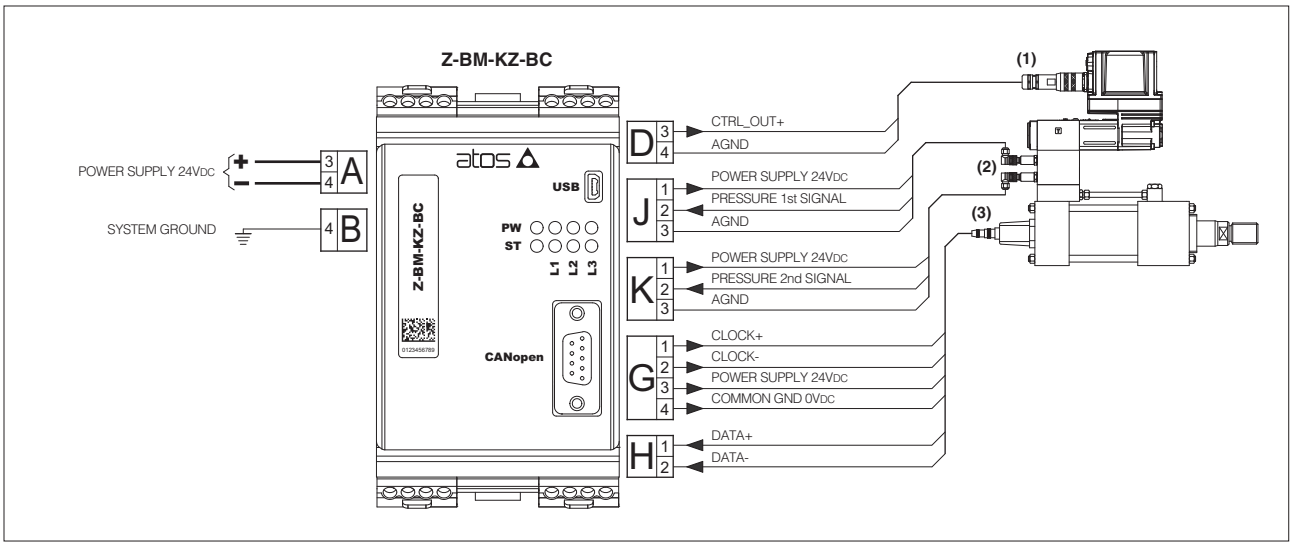
15 WIRING EXAMPLES

15.1 Position control - analog reference - analog position transducer



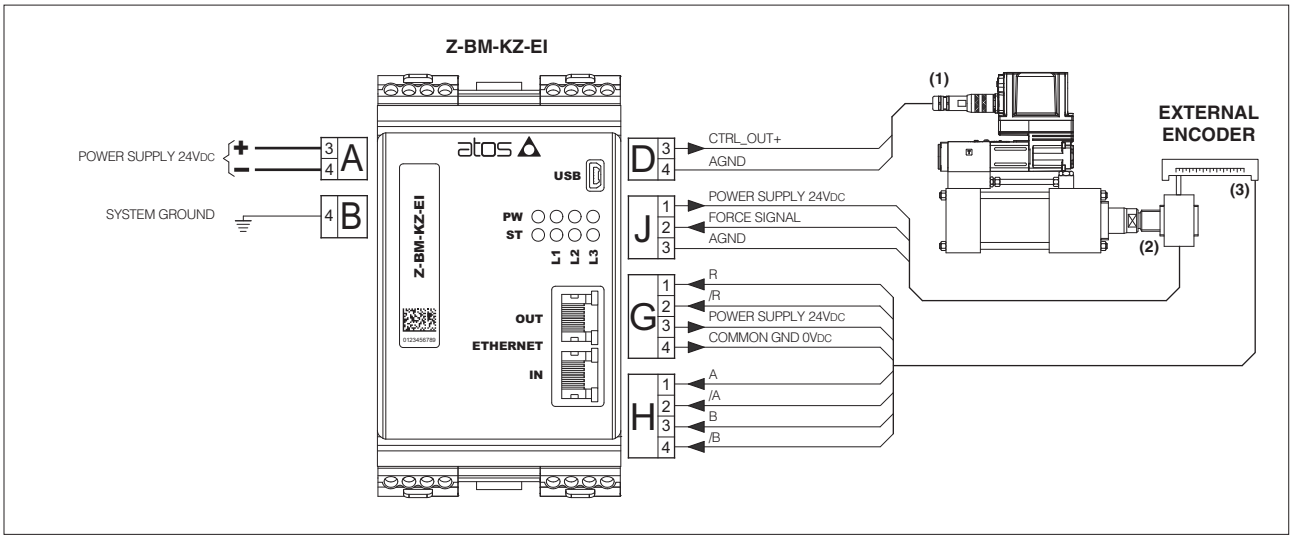
(1) For valve driver electrical connections please refer to the specific technical table
(2) The analog position transducer connections are intended as generic example, for details please consult the transducer datasheet

15.2 Alternated position/force control - CANopen reference - SSI position transducer - 2 analog pressure transducers



(1) For valve driver electrical connections please refer to the specific technical table
(2) Pressure transducers connections are shown with voltage signal output; for connections with current signal output see 8.5
(3) The SSI position transducer connections are intended as generic example, for details please consult the transducer datasheet

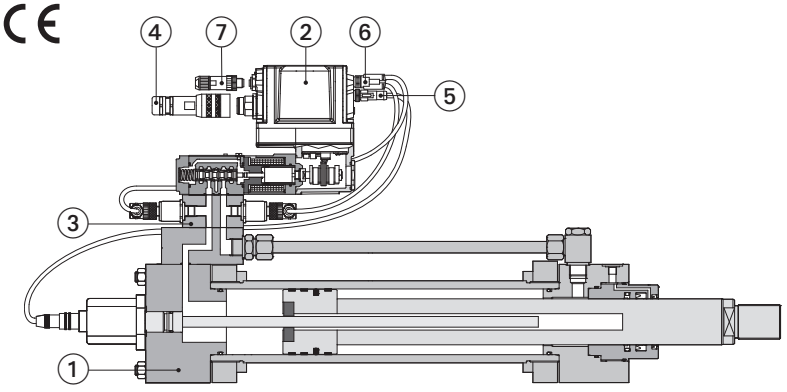
15.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



(1) For valve driver electrical connections please refer to the specific technical table
(2) Load cell connections is shown with voltage signal output; please consult the load cell datasheet for details about connections
(3) The Encoder position transducer connections are intended as generic example, for details please consult the transducer datasheet

Digital electrohydraulic servoactuators

servocylinder plus servoproportional directional with on-board driver & axis card



***** AZC-D-SF-EH/CKM200/100D0500/V040**

① Servocylinder with on-board LVDT transducer
② Servoroportional valve with on-board digital driver + axis card
③ Block with double pressure transducer
④ Main connector
⑤ LVDT transducer connector
⑥ Pressure transducers connector
⑦ Fieldbus connectors

AZC

Digital electrohydraulic servoactuators are stand-alone units performing closed loop position controls.
The complete motion control cycle can be operated by external signals (from machine PLC) or programmed internally to the controller.
Alternate force control added to the basic position one with pressure transducers or load cell factory pre-assembled and wired.
The servoacuators are composed by a servocylinder with position transducer, servoproportional valve with on-board driver plus axis card, factory assembled and tested.
They can be provided with optional fieldbus interfaces for functional parameters setting, reference signals and real time diagnostics.
The USB interface is always present for connection to Atos PC software which allows to easily customize the AZC configuration to the specific application requirements.

1 MODEL CODE

***	AZC	M	-	D	-	SF	-	EH	/	CK	M	200	/	100	D	0500	/	V0	40

******* Design number

AZC Digital electrohydraulic servoactuator for linear axis position control

Cycle Generation type:
- = none
I = injection
M = mold
P = parison
S = synchronism
X = positioning
9 = customized

Position transducer type:
A = analog
D = digital

Alternated P/Q controls:
SN = none
SF = with on-board double pressure transducer
SL = with on-board load cell transducer
XL = with remote load cell transducer

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Servocylinder Type, tech table **B310**:
CN = ISO 6020-1, Pmax 250 bar - tech table **B180**
CK = ISO 6020-2, Pmax 250 bar - tech table **B137**
CH = ISO 6020-3, Pmax 250 bar - tech table **B160**
CC = ISO 6022, Pmax 320bar - tech table **B241**

Cylinder position transducer type, see section 6 :
Analog (only for AZC-A)
P = potentiometer, max stroke 900mm
F = analog magnetosonic, max stroke 2500mm
N = analog magnetostrictive, max stroke 4000mm
T = LVDT, max stroke 16mm
L = LVDT, max stroke 30mm
V = inductive, max stroke 900mm

Digital (only for AZC-D)
M = SSI magnetosonic, max stroke 900mm

Analog or Digital
9 = special
X = remoted

Bore diameter [mm]

Rod diameter [mm]

Rod:
S = single rod
D = double rod

Stroke [mm]

Servoproportional valve size with axis controller:
V0 = direct, size 06
V1 = direct or piloted, size 10
V2 = piloted size 16
V4 = piloted size 25 or size 27

Servoproportional valve configuration, zero spool overlap:
40 = with fail safe, sleeve execution, direct (tech table **FS610**)
60 = without fail safe, sleeve execution, direct (tech table **FS610**) or piloted (tech table **FS630**)
70 = spring central position, direct (tech table **FS620**) or piloted (tech table **FS630**)

2 MAIN CHARACTERISTICS

Assembly position		Any position	
Ambient temperature range		standard execution = -20°C ÷ +60°C	
Storage temperature range		Standard execution = -20°C ÷ +70°C	
Protection degree to EN60529		IP66 / IP67	
Duty factor		Continuous rating (ED=100%)	
Recommended fluid temperature		-20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

Hydraulic fluid	Classification	Ref. Standard
Mineral oils	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	HFDU, HFDR	ISO 12922
Flame resistant with water	HFC	

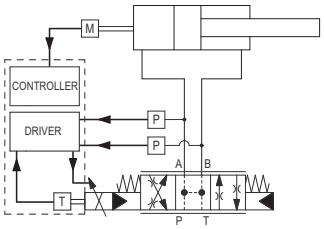
3 AXIS CONTROLLER

Digital servoproportionals direct or pilot operated include valve with on-board digital driver plus axis card to perform the position closed loop of hydraulic actuator. Axis controllers are operated by an external or internally generated reference position signal.
For detailed information about integral axis controller see tech tables **FS610**, **FS620**, **FS630**.

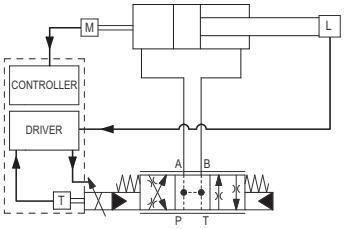
4 ALTERNATED P/Q CONTROLS

SF and **SL** controls add the alternated force closed loop control to the actuator standard position control.
A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
For detailed information about SF, SL controls, see tech table **FS500**.

SF



SL



T valve spool transducer | M actuator position transducer | P pressure transducer | L load cell

5 FIELDBUS

Fieldbus allows the direct communication of the servoactuator with machine control unit for digital reference signal, diagnostics and settings of functional parameters. Analog reference signal remain available on the main connector for quick commissioning and maintenance.
For detailed information about fieldbus features and specification see tech table **GS510**.

6 ACTUATOR TRANSDUCER CHARACTERISTICS

6.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controllers, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).
Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.
Transducers with analog interface grant simple and cost effective solutions.

6.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected force transducer. Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.
The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

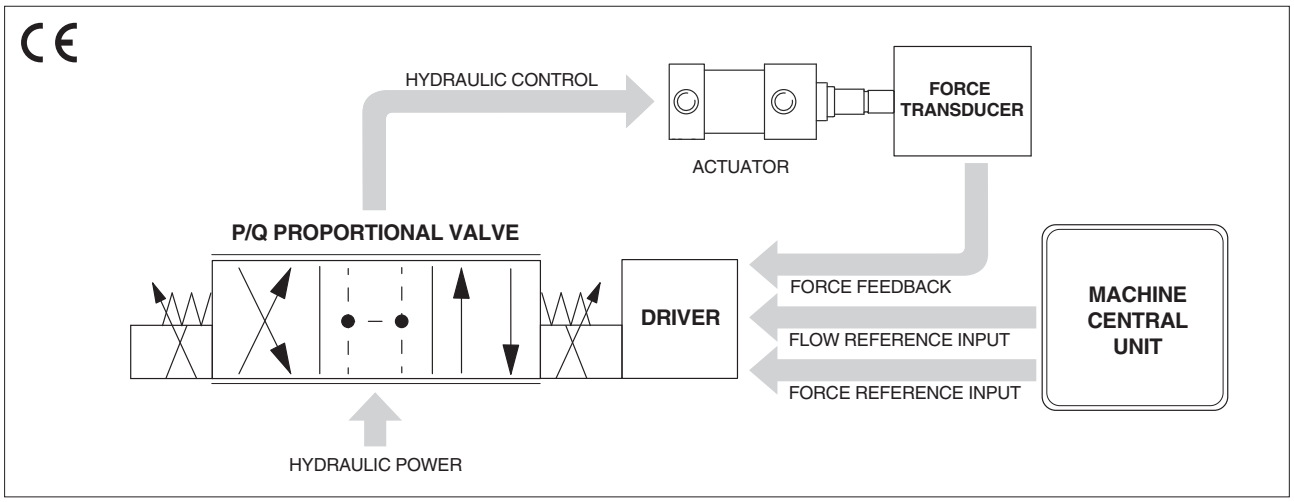
6.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				Pressure/Force
Execution	A		D		SF, SL
Input type	Potentiometer	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	±10 Vdc	+24 Vdc	+5 Vdc / +24 Vdc	+5 Vdc / +24 Vdc	+24 Vdc
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by digital controller **(2)** percentage of total stroke **(3)** Balluff BTL7 with SSI interface is not supported

Digital proportional valves with P/Q control

directional valves with LVDT transducer and on-board driver



1 GENERAL DESCRIPTION

Proportional directional valves with P/Q control are identified by option SP, SF or SL and they are designed to perform the alternated regulation of speed/position/force of hydraulic actuators.
These options add the closed loop control of pressure (for SP) or force (for SF and SL) to the standard direction and flow regulation operated by the servoproportional and high performance proportional directional valves.

Note: for simplification, the following description always refers to the “force control”, even if for the SP option the control is the “pressure”.

The switching from the flow control to the force control is automatically performed by the valve thanks to a sophisticated algorithm.
The advantage offered by this solution is the high accurate and high dynamic control of the machine actuator in terms of direction, speed, position and force, all performed by a single valve.

2 FUNCTIONAL DESCRIPTION

The alternated P/Q control is operated by means of two electronic reference signals sent from the machine central unit to the valve driver: one for flow regulation and one for regulation. The valve driver has to be interfaced to a remote pressure transducer or to a load cell for the measurement and feedback of the actual pressure or force.
The SP option controls the pressure on A user port and it has to be interfaced to a single pressure transducer.
The SF option controls the force by measuring the delta p across A and B user ports and it has to be interfaced to two pressure transducers.
The SL option directly controls the actuator force and it has to be interfaced to a load cell.

See section 4 for configuration examples.

A dedicated algorithm automatically selects which control (flow or force) will be active time by time. The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations.
The flow regulation is active when the actual system force measured by the force transducer is lower than the relevant input reference signal.
The valve normally works to regulate the flow by controlling in closed-loop the spool position through the integral LVDT transducer.
The force control is activated when the actual system force, measured by remote transducers, reaches the setpoint defined by the relevant force reference input signal and meets the regulation requirements defined within the control algorithm.
The flow regulation is consequently reduced to keep steady the closed loop regulation of the force.
If the force decreases below its input reference signal, the flow control returns active.

The dynamic response of the force control can be adapted to different system characteristics, by setting the internal PID parameters using Atos PC software. Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.

3 VALVES RANGE

Options SP, SF, SL are available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ on-board digital driver + axis card.
Valve’s performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

Servoproportionals:
DLHZO-TES, DLKZOR-TES - direct, zero spool overlap, sleeve execution - technical tables **FS180**
DHZO-TES, DKZO-TES - direct, zero spool overlap - technical tables **FS168**
DPZO-LES - piloted, zero spool overlap - technical table **FS178**
LIQZO-LES, LIQZP-LES - 3-way servocartridges - technical table **FS340**

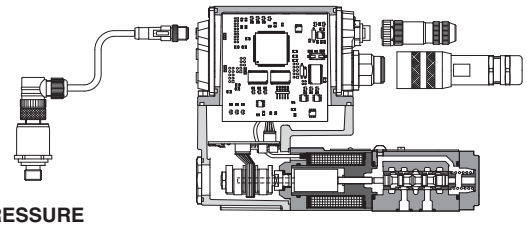
Servoproportionals with TEZ/LEZ on-board digital driver + axis card:

DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap, sleeve execution - technical tables **FS610**
DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables **FS620**
DPZO-LEZ - piloted, zero spool overlap - technical tables **FS630**

High perfomance proportionals:
DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table **FS165**
DPZO-LES - piloted, positive spool overlap - technical table **FS175**

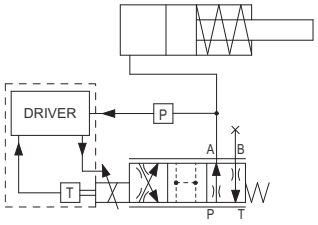
4 SP, SF, SL CONFIGURATION EXAMPLES

SP - Pressure Control - 1 pressure transducer



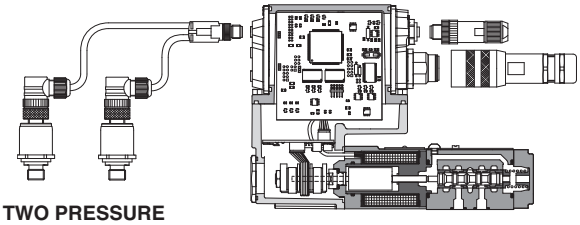
PRESSURE TRANSDUCER

e.g. DLHZO-TES- **SP** -BP PROFIBUS DP



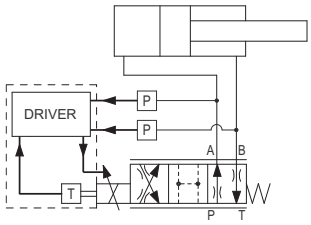
one remote pressure transducer has to be installed on the actuator's port to be controlled.
In this example the SP option regulates the pressure on port A

SF - Force Control - 2 pressure transducers



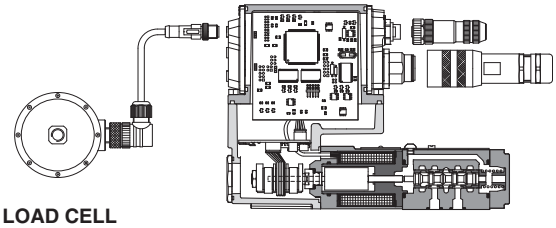
TWO PRESSURE TRANSDUCERS

e.g. DLHZO-TES- **SF** -EH EtherCAT



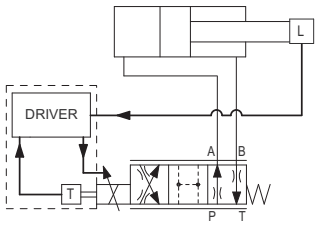
two remote pressure transducers have to be installed on the actuator's ports A and B.
The bore and rod dimensions of the actuator have to be input into the valve software, which calculates the relevant areas:
A1 = bore area; A2 = ring area
The SF option directly controls the actuator force (F) as result of the following calculation:
F = (Pa x A1) - (Pb x A2)

SL - Force Control - 1 load cell



LOAD CELL

e.g. DLHZO-TES- **SL** -EW POWERLINK



one load cell transducer has to be installed between the actuator and the controlled load
The SL option directly control the actuator force

5 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

6 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

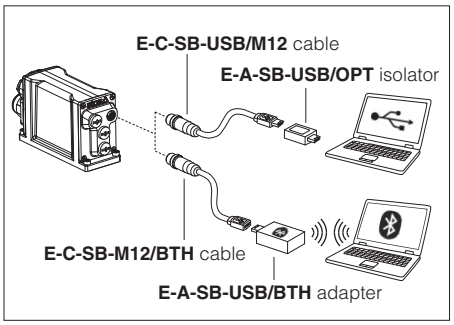
E-SW-BASIC/PQ supports: NP (USB)

E-SW-FIELDBUS/PQ and **Z-SW-FULL** support:

NP (USB)		
BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

7 FUNCTIONAL EXAMPLES

The following functional examples are just generic reference of the possible applications of with proportional directional valves with alternated P/Q control, **SP**, **SF**, **SL**.
Please contact Atos technical department for additional evaluations related to specific applications usage.

7.1 High-dynamic pressure reducing controls - only for **SP**

Directional proportional valves with zero spool overlap and SP control, are operated in 3-way hydraulic configuration to obtain high-dynamic pressure reducing control on the A (or B) user port:

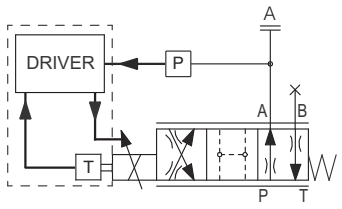
- flow reference signal is used to limit the maximum flow during the pressure regulation
- pressure reference signal is used to regulate the pressure on the valve's A user port; the rapid/repeatable response of the pressure control is performed in high dynamics by the directional valve's closed loop regulation

Requirements:

- an remote pressure transducer has to be installed in the hydraulic system on the controlled user port (when using 4 way valves either A or B port can be used while the not controlled port must be plugged)
- zero overlap valves without fail safe position are recommended;

⚠ Positive overlap valves with PABT ports closed in central position are not suitable for this application

High-dynamic - only for **SP**



3 way connection SP

7.2 Single effect actuators with speed/pressure/force controls - only for **SP** or **SL**

Directional proportional valves with SP or SL control, are operated in 3-way hydraulic configuration to control speed/pressure (force) on single effect actuators:

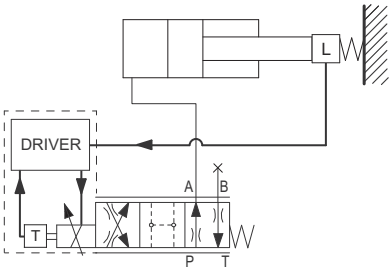
- flow reference signal is used to regulate the actuator's forward and backward speed while pressure (force) reference signal is used to limit the maximum pushing pressure (force) to the actuator
  or
- pressure (force) reference signal is used to regulate the actuator pushing pressure (force) while flow reference signal is used to limit the maximum actuator speed

Requirements:

- for SP control a remote pressure transducer has to be installed in the hydraulic system on the actuator pushing port
- for SL control a remote force transducer has to be installed between the actuator and the controlled load
- zero overlap valves without fail safe position are recommended;

⚠ Positive overlap valves with PABT ports closed in central position are not suitable for this application

Single effect - only for **SP** or **SL**



3 way connection SL

7.3 Double effect actuators with speed/pressure controls - only for **SP**

Directional proportional valves with SP control, regulate speed/pressure on double effect actuators:

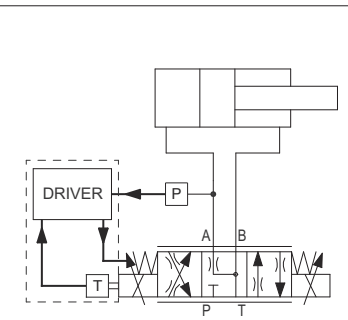
- flow reference signal is used to regulate the actuator's forward and backward speed while pressure reference signal is used to limit the maximum pushing pressure of the actuator
  or
- pressure reference signal is used to regulate the actuator pushing pressure while flow reference signal is used to limit the maximum forward and backward actuator speed

Requirements:

- a remote pressure transducer has to be installed on the actuator's pushing port
- a dedicated Q5 spool with strong "meter-in" characteristic in central position has to be used; during pressure regulation, the not controlled port remains connected to T line to avoid any back pressure - see section 7.4

⚠ Positive overlap valves with PABT ports closed are not suitable for this application

Double effect - only for **SP**



4 way connection SP

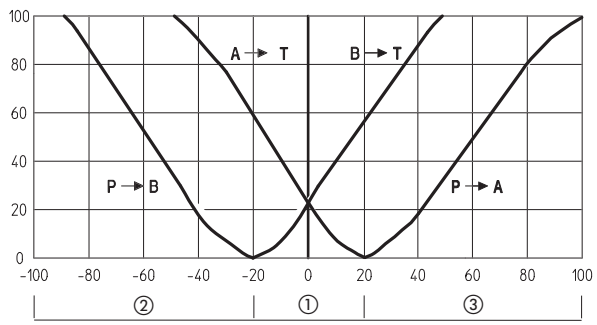
7.4 Q5 spool for 4 way connection with SP control

Spool type **Q5** allows fast direction reverse during motion phases (e.g. ejector motion with max strain limitation)

① depressuring (pressure control active)

② backward movements (flow control active)

③ forward movements (flow or pressure control active)



7.5 Double effect actuators with force limit/regulation - only for **SF** or **SL**

4 way directional proportional valves with SF or SL control, regulate speed/force on double effect actuators:

- flow reference signal is used to regulate the actuator's forward and backward speed while force reference signal is used to limit the maximum pushing and pulling force of the actuator

  or
- force reference signal is used to regulate the actuator pushing and pulling force while flow reference signal is used to limit the maximum actuator speed

Requirements:

- for SF two remote pressure transducers have to be installed on the both actuator's ports
- for SL one push/pull load cell transducer has to be installed between the actuator and the controlled load
- zero overlap valves are recommended;

⚠ positive overlap valves with PABT ports closed in central position are not suitable for this application

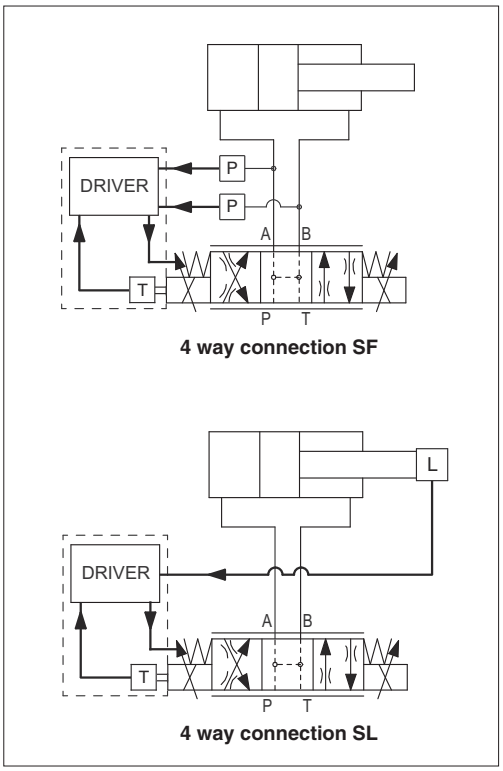
Advantages:

- force control is possible in both push and pull directions
- SL allows a more precise force control despite of a more complex installation of the load cell transducer
- SF allows to add force control also into existing systems thanks to the simple installation of pressure transducers

Control modes:

- Flow priority: flow reference signal is used to move forward and backward the actuator while force is limited/regulated in both push and pull direction
- Force priority: force reference signal is used to control both push and pull forces while flow is limited/regulated in both direction

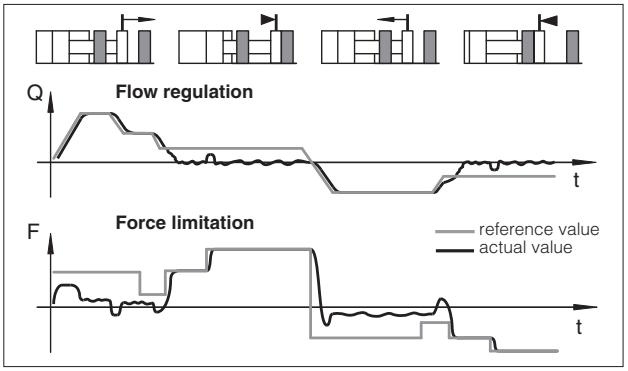
Double effect - only for **SF** or **SL**



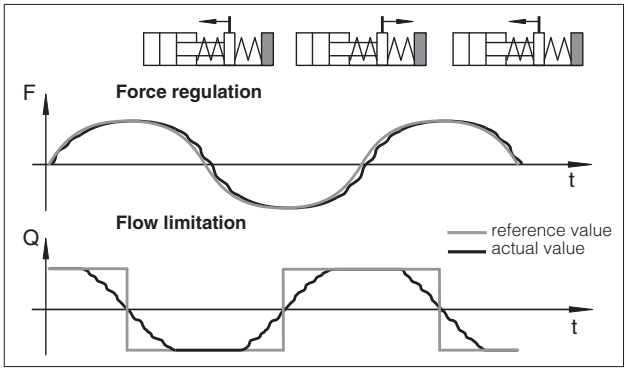
Notes:

auxiliary check valves are recommended to intercept A and B lines in case of specific hydraulic configuration requirements in absence of power supply or fault

7.6 Flow priority



7.7 Force priority



8 PRESSURE/FORCE TRANSDUCER CHARACTERISTICS

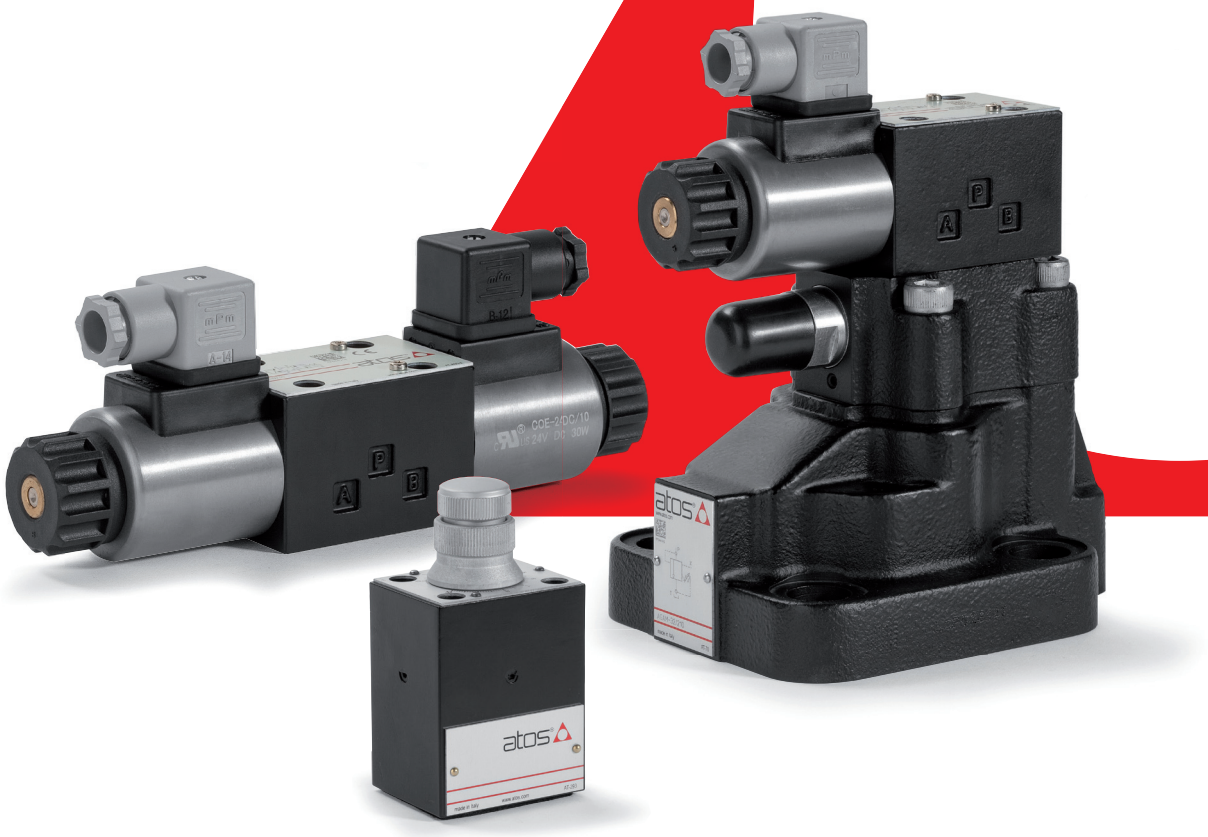
The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducers.

Pressure/force controls require to install remote pressure transducers or load cell to measure the actual pressure/force values:

- **Pressure Transducers:** allow easy system integration and cost effective solution for both pressure and force controls, see tech table **GS465** for E-ATR-8 pressure transducer details
- **Load Cell Transducers:** allow the user to get high accuracy and precise regulations for force control, but it increases the complexity of the mechanical installation

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115÷120 % of the maximum regulated pressure/force.

3 ON-OFF VALVES



INDEX

ON-OFF VALVES

		Size	Qmax [l/min]	Table	Pag
CHECK VALVES					
DB, DR	direct, screw-in cartridge	G1/4" ÷ G1/2	95	C400	631
ADR	direct, in line	G1/4" ÷ G1 1/4"	500	C406	633
ADRL	piloted, in line	G3/8" ÷ G1 1/4"	300	C450	635
AGRL	piloted, subplate	10 ÷ 32	160 ÷ 500		
SAFETY VALVES					
directionals, machine directive 2006/42/EC					
DHI/FV, DHE/FV, DKE/FV DHI/FI, DHE/FI, DKE/FI	direct, spool type, subplate, AC or DC solenoids	06 ÷ 10	60 ÷ 150	EY010	639
HF/FV	direct, spool type, modular, AC or DC solenoids	06	60	EY050	649
JO-DL/FV	piloted, poppet type, leak free screw-in cartridge, DC solenoids	UNF 3/4" ÷ 1 5/16"	40 ÷ 300	EY105	653
DPHI/FV, DPHE/FV	piloted, spool type, subplate, AC or DC solenoids	10 ÷ 25	160 ÷ 700	EY030	657
LIFI, LIDA/FV, LIDAS/FV	piloted, poppet type, ISO cartridge, optional AC or DC solenoids	16 ÷ 50	120 ÷ 1800	EY120	667
pressure relief, PED 2014/68/UE					
CART M/PED CART ARE/PED	direct, screw-in cartridge	G1/2" ÷ M35	2,5 ÷ 150	CY010	675
ARE/PED	direct, in line	G3/8" ÷ G1/2"	60 ÷ 100	CY020	679
ARAM/PED	piloted, in line, optional AC or DC solenoids	G3/4" ÷ G1 1/4"	350 ÷ 500	CY045	683
AGAM/PED	piloted, subplate, optional AC or DC solenoids	10 ÷ 32	200 ÷ 600	CY066	689
MODULAR VALVES					
directionals					
HF	direct, spool type, modular, AC or DC solenoids	06	60	D050	695
pressure					
HMP, HM, KM	relief, direct or piloted, poppet type	06 ÷ 10	35 ÷ 120	D120	699
HS, KS	sequence, direct or piloted, spool type	06 ÷ 10	40 ÷ 80	D130	703
HG, KG, JPG	reducing, direct or piloted, spool type, 3 or 2 way	06 ÷ 25	50 ÷ 300	D140	705
HC, KC, JPC	compensator, direct or piloted, spool type, 2 way	06 ÷ 16	50 ÷ 200	D150	709
flow					
DHQ	direct, pressure compensated, by-pass solenoid valve	06	36	D170	711
HQ, KQ, JPQ	throttle, reverse free flow	06 ÷ 25	80 ÷ 300	D160	713
check					
HR, KR, JPR	direct or piloted	06 ÷ 25	60 ÷ 300	D180	717

NEXT

ISO CARTRIDGES		Size	Qmax [l/min]	Table	Pag
SC LI	2 way, slip-in	16 ÷ 100	270 ÷ 9000	H003	721
directionals					
LIDEW, LIDBH	functional covers, optional AC or DC solenoids	16 ÷ 100	270 ÷ 9000	H030	725
LIDAS, LIDASH	2 way, active piloting, optional AC or DC solenoids	16 ÷ 50	240 ÷ 2100	H050	731
pressure					
LIMM	relief, functional covers, optional AC or DC solenoids	16 ÷ 80	180 ÷ 4900	H010	735
LIRA	reducing, functional covers	16 ÷ 40	140 ÷ 750		
LIC	compensator, functional covers	16 ÷ 80	180 ÷ 4900		
flow					
LIDD	functional covers, throttle with stroke limiter	16 ÷ 63	270 ÷ 4000	H020	741
check					
LIDA	normally closed, functional covers	16 ÷ 100	270 ÷ 9000	H040	745
LIDO	normally open, functional covers	16 ÷ 50	160 ÷ 1800		
LIDB	normally closed, functional covers, shuttle valve	16 ÷ 63	270 ÷ 4000		
LIDR	normally closed, functional covers, check valve	16 ÷ 63	270 ÷ 4000		

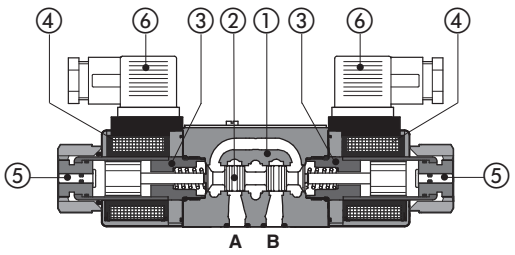
ACCESSORIES			
E-ATR-8	pressure transducer with amplified analog output signal	GS465	813
E-DAP-2	electronic pressure switch with digital output signals and display	GS470	815
MAP	manual pressure switch with fixed differential switching pressure	D250	817
BA	single station subplates, mounting surfaces ISO 4401, 6264 and 5781	K280	819
BA-214, BA-314, BA-244	multi-station subplates, mounting surface ISO 4401	K290	823
BA-214/AL	multi-station subplates, mounting surface ISO 4401, aluminium	K295	827
HAND LEVERS	for on-off and proportional valves	E138	829
HANDWHEELS & KNOBS	for on-off and proportional valves	K150	831
CONNECTORS	for transducers, on-off and proportional valves	K800	833

OPERATING INFORMATION		
Operating and maintenance information for on-off valves	E900	885
Operating and maintenance information for safety PED pressure relief valves	CY900	891

Supplementary components range available on **www.atos.com**

Solenoid directional valves type DHL

direct, spool type, compact execution



DHL-071*-DC

① Valve body
② Spool
③ Solenoid tube
④ Solenoid coil
⑤ Manual override pin
⑥ Electric connector (DIN43650) to be ordered separately

Spool type, 4/3, 4/2, 3/2 way version.
Wet type solenoids made by:
- screwed tube ③, different for AC and DC power supply
- interchangeable coils ④, specific for AC or DC power supply, easily replaceable without tools - see section 6 for available voltages

The valve body ① is 3 chamber type made by shell-moulding casting with wide internal passages ensuring low pressure drops.

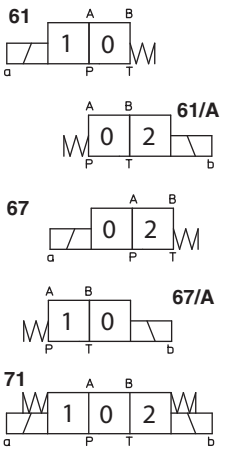
Mounting surface: **ISO 4401 size 06**
Max flow: **60 l/min**
Max pressure: **350 bar**

1 MODEL CODE

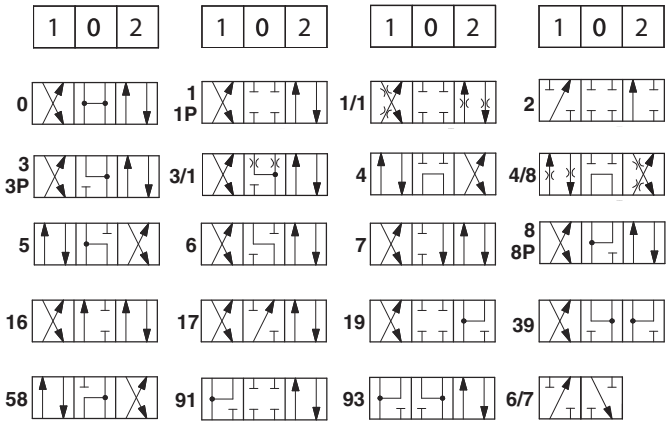
DHL - 0	61	1	/	A	-	X	24 DC	*	/	*
Solenoid directional valves size 06	Valve configuration, see section 2 **61** = single solenoid, center plus external position, spring centered **63** = single solenoid, 2 external positions, spring offset **67** = single solenoid, center plus external position, spring offset **70** = double solenoid, 2 external positions, without springs **71** = double solenoid, 3 positions, spring centered **75** = double solenoid, 2 external positions, with detent	Spool type, see section 2		Options, see section 7		**00-AC** = AC solenoids without coils **00-DC** = DC solenoids without coils **X** = without connector See section 12 for available connectors, to be ordered separately Coils with special connectors, see section 13 **XK** = Deutsch connector	Voltage code, see section 6	Series number		Seals material, see section 14: **-** = NBR **PE** = FKM

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

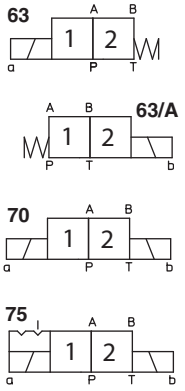
Configurations



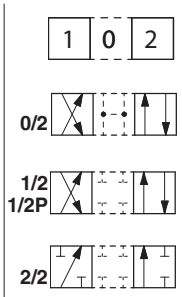
Spools



Configurations



Spools



Note: Spool type **6/7** is available only for configuration 61, not available for version /A
Spool type **3/1** has restricted oil passages in central position, from user ports to tank.
Spools type **1/1** and **4/8** are properly shaped to reduce water-hammer shocks during the swiching.
Spools type **1P, 3P, 8P** and **1/2P** reduced the valve internal leakages

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Operating pressure	Ports P,A,B: **350** bar; Port T **210** bar for DC version; **160** bar for AC version
Max flow	**60 l/min**, see Q/Δp diagram at section 8 and operating limits at section 9

5 ELECTRICAL CHARACTERISTICS

Insulation class	**H** (180°C) for DC coils; **F** (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%

6 COIL VOLTAGE

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil DHL
12 DC	**12 DC**	666 or 667	29W	COL-12DC
14 DC	**14 DC**			COL-14DC
24 DC	**24 DC**			COL-24DC
28 DC	**28 DC**			COL-28DC
110 DC	**110 DC**			COL-110DC
220 DC	**220 DC**			COL-220DC
110/50 AC (1)	**110/50/60 AC**		58VA (3)	COL-110/50/60AC
115/60 AC	**115/60 AC**			COL-115/60AC
230/50 AC (1)	**230/50/60 AC**			COL-230/50/60AC
230/60 AC	**230/60 AC**			COL-230/60AC
110/50 AC - 120/60 AC	**110 DC**	669	29W	COL-110DC
230/50 AC - 230/60 AC	**220 DC**			COL-220DC

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA.

(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

7 OPTIONS

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see section 18

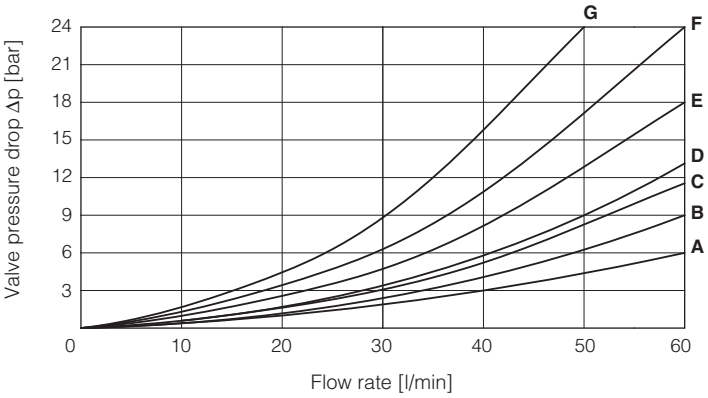
WP = prolonged manual override protected by rubber cap.

WPD/HL = manual override override with detent, to be ordered separatelly, see section 18

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar

8 **Q/ΔP DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0	A	A	C	C	D
1, 1P, 1/1	C	C	C		
3, 3P, 3/1	D	D	A	A	
4, 4/8, 5	F	F	G	C	E
0/2, 1/2, 1/2P	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8, 8P	A	A	E	E	
2, 6/7	D	D			
2/2	F	F			
19, 91	E	E	D	D	
39, 93	F	F	G	G	

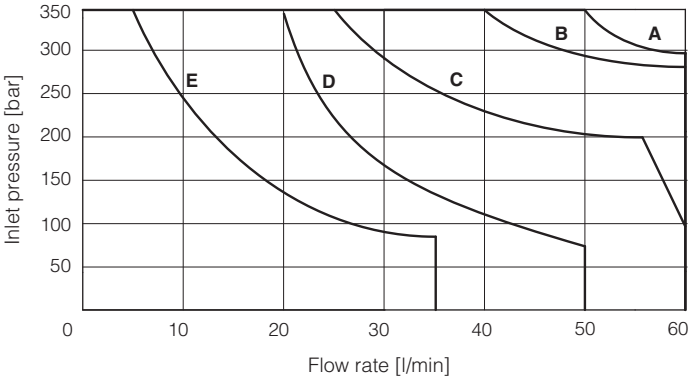


9 **OPERATING LIMITS** based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

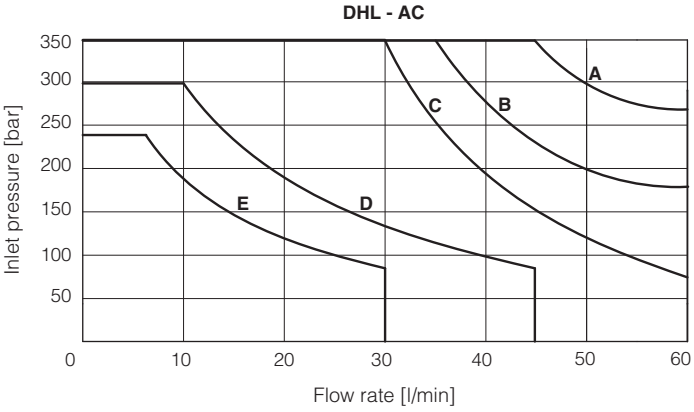
Curve	DC version, spool type:
A	0, 0/2, 1/2, 1/2P, 8, 8P
B	1, 1P, 1/1
C	3, 3P, 3/1, 6, 7
D	4, 4/8, 16, 17, 5, 19, 39, 58, 91, 93
E	2, 2/2, 6/7

DHL - DC



Curve	AC version, spool type:
A	0, 0/2, 1/2, 1/2P, 8, 8P
B	1, 1P, 1/1
C	3, 3P, 3/1, 6, 7
D	4, 16, 17, 4/8, 5, 19, 39, 58, 91, 93
E	2, 2/2, 6/7

DHL - AC



10 **SWITCHING TIMES** (average values in msec)

Test conditions: - 20 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

Valve	Switch-on AC	Switch-off AC	Switch-on DC	Switch-off DC
DHL	10 - 25	20 - 40	30 - 50	15 - 25

11 **SWITCHING FREQUENCY**

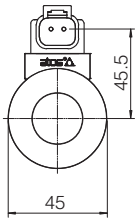
Valve	AC (cycles/h)	DC (cycles/h)
DHL + 666 / 667	7200	15000

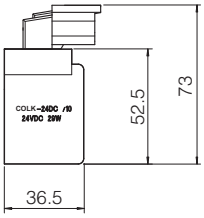
12 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

13 COILS WITH SPECIAL CONNECTORS only for voltage supply **12, 14, 24, 28** VDC

Deutsch connector DT-04-2P





Options -XK

Coil type COLK, Deutsch connector DT-04-2P male
Protection degree **IP67**

Note: For the electric characteristics refer to standard coils features - see section 6

14 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, reccomended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

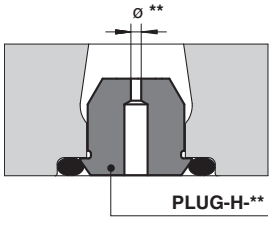
15 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary is case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.

PLUG-H	-	**	A

08, 10, 12, 15 calibrated orifice diameter in tenths of mm
Example PLUG-H-**12** = orifice diameter **1,2 mm**
Other orifice dimensions are available on request

Short calibrated orifice



PLUG-H-**

16 FASTENING BOLTS AND SEALS

Fastening bolts	**Seals**
4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm	4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)

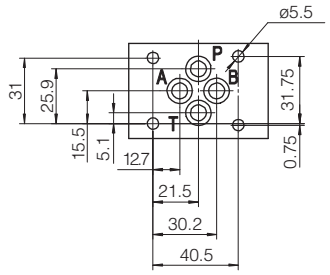
17 DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

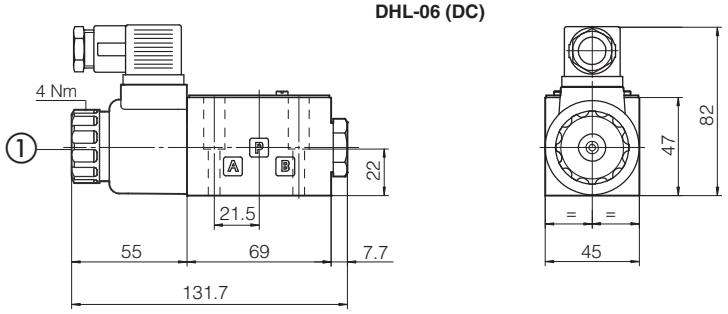
Mass (Kg)		
	DC	AC
DHL-06	1,3	1,2
DHL-07	1,6	1,4

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

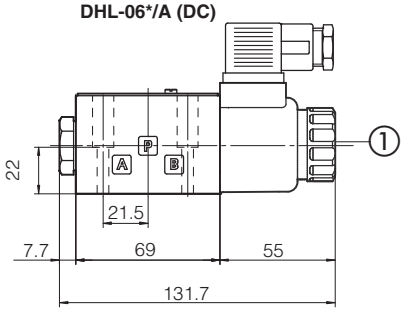
Valve's bottom view



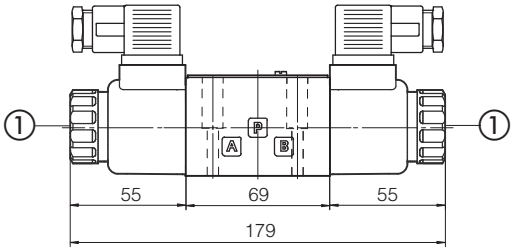
DHL-06 (DC)



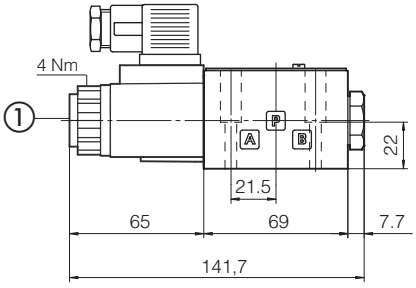
DHL-06*/A (DC)

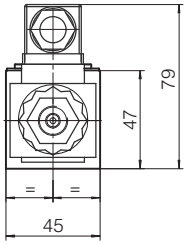


DHL-07 (DC)

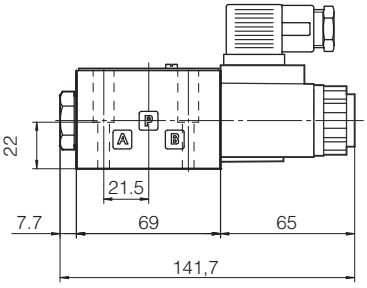


DHL-06 (AC)

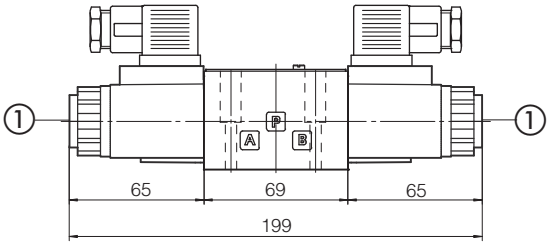




DHL-06*/A (AC)



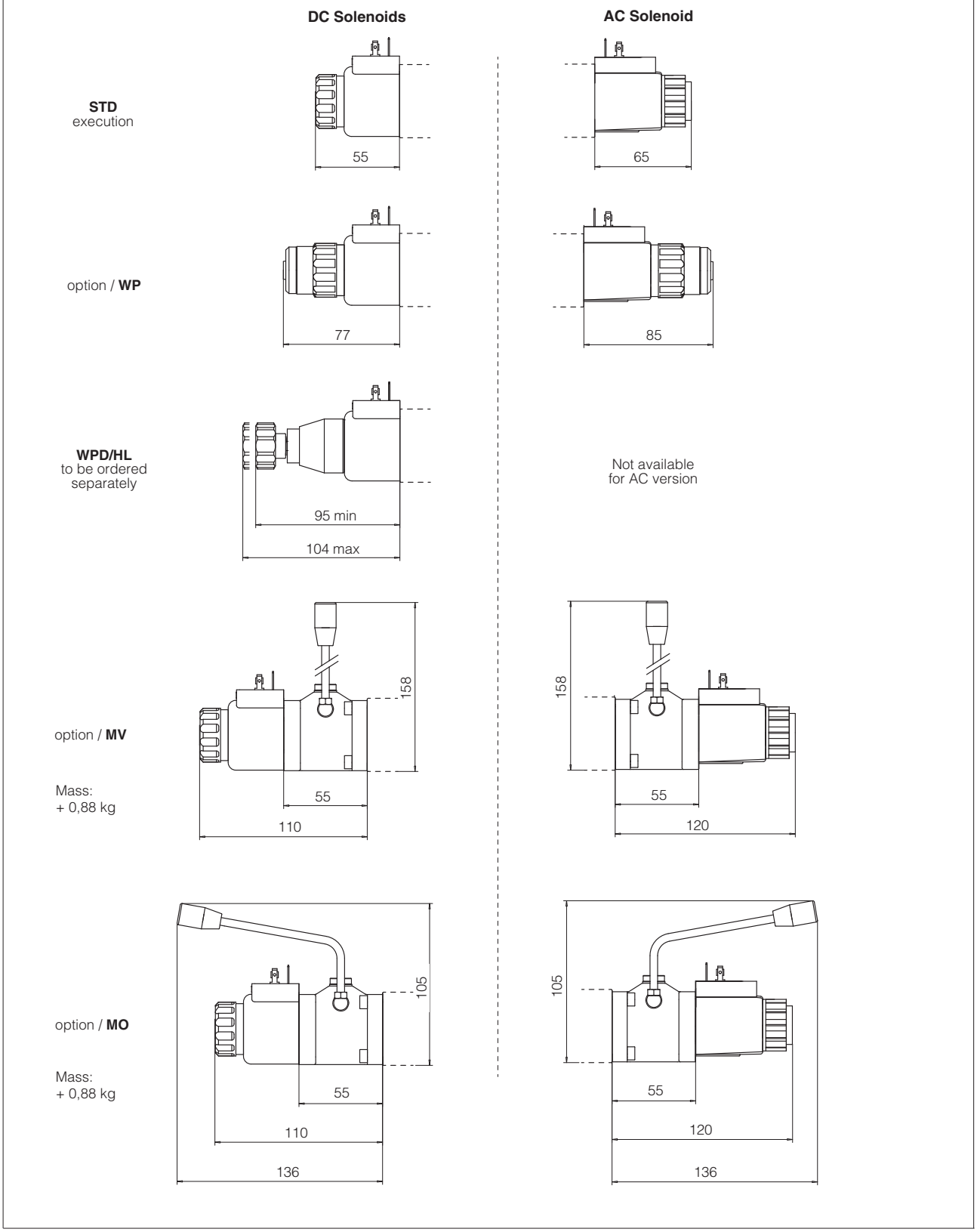
DHL-07 (AC)



① Standard manual override PIN

⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

18 MANUAL OVERRIDE

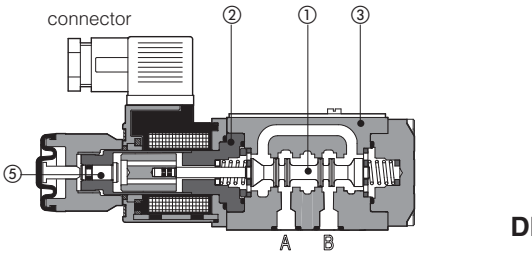


19 RELATED DOCUMENTATION

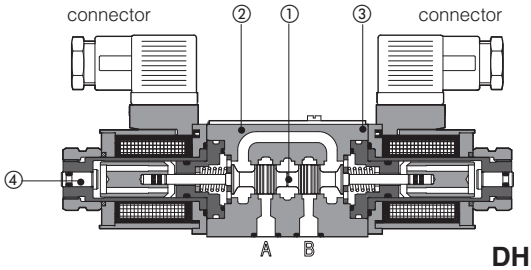
E001	Basics for solenoid directional valves
K150	Handwheels for hydraulic controls
K280	Single and modular subplates
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
E900	Operating and maintenance information

Solenoid directional valves type DHI

direct, spool type



DHI-063*/WP



DHI-071*

Spool type, two or three position, direct operated valves with solenoids certified according the North American standard **cURus**.
Solenoids ② are made by:
- wet type flanged tube, same for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section 5 for available voltages

Standard coils protection **IP65**, optional coils with IP67 AMP Junior Timer, XK Deutsch or Lead Wire connections.
Wide range of interchangeable spools ①, see section 2
The valve body ③ is 3 chamber type made by shell-moulding casting with wide internal passages.

Mounting surface: **ISO 4401 size 06**
Max flow: **60 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHI - 0	61	1	/	A	-	X	24 DC	*	/	*

DHI - 0: Directional control valves size 06

61: Valve configuration, see section 2
- **61** = single solenoid, center plus external position, spring centered
- **63** = single solenoid, 2 external positions, spring offset
- **67** = single solenoid, center plus external position, spring offset
- **70** = double solenoid, 2 external positions, without springs
- **71** = double solenoid, 3 positions, spring centered
- **75** = double solenoid, 2 external positions, with detent
- **77** = double solenoid, center plus external position, without springs

1: Spool type, see section 2

A: Options, see note 1 at section 4

X: Seals material, see section 3:
- **-** = NBR
- **PE** = FKM
- **BT** = HNBR

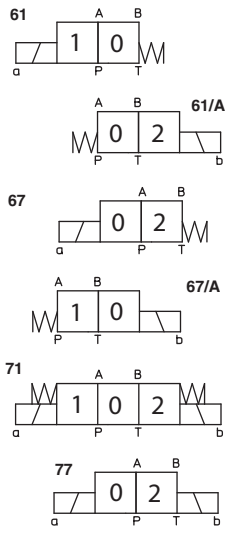
*****: Series number

24 DC: Voltage code, see section 5
- **00** = valve without coils
- **X** = without connector

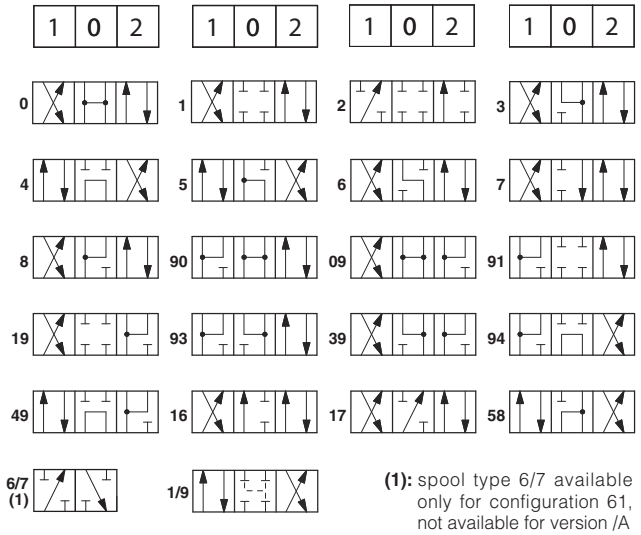
See section 13 for available connectors, to be ordered separately
Coils with special connectors, see section 10
- **XJ** = AMP Junior Timer connector
- **XK** = Deutsch connector
- **XS** = Lead Wire connection

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

Configurations

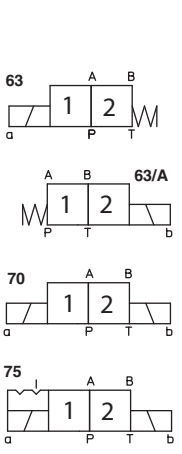


Spools

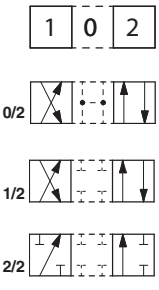


(1): spool type 6/7 available only for configuration 61, not available for version /A

Configurations



Spools



Note: see also section 4, note 3, for special shaped spools

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type - 70 and 77 (without springs) that must be installed with horizontal axis if operated by impulses		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Storage temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +80°C		
Surface protection	Body: zinc coating with black passivation Coil: plastic incapsulation		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: **350** bar; Port T **120** bar		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	**60 l/min**, see operating limits at section 7		

3.1 Coils characteristics

Insulation class	**H** (180°C) Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 6
Supply voltage tolerance	± 10%
Certification	**cURus**

4 NOTES

1 Options

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.

WP = prolonged manual override protected by rubber cap - see section 11.

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see table E138.

2 Accessories

WPD/H = manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1.** They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 3, 8** and 1/2 are available as **1P, 3P, 8P** and **1/2P** to limit valve internal leakages.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- Other types of spools can be supplied on request.

5 ELECTRIC FEATURES

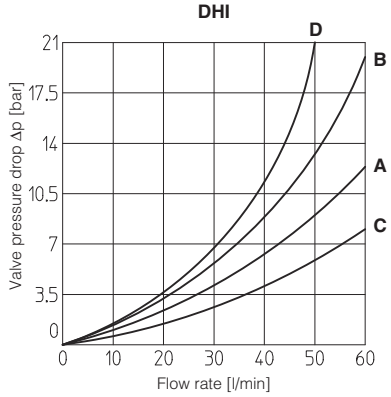
External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil DHI	Colour of coil label
6 DC	**6 DC**	666 or 667	33 W	COU-6DC/ 80	brown
9 DC	**9 DC**			COU-9DC /80	light blue
12 DC	**12 DC**			COU-12DC /80	green
14 DC	**14 DC**			COU-14DC /80	brown
18 DC	**18 DC**			COU-18DC /80	blue
24 DC	**24 DC**			COU-24DC /80	red
28 DC	**28 DC**			COU-28DC /80	silver
48 DC	**48 DC**			COU-48DC /80	silver
110 DC	**110 DC**			COU-110DC /80	black
125 DC	**125 DC**			COU-125DC /80	silver
220 DC	**220 DC**			COU-220DC /80	black
24/50 AC 24/60 AC	**24/50/60 AC**		60 VA (3)	COI-24/50/60AC /80 (1)	pink
48/50 AC 48/60 AC	**48/50/60 AC**			COI-48/50/60AC /80 (1)	white
110/50 AC 120/60 AC	**110/50/60 AC** **120/60 AC**			COI-110/50/60AC /80 (1) COI-120/60AC /80	yellow white
230/50 AC 230/60 AC	**230/50/60 AC** **230/60 AC**			COI-230/50/60AC /80 (1) COI-230/60AC /80	light blue silver
110/50 AC 120/60 AC	**110RC**	669	33 W	COU-110RC /80	gold
230/50 AC 230/60 AC	**230RC**			COU-230RC /80	blue

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA
(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1	C	C	C	C	
0/2, 1, 1/1, 1/2	A	A	A	A	
2, 3, 3/1	A	A	C	C	
2/2, 4, 4/8, 5, 5/1, 58, 58/1, 94	D	D	D	D	A
6, 7, 16, 17	A	A	C	A	
8	C	C	B	B	
9, 19, 90, 91	B	B	A	A	
1/9, 39, 93	D	D	D	D	

DHI



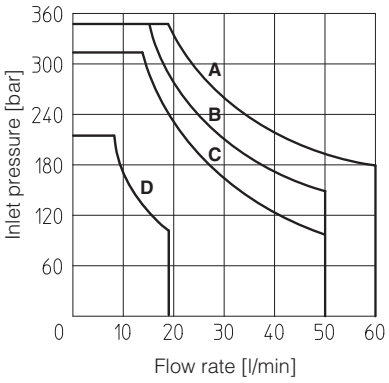
7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

DHI

Curve	Spool type
A	0, 1, 1/2, 8
B	0/1, 0/2, 1/1, 1/9, 3, 3/1
C	4, 4/8, 5, 5/1, 6, 7, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	2, 2/2

DHI



8 SWITCHING TIMES (average values in msec)

Valve	Switch-on AC	Switch-on DC	Switch-off
DHI + 666 / 667	30	45	20
DHI + 669	45	—	80
DHI + E-SD	30	45	50

Test conditions:

- 36 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C.

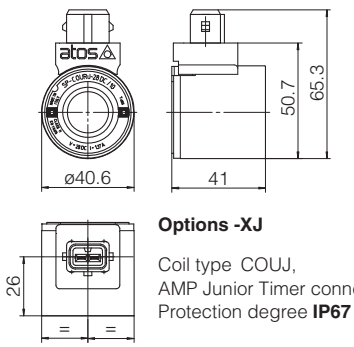
The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

9 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHI + 666 / 667	7200	15000

10 COILS WITH SPECIAL CONNECTORS only for voltage supply **12, 14, 24, 28** VDC

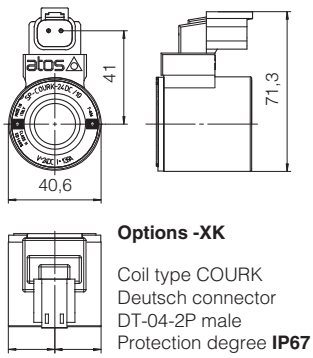
AMP Junior timer connector



Options -XJ

Coil type COUJ,
AMP Junior Timer connector
Protection degree **IP67**

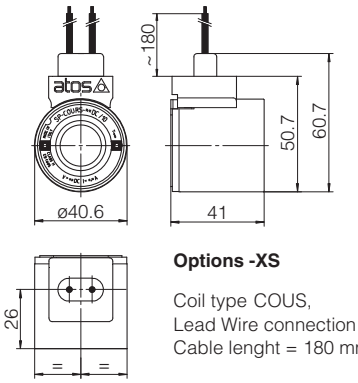
Deutsch connector DT-04-2P



Options -XK

Coil type COURK
Deutsch connector
DT-04-2P male
Protection degree **IP67**

Lead Wire connection



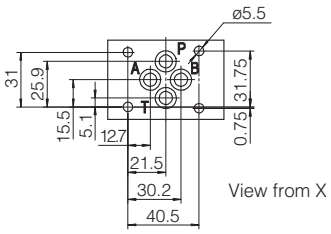
Options -XS

Coil type COUS,
Lead Wire connection
Cable lenght = 180 mm

Note: For the electric characteristics refer to standard coils features - see section 5

11 DIMENSIONS [mm]

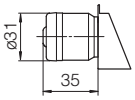
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).



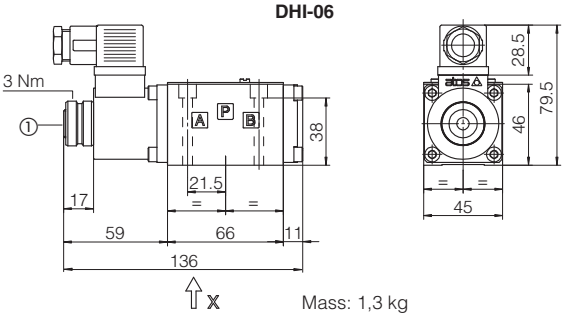
View from X

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

OPTION /WP

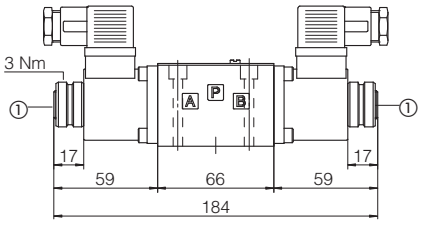


DHI-06



Mass: 1,3 kg

DHI-07



Mass: 1,6 kg

① Standard manual override PIN
⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

Overall dimensions refer to valves with connectors type 666

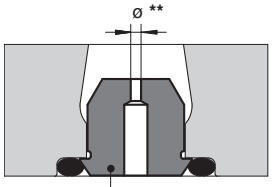
12 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary is case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.

PLUG-H	-	**	A

08, 10, 12, 15 calibrated orifice diameter in tenths of mm
Example PLUG-H-**12** = orifice diameter **1,2 mm**
Other orifice dimensions are available on request

Short calibrated orifice



PLUG-H-**

13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

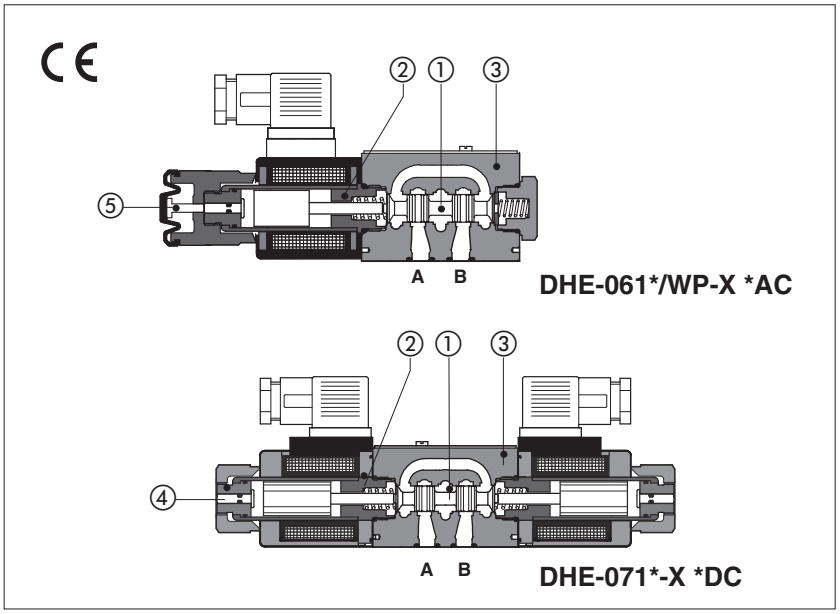
14 MOUNTING SUBPLATES

Model	Ports location	GAS Ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [kg]
BA-202	Ports A, B, P, T underneath;	3/8"	–	1,2
BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
BA-302	Ports A, B, P, T underneath	1/2"	30	1,8

The subplates are supplied with 4 fastening bolts M5x50. Also available are multi-station subplates and modular subplates. For further details see table K280.

Solenoid directional valves type DHE

direct, spool type, high flow



Spool type, two or three position direct operated valves with high performance threaded solenoids certified according the North American standard **cURus**.

Solenoids ② are made by:

- wet type screwed tube, different for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section 5 for available voltages

Standard coils protection **IP65** optional coils with IP67 AMP Junior Timer or lead wire connections.

Wide range of interchangeable spools ①, see section 2.

The valve body ③ is 3 chamber type made by shell-moulding casting with wide internal passages.

Mounting surface: **ISO 4401 size 06**
Max flow: **80 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHE - 0	61	1	/	A	-	X	24 DC	*	/	*

DHE - 0: Directional control valves size 06

61: Valve configuration, see section 2
61 = single solenoid, center plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, center plus external position, spring offset
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent

1: Spool type, see section 2.

A: Options, see note 1 at section 4.

X: **00-AC** = AC solenoids without coils
00-DC = DC solenoids without coils
X = without connector
See section 14 for available connectors, to be ordered separately
Coils with special connectors, see section 11
XJ = AMP Junior Timer connector
XK = Deutsch connector
XS = Lead Wire connection

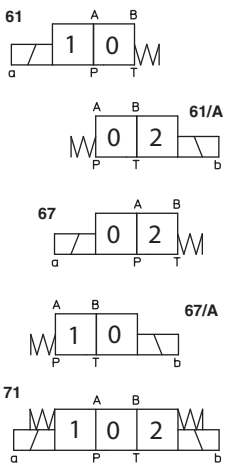
24 DC: Voltage code, see section 5

*****: Series number

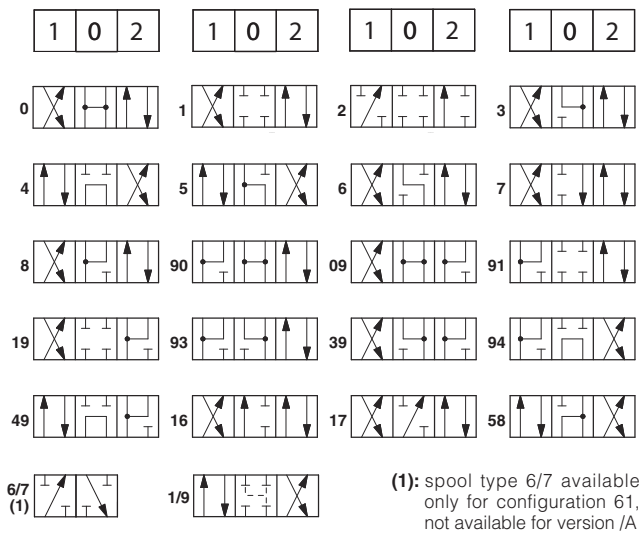
*****: Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

Configurations

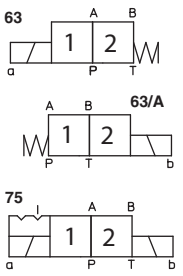


Spools

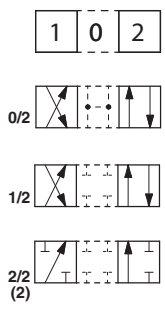


(1): spool type 6/7 available only for configuration 61, not available for version /A

Configurations



Spools



(2): not available for configuration 75

Note: see also section 4, note 3, for special shaped spools

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Storage temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +80°C		
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: **350** bar; Port T **210** bar for DC version; **160** bar for AC version		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	**80 l/min**, see operating limits at section 7		

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils **F** (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

4 NOTES

1 Options

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.

WP = prolonged manual override protected by rubber cap.

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar - see section 12.

L1, L2, L3 = (only for DHE-DC) device for switching time control, installed in the valve solenoid, see section 9.
For spools 4 and 4/8 only device L3 is available.

FI, FV = with proximity or inductive position switch for monitoring spool position: see tab. E110.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see table E138.

2 Accessories

WPD/HE-DC = (only for DHE-DC) manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4**, **5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1.** They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 1/2, 3, 8** are available as **1P, 1/2P, 3P, 8P** to limit valve internal leakages.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- Other types of spools can be supplied on request.

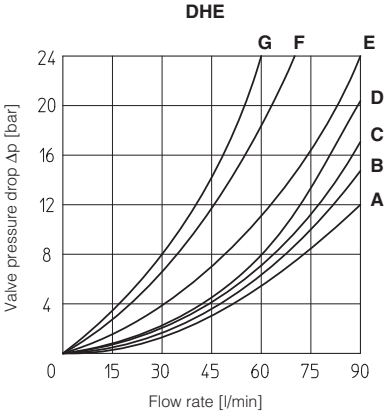
5 ELECTRIC FEATURES

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil DHE
12 DC	**12 DC**	666 or 667	30 W	COE-12DC
14 DC	**14 DC**			COE-14DC
24 DC	**24 DC**			COE-24DC
28 DC	**28 DC**			COE-28DC
48 DC	**48 DC**			COE-48DC
110 DC	**110 DC**			COE-110DC
125 DC	**125 DC**			COE-125DC
220 DC	**220 DC**			COE-220DC
110/50 AC	**110/50/60 AC**		58 VA (3)	COE-110/50/60AC (1)
230/50 AC	**230/50/60 AC**			COE-230/50/60AC (1)
115/60 AC	**115/60 AC**		80 VA (3)	COE-115/60AC
230/60 AC	**230/60 AC**			COE-230/60AC
110/50 AC - 120/60 AC	**110 RC**	669	30 W	COE-110RC
230/50 AC - 230/60 AC	**230 RC**			COE-230RC

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.
(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

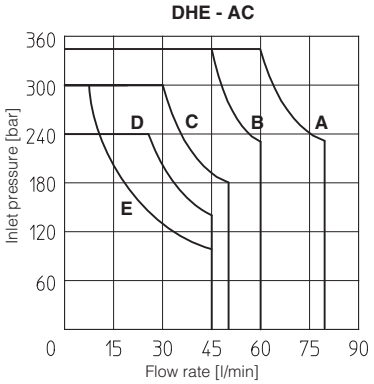
Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0, 0/1	A	A	C	C	D
1, 1/1	D	C	C	C	
3, 3/1	D	D	A	A	
4, 4/8, 5, 5/1, 49, 58, 58/1, 94	F	F	G	C	E
1/2, 0/2	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8	A	A	E	E	
2	D	D			
2/2	F	F			
09, 19, 90, 91	E	E	D	D	
1/9, 39, 93	F	F	G	G	

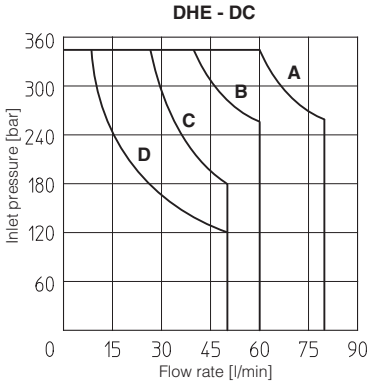


7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

Curve	Spool type AC	Spool type DC
A	1, 1/2, 8	0, 0/1, 1, 1/2, 3, 8
B	0, 0/1, 0/2, 1/1, 1/9, 3	0/2, 1/1, 6, 7, 1/9, 19
C	3, 3/1, 6, 7	3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	4, 4/8, 5, 5/1, 16, 17, 19, 39, 58, 58/1, 09, 90, 91, 93, 94	2, 2/2
E	2, 2/2	-





8 SWITCHING TIMES (average values in msec)

Test conditions: - 36 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C

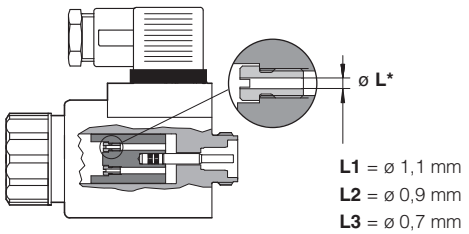
The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

Valve	Switch-on AC	Switch-off AC	Switch-on DC	Switch-off DC
DHE	10 - 25	20 - 40	30 - 50	15 - 25
DHE-*/L1	—	—	60	60
DHE-*/L2	—	—	80	80
DHE-*/L3	—	—	150	150

9 DEVICES FOR THE SWITCHING TIME CONTROL

These devices are used to control the valve's switching time (only for DC version) and therefore reduce the hammering shocks in the hydraulic circuit.

Options L1, L2, L3 control the switching time in both moving directions of the valve spool by means of calibrated restrictors installed in the solenoid anchor.



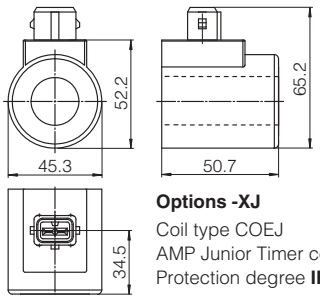
L1 = ø 1,1 mm
L2 = ø 0,9 mm
L3 = ø 0,7 mm

10 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHE + 666 / 667	7200	15000

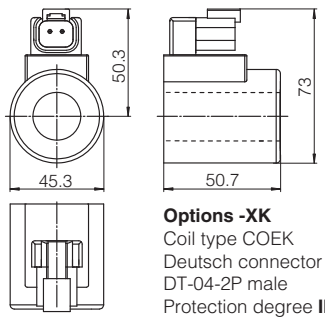
11 COIL WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 VDC

AMP Junior timer connector



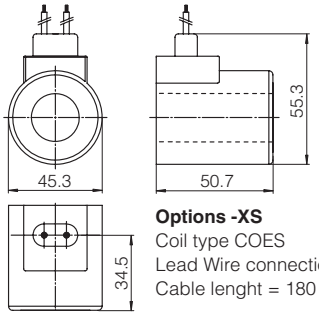
Options -XJ
Coil type COEJ
AMP Junior Timer connector
Protection degree **IP67**

Deutsch connector DT-04-2P



Options -XK
Coil type COEK
Deutsch connector
DT-04-2P male
Protection degree **IP67**

Lead Wire connection

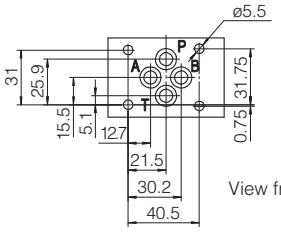


Options -XS
Coil type COES
Lead Wire connection
Cable lenght = 180 mm

Note: for the electric characteristics refer to standard coils features - see section 5

12 DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5x30 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

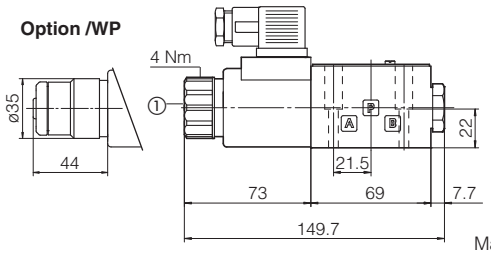


View from X

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

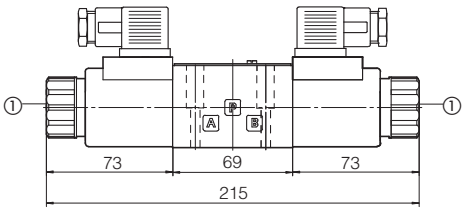
DHE-06(DC)

Option /WP



Mass: 1,5 kg

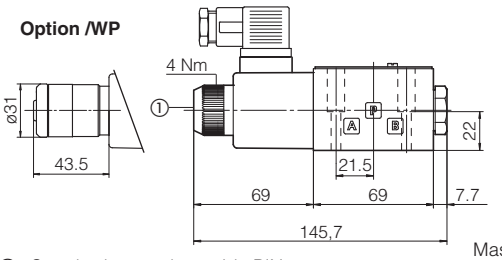
DHE-07(DC)



Mass: 2 kg

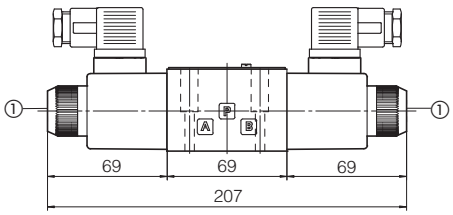
DHE-06(AC)

Option /WP



Mass: 1,4 kg

DHE-07(AC)



Mass: 1,8 kg

① Standard manual override PIN

⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

Overall dimensions refer to valves with connector 666

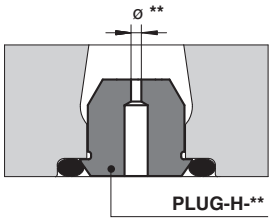
13 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary is case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.

PLUG-H	-	**	A

08, 10, 12, 15 calibrated orifice diameter in tenths of mm
Example PLUG-H-**12** = orifice diameter **1,2 mm**
Other orifice dimensions are available on request

Short calibrated orifice



PLUG-H-**

14 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

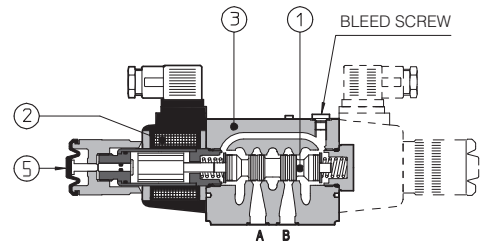
15 MOUNTING SUBPLATES

Model	Ports location	GAS Ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [kg]
BA-202	Ports A, B, P, T underneath;	3/8"	–	1,2
BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
BA-302	Ports A, B, P, T underneath	1/2"	30	1,8

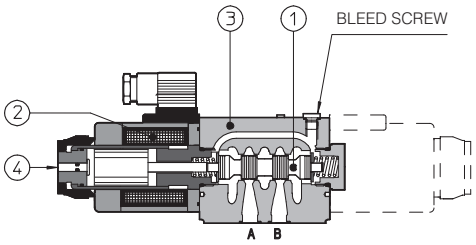
The subplates are supplied with 4 fastening bolts M5x50. Also available are multi-station subplates and modular subplates. For further details see table K280.

Solenoid directional valves type DKE

direct, spool type



DKE-161*/WP-X *AC (3 CHAMBERS BODY)



DKE-17*-X *DC (5 CHAMBERS BODY)

Spool type, two or three position direct operated valves with threaded solenoids certified according the North American standard **cURus**.

Solenoids ② are made by:

- wet type screwed tube, different for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section 5 for available voltages

Standard coils protection **IP65**, optional coils with IP67 AMP Junior Timer or lead wire connections.

The valve body ③ is 5 chamber type for all DC versions and for AC safety version /FI and FV

Standard AC version uses 3 chamber type body

Wide range of interchangeable spools ①, see section 2.

The body is made by shell-moulding casting with wide internal passages ensuring low pressure drops

Mounting surface: **ISO 4401 size 10**
Max flow: **150 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DKE - 1	61	1	/	A	-	X	24 DC	*	/	*

Directional control valves size 10

Valve configuration, see section 2
61 = single solenoid, center plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, center plus external position, spring offset
70 = double solenoid, 2 external positions, without springs
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent

Spool type, see section 2.

Options, see note 1 at section 4.

Series number

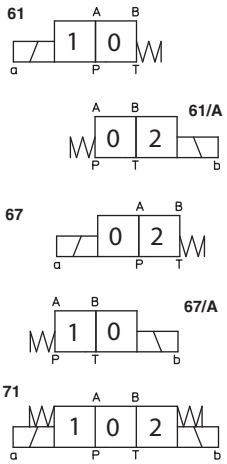
Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

Voltage code, see section 5

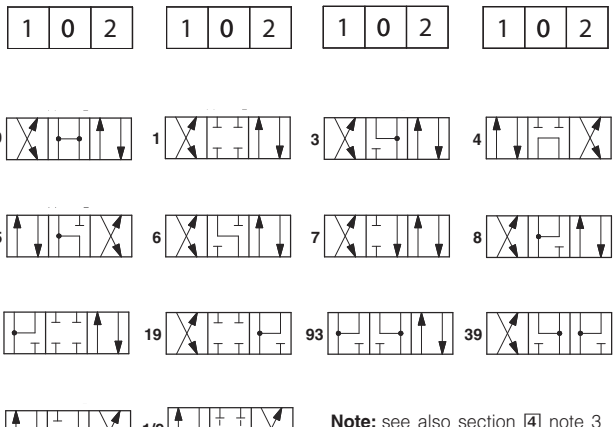
00-AC = AC solenoids without coils
00-DC = DC solenoids without coils
X = without connector
See section 14 for available connectors, to be ordered separately
Coils with special connectors, see section 11
XJ = AMP Junior Timer connector
XK = Deutsch connector
XS = Lead Wire connection

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

Configurations

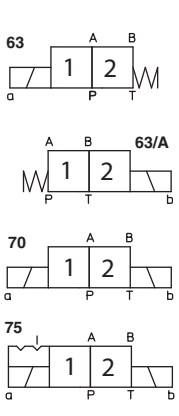


Spools

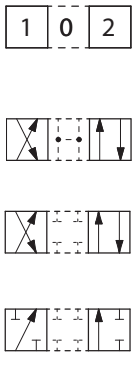


Note: see also section 4 note 3 for special shaped spools

Configurations



Spools



3 MAIN CHARACTERISTCS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type - 170* (without springs) that must be installed with horizontal axis if operated by impulses		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Storage temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +80°C		
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: **350** bar; Port T **210** bar for DC version (**250** bar with option /Y); **160** bar for AC version		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	**150 l/min**, see operating limits at section 7		

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils **F** (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

4 NOTES

1 Options

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.
WP = prolonged manual override protected by rubber cap - see section 12.
L, L1, L2, L3, LR, L7, L8 see section 10 = device for switching time control (only for DC solenoids).
L7 and L8 are available only for spool type 0/1, 1/1, 3/1, 4 and 5.
FI, FV = 5 chambers body for DC and AC versions with proximity switch for spool position monitoring: see tab. E110.
Y = external drain, only for DC version, to be selected if the pressure at T port is higher than the max allowed limits.

2 Accessories

WPD/KE-DC = (only for DC supply) manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spool type **1** is also available as **1/1**, properly shaped to reduce the water-hammer shocks during the switching.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.

5 ELECTRIC FEATURES

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil
12 DC	**12 DC**	666 or 667	36 W	CAE-12DC
14 DC	**14 DC**			CAE-14DC
24 DC	**24 DC**			CAE-24DC
28 DC	**28 DC**			CAE-28DC
110 DC	**110 DC**			CAE-110DC
125 DC	**125 DC**			CAE-125 DC
220 DC	**220 DC**			CAE-220DC
110/50/60 AC	**110/50/60 AC**		100 VA (3)	CAE-110/50/60AC (1)
230/50/60 AC	**230/50/60 AC**			CAE-230/50/60AC (1)
115/60 AC	**115/60 AC**		130 VA (3)	CAE-115/60AC
230/60 AC	**230/60 AC**			CAE-230/60AC
110/50/60 AC	**110 DC**	669	36 W	CAE-110DC
230/50/60 AC	**220 DC**			CAE-220DC

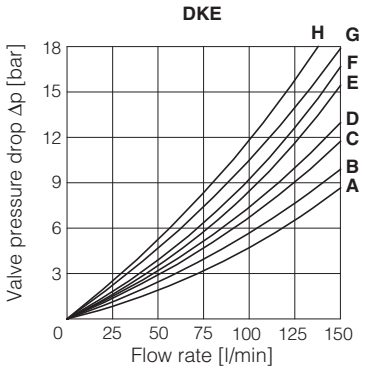
(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 90 VA

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

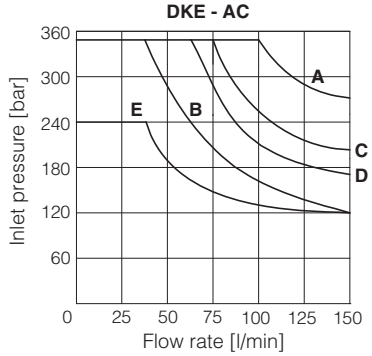
6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

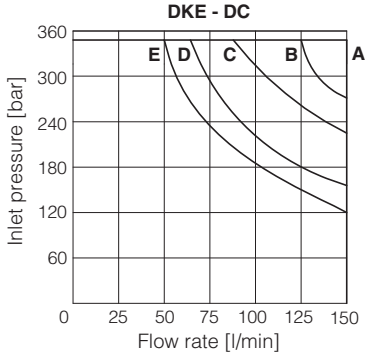
Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T	B→A
0, 0/1, 0/2, 2/2	A	A	B	B		
1, 1/1, 6, 8	A	A	D	C		
3, 3/1, 7	A	A	C	D		
4	B	B	B	B	F	
5, 58	A	B	C	C	G	
1/2	B	C	C	B		
19, 91	F	F	G	G		H
1/9, 39, 93	F	F	G	G		H

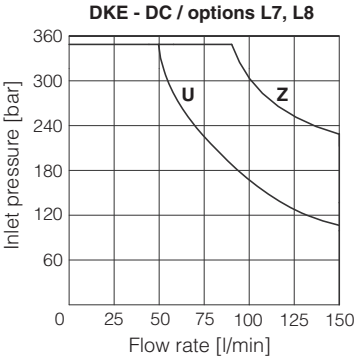


7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.







Curve	Spool type AC	Spool type DC
A	0/1	0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8
B	4, 5, 19, 91	6, 7
C	0, 1/1, 3, 3/1	19, 91
D	1, 1/2, 0/2	4, 5
E	6, 7, 8, 2/2	2/2
U	-	4, 5
Z	-	0/1, 1/1, 3/1

8 SWITCHING TIMES (average values in msec)

Valve	Switch-on AC	Switch-on DC	Switch-off AC	Switch-off DC
DKE + 666 / 667	40	60	25	35
DKE + 669	60	—	90	—
DKE-*/L*	—	75÷150	—	45÷150
DKE-*/L7 - DKE-*/L8	—	100÷150	—	100÷150

Test conditions:
- 50 l/min; 150 bar
- nominal supply voltage
- 2 bar of back pressure on port T
- mineral oil ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

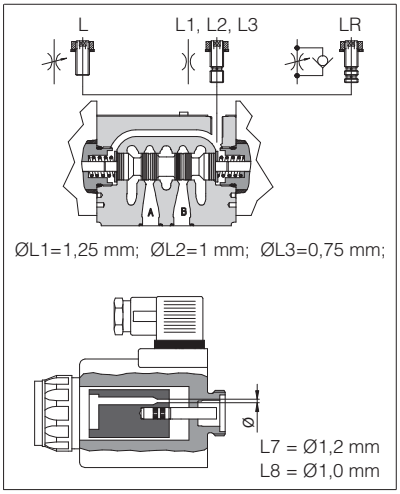
9 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DKE + 666 / 667	7200	15000

10 DEVICES FOR SWITCHING TIME CONTROL

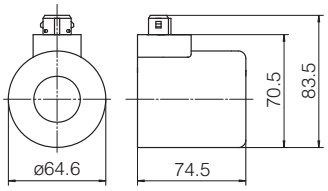
These devices are only available for DC valve version (5 chambers body) and can control the switching time and therefore reduce the coil hammering in the hydraulic circuit. The different types are available shown in the figure.
- **L**: controls and regulates the switching time in both moving directions of the spool: regulation is carried out by screwing/unscrewing the element itself (regulating choke);
- **L1/L2/L3**: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (gauged flow). The restrictor is positioned in the valve's body ØL1 = 1,25 mm; ØL2 = 1 mm; ØL3 = 0,75 mm;
- **LR**: controls and regulates the switching time in the B→A direction of the spool movement. The device does not control the switching time (standard time) in the opposite direction A→B of the spool movement.
- **L7/L8**: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (gauged flow). The restrictor is installed in the solenoid's anchor.

For a correct operation of the switching time control, the passage in which the control device is installed must be completely filled with oil.

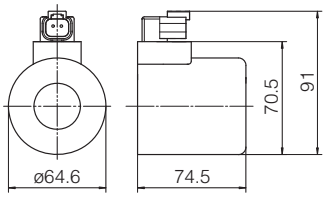


11 COILS TYPE CAE WITH SPECIAL CONNECTORS (only for 12DC, 14DC, 24DC and 28DC)

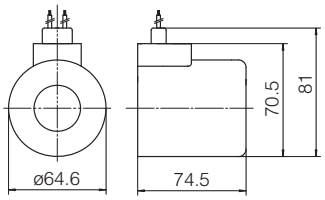
Options -XJ
Coil type CAEJ
AMP Junior Timer connector
Protection degree IP67



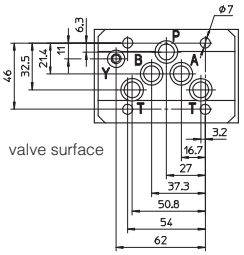
Options -XK
Coil type CAEK
Deutsch connector, DT-04-2P male
Protection degree IP67



Options -XS
Coil type CAES
Lead Wire connection
Cable lenght = 180 mm



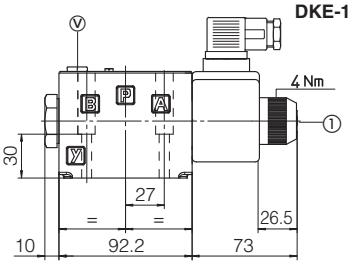
12 INSTALLATION DIMENSIONS [mm]

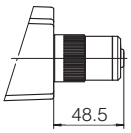


ISO 4401: 2005
Mounting surface according to 4401-05-05-0-05
(without X port, Y port optional)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050 and 1 OR 108
Ports P,A,B,T: Ø = 11.5 mm (max)
Ports Y: Ø = 5 mm

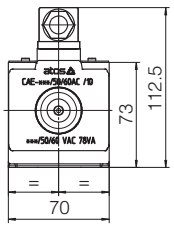
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
Y = DRAIN PORT (only for option /Y)
For the max pressures on ports, see section 3

DKE-16*-AC



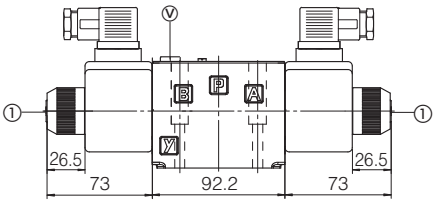


Option /WP



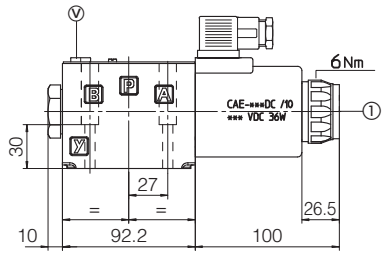
Mass: 3,9 kg

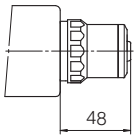
DKE-17*-AC



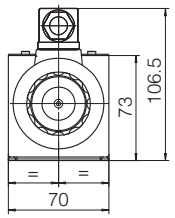
Mass: 4,7 kg

DKE-16*-DC



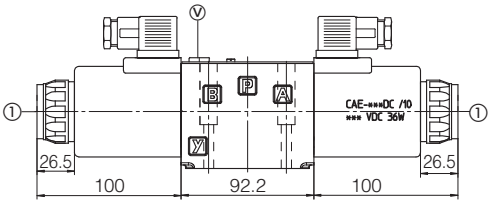


Option /WP



Mass: 4,5 kg

DKE-17*-DC



Mass: 6,1 kg

① Standard manual override PIN. The manual override operation can be possible only if the pressure at T ports is lower than 50 bar
Ⓥ Bleed screw

13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

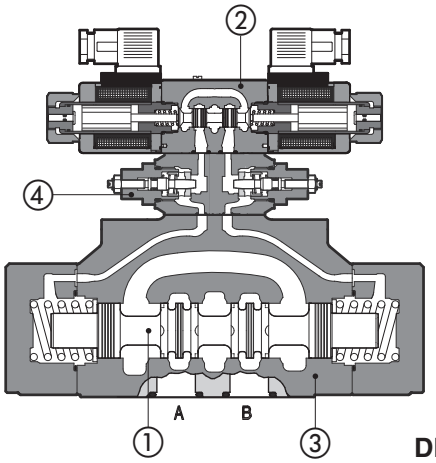
14 MOUNTING SUBPLATES

Model		Ports location	GAS Ports A-B-P-T (X-Y)	Ø Counterbore [mm] A-B-P-T (X-Y)	Mass [kg]
BA-308	(/Y)	Ports A, B, P, T (X, Y) underneath	1/2" (1/4")	30 (21,5)	2,5
BA-428	(/Y)	Ports A, B, P, T (X, Y) underneath	3/4" (1/4")	36,5 (21,5)	5,5
BA-434	(/Y)	Ports P, T, (X, Y) underneath; ports A, B on lateral side	3/4" (1/4")	36,5 (21,5)	8,5

The subplates are supplied with 4 fastening bolts M6x40. Also available are multi-station subplates and modular subplates.
For further details see table K280.

Solenoid directional valves type DPHI and DPHE

piloted, spool type



DPHE-471*/H

Spool type, two stage directional valves with solenoids certified according to North American standard **cURus**, available in two different executions:

- DPHI for AC and DC supply, solenoid pilot ② type DHI, see tech. table E010
- DPHE high performances, for AC and DC supply, solenoid pilot ② type DHE see tech. table E015

Single and double solenoids versions are available in two or three position configurations and with a wide range of interchangeable spools ①, see section 2.
Standard coils protection **IP65**.
The valve body is made by shell-moulding casting ③ with wide internal passages.
The valves can be supplied with optional devices, see section 4 for available options.

Mounting surface: **ISO 4401, size 10, 16, 25 and 32**
Max flow: **160, 300, 700, 1000 l/min.**
Max pressure: **350 bar**

1 MODEL CODE

DPH	E	-	2	61	1	/	A	-	X	24 DC	*	/	*

DPH — Two stage directional control valve

Solenoid pilot valve:
I = DHI for AC and DC supply with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

Valve size:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Valve configuration, see section 2
61= single solenoid, center plus external position, spring centered
63= single solenoid, 2 external positions, spring offset
67= single solenoid, center plus external position, spring offset
70= double solenoid, 2 external positions, without springs
71= double solenoid, 3 positions, spring centered
75= double solenoid, 2 external positions, with detent

Spool type, see section 2.

Options, see note 1 at section 4

X = without connector
See section 14 for available connectors, to be ordered separately
00 = solenoid valve without coils (for DPHI)
00-AC = AC solenoid valve without coils (for DPHE)
00-DC = DC solenoid valve without coils (for DPHE)

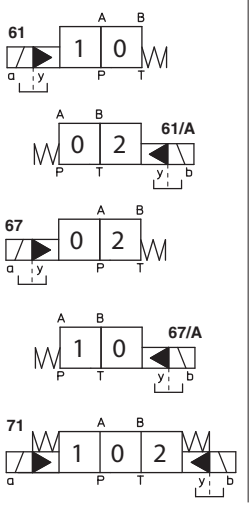
Voltage code, see section 5

Series number

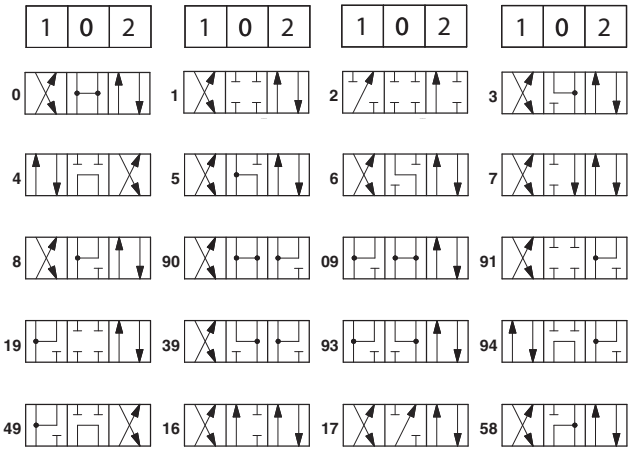
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1, for functional scheme, see section 4)

Configurations

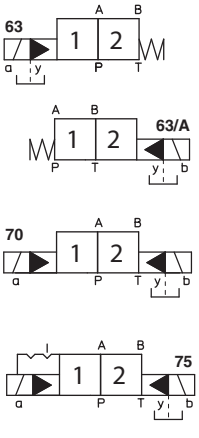


Spools

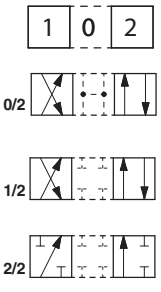


NOTES (see also section 4,2 for special shaped spools):
- For **DP*-1** are available only spools: **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- For **DP*-6** are available only spools: **0, 1, 1/2, 2, 3, 4, 5, 58, 6, 7, 8, 19, 91**

Configurations



Spools



3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

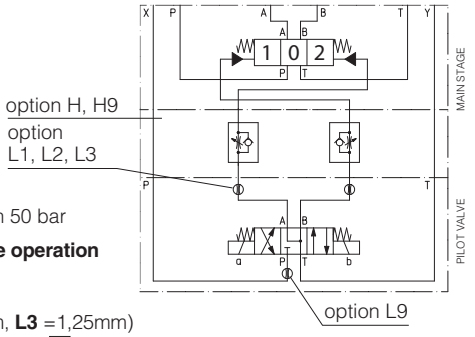
Assembly position / location	Any position for all valves except for type -*70 (without springs) that must be installed with horizontal axis if operated by impulses.		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007		
Ambient temperature	**Standard** = -30°C ÷ +70°C	**/PE** option = -20°C ÷ +70°C	**/BT** option = -40°C ÷ +70°C
Storage temperature	**Standard** = -30°C ÷ +80°C	**/PE** option = -20°C ÷ +80°C	**/BT** option = -40°C ÷ +80°C
Surface protection	Body: zinc coating with black passivation		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	P, A, B, X = **350 bar** (for pilot pressure see also option /L9 at section 4) T = **250 bar** for external drain (standard) T and Y with internal drain (option /D) = **120 bar** DPHI; **210 bar** DPHE (DC); **160 bar** DPHE (AC) Ports Y and L (if required): 0 bar Minimum pilot pressure for correct operation is 8 bar		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	DPH*-1: **160 l/min;** DPH*-2: **300 l/min;** DPH*-4: **700 l/min;** DPH*-6: **1000 l/min** (see rated flow at section 6 and operating limits at section 7)		

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils (all versions) and AC coils (only DPHI) **F** (155°C) for AC coils (only DPHE) Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	**cURus** North American standard

4 NOTES

FUNCTIONAL SCHEME (config. 71)
example of switching control options



4.1 Options

/A = Solenoid mounted at side of port A of main body (only for single solenoid valves).
In standard version, solenoid is mounted at side of port B.
/D = Internal drain (standard configuration is external drain)
/E = External pilot pressure (standard configuration is internal pilot pressure).
/FV = With proximity switch for spool position monitoring: see tab. E110.
/R = Pilot pressure generator (4 bar on port P - not for DPH*-1, see section 9.
/S = Main spool stroke adjustment (not for DPH*-1).
/WP = Prolonged manual override protected by rubber cap.

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar

Devices for main spool switching control and to reduce the hydraulic shocks at the valve operation
/H = Adjustable chokes (meter-out to the pilot chambers of the main valve).
/H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve).
/L1, /L2, /L3 = calibrated restrictors on A and B ports of the pilot valve: **L1** =0,8mm, **L2** =1mm, **L3** =1,25mm)
/L9 = (only for DP-2 and DP-4) plug with calibrated restictor in P port of pilot valve - see section 10
Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

4.2 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5, 58, 6** and **7** are also available as **1/1, 4/8, 5/1, 58/1, 6/1** and **7/1** that are properly shaped to reduce water-hammer shocks during the switching (to use with option /L*).

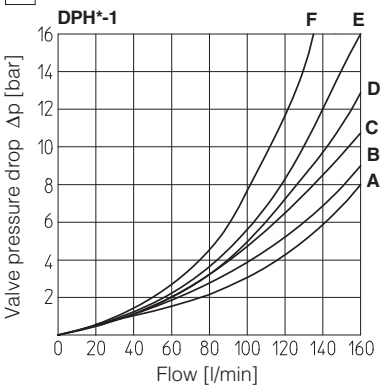
Shaped spool availability	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPH*-1	•	•		•				
DPH*-2, DPH*-4	•	•	•	•	•	•	•	•
DPH*-6		•	•	•				

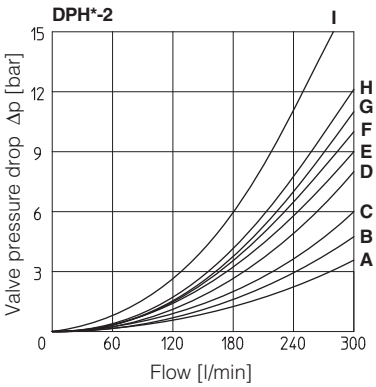
5 ELECTRIC FEATURES

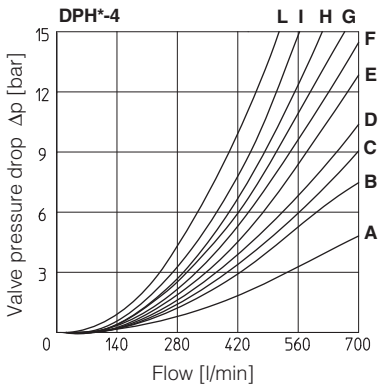
Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)** DHI	Power consumption **(3)** DHE	Code of spare coil DPHI	Colour of coil label DPHI	Code of spare coil DPHE
DPHI DPHE	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC 24/60 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	48/50 AC 48/60 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC 120/60 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	230/50 AC 230/60 AC	**230RC**				COU-230RC	blue	COE-230RC

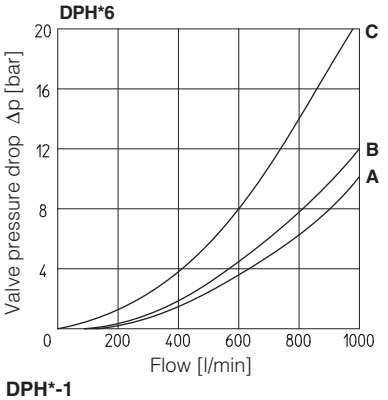
(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DPHI) and 58 VA (DPHE)
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(4) Only for DPHI
(5) Only for DPHE

6 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C









DPH*-1

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	C	-
0	D	E	C	C	E
1	A	B	D	C	-
3, 6, 7	A	B	C	C	-
4, 4/8	B	C	D	D	-
5, 58	A	E	C	C	F

DPH*-6

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0	A	A	B	B	B
1	A	A	A	B	-
3	A	-	A	B	-
4	A	A	C	C	C

DPH*-2

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1, 3, 6, 7, 8	A	A	C	D	-
1/1, 1/2, 7/1	B	B	D	E	-
0	A	A	D	E	C
0/1	A	A	D	-	-
2	A	A	-	-	-
2/2	B	B	-	-	-
3/1	A	A	D	D	-
4	C	C	H	I	F
4/8	C	C	G	I	F
5	A	B	F	H	G
5/1	A	B	D	F	-
6/1	B	B	C	E	-
09	A	-	-	G	-
16	A	C	D	F	-
17	C	A	E	F	-
19	C	-	-	G	-
39	C	-	-	H	-
49	-	D	-	-	-
58	B	A	F	H	H
58/1	B	A	D	F	-
90	A	A	E	-	D
91	C	C	E	-	-
93	-	C	D	-	-
94	D	-	-	-	-

DPH*-4

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
1	B	B	B	D	-
1/1	D	E	E	F	-
1/2	E	D	B	C	-
0	D	C	D	E	F
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-
0/2	D	D	D	E	-
2	B	B	-	-	-
2/2	E	D	-	-	-
3	B	B	D	F	-
4	C	C	H	L	L
5	A	D	D	D	H
6/1	D	E	D	F	-
7/1	D	E	F	F	-
8	D	D	E	F	-
09	D	-	-	F	F
16	C	D	E	F	-
17	E	D	E	F	-
19	F	-	-	E	-
39	G	F	-	F	-
58	E	A	B	F	H
58/1	E	D	D	F	-
90	D	D	D	-	F
91	F	F	D		
93	-	G	D	-	-

7 OPERATING LIMITS

For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPH*-1

Spool	Inlet pressure [bar]			
	70	160	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7	160	160	160	145
4, 4/8	160	160	135	100
5, 58	160	160	145	110
0/1, 0/2, 1/2	160	160	145	135

DPH*-2

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7, 8	300	300	300	300
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1, 0/2, 1/2	300	250	210	180
16, 17, 56, *9, 9*	300	300	270	200

DPH*-4

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 6, 7, 8	700	700	700	600
2, 4, 4/8	500	500	450	400
5, 0/1, 0/2, 1/2	600	520	400	300
0, 3	700	700	600	540
16, 17, 58, *9, 9*	500	500	500	450

DPH*6

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 3, 6, 7, 8	1000	950	850	700
0	950	900	800	650
2, 4, 4/8, 5	850	800	700	450
0/1, 58, 19, 91	950	850	650	450

8 SWITCHING TIMES (average values in m sec)

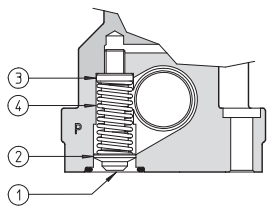
Valve model	Configuration		Piloting pressure 70 bar		140 bar		250 bar	
			Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
DPH*-1	71, 61, 67, 61*/A, 67*/A	Switch ON	35	50	30	45	20	35
		Switch OFF	50					
	63, 63*/A	Switch ON	50	75	40	65	30	50
		Switch OFF	80					
DPH*-2	71, 61, 67, 61*/A, 67*/A	Switch ON	40	55	30	50	20	40
		Switch OFF	60					
	63, 63*/A	Switch ON	55	80	45	70	35	55
		Switch OFF	95					
DPH*-4	71, 61, 67, 61*/A, 67*/A	Switch ON	60	80	45	60	30	45
		Switch OFF	80					
	63, 63*/A	Switch ON	95	115	75	95	50	65
		Switch OFF	130					
DPH*-6	71, 61, 67, 61*/A, 67*/A	Switch ON	70	95	55	70	40	55
		Switch OFF	150					
	63, 63*/A	Switch ON	115	145	95	110	70	90
		Switch OFF	280					

Notes:

1) For configuration 75, times of switching ON and switching OFF are the same: this value is equal to time of switch ON of configuration 63.
2) TEST CONDITIONS
   - Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;
   - 2 bar of counter pressure on port T;
   - mineral oil: ISO VG 46 at 50°C
3) The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature.

9 PILOT PRESSURE GENERATOR (OPTION /R)

The device **/R** generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0, 0/1, 4, 4/8, 5, 58, 09, 90, 94, 49.** The device **/R** has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.

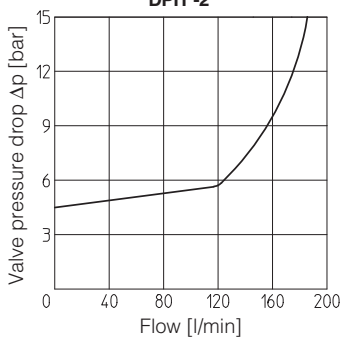


① Flapper-guide
② Flapper
③ Spring stop-washer
④ Spring

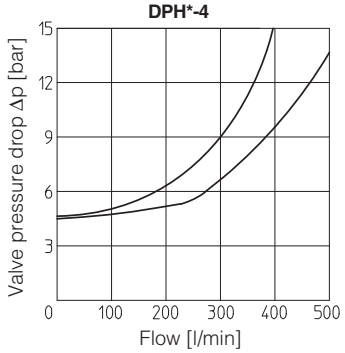
Ordering code of spare pilot pressure generator

R/DP	-	*
Pilot pressure generator		Size: **2** for DP-2 **4** for DP-4 **6** for DP-6

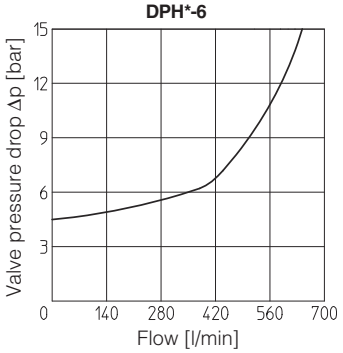
DPH*-2



DPH*-4



DPH*-6

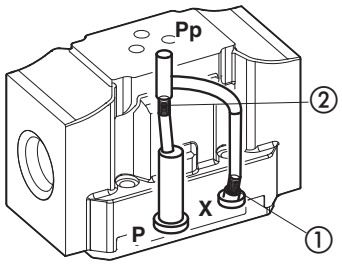


10 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

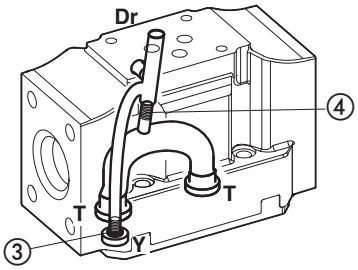
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPH*-1

Pilot channels



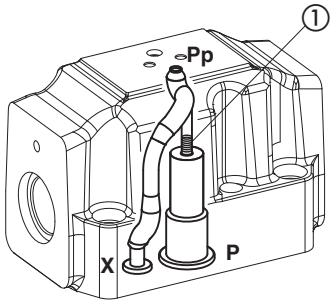
Drain channels



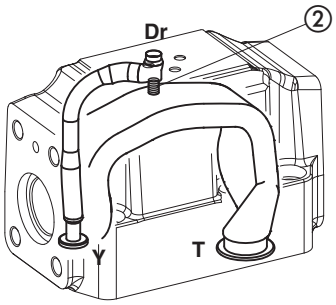
Internal piloting: blinded plug SP-X300F ① in X;
plug SP-X310F ② in Pp;
External piloting: blinded plug SP-X300F ② in Pp;
plug SP-X310F ① in X;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPH*-2

Pilot channels

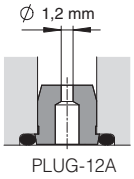


Drain channels



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

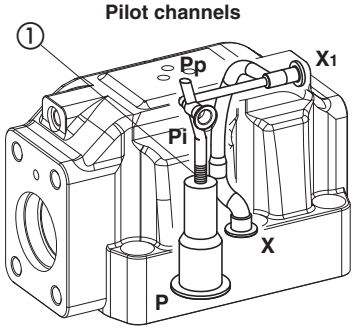
Option L9
This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve



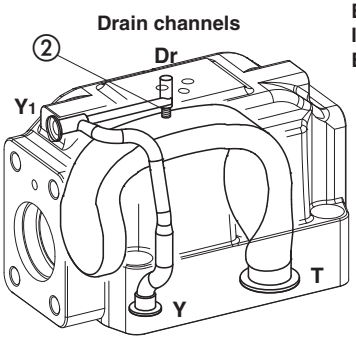
PLUG-12A

DPH*-4

Pilot channels

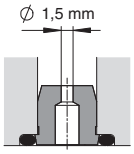


Drain channels



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

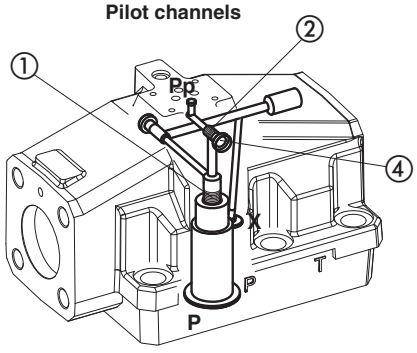
Option L9
This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve



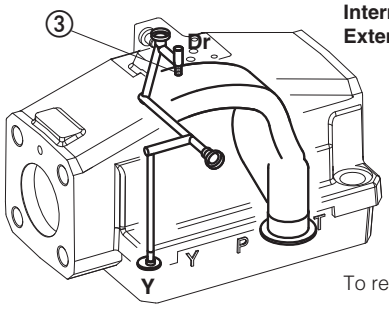
PLUG-15A

DPH*-6

Pilot channels



Drain channels



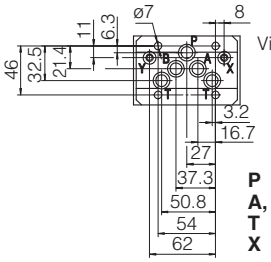
Internal piloting: Without plug ①;
plug SP-X325A in pos ②;
External piloting: Add DIN-908 M16x1,5 in pos ①;
plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orifice ②, remove plug ④ = G 1/8”

11 DIMENSIONS FOR DPH*-1 AND DPH*-2 [mm]

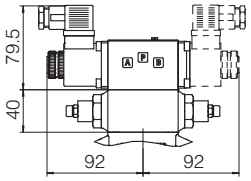
DPH*-1*

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A,B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;
Seals: 5 OR 2050, 2 OR 108

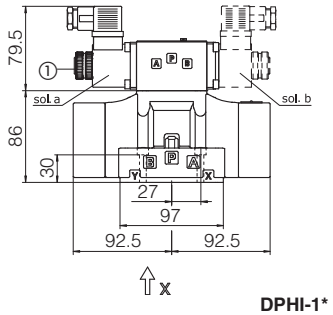


P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

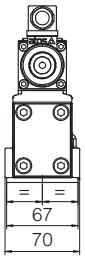
DPHI-1*/H /H9

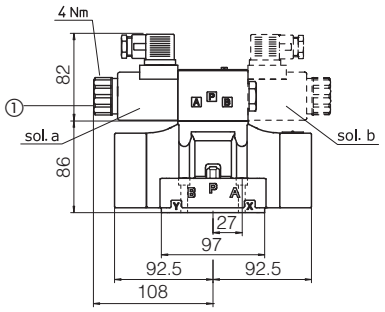


Mass (Kg)	
DPHI-16	6,8
DPHI-17	7,1
DPHE-16	6,9
DPHE-17	7,3
Option H, H9	+1,0



DPHI-1*



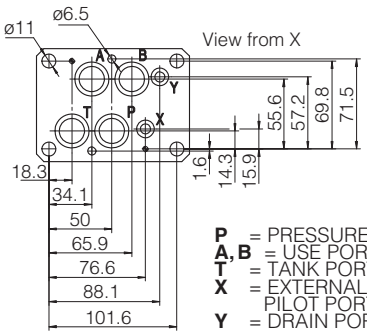


DPHE-1*

① Standard manual override PIN

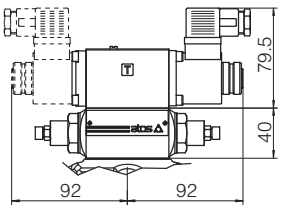
DPH*-2*

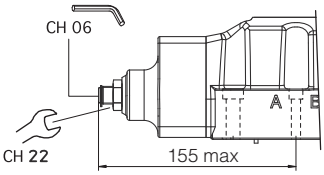
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 130, 2 OR 2043



P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

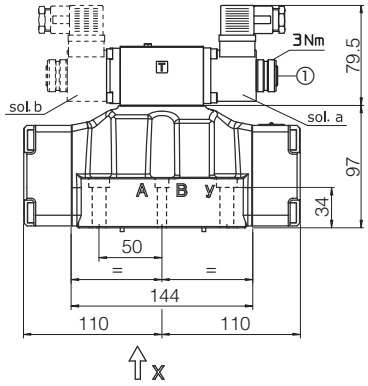
DPHI-2*/H /H9



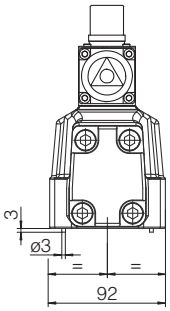


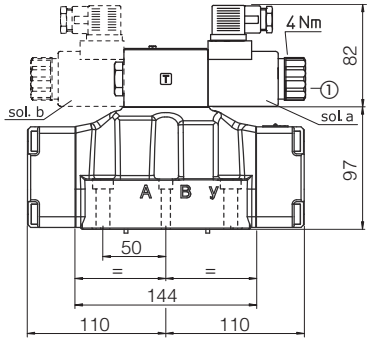
Stroke adjustment device for option /S

Mass (Kg)	
DPHI-26	9,8
DPHI-27	10,1
DPHE-26	9,9
DPHE-27	10,3
Option /S	+1,0
Option H, H9	+1,0



DPHI-2*





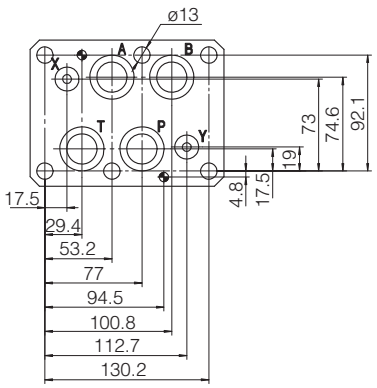
DPHE-2*

① Standard manual override PIN

Overall dimensions refer to valves with connectors type 666

DPH*-4*

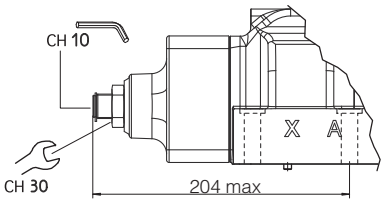
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Seals: 4 OR 4112; 2 OR 3056
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;



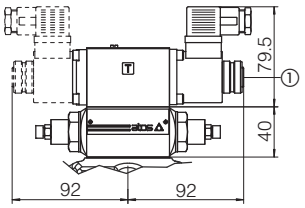
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT
For the max pressures on ports, see section

Mass (Kg)	
DPHI-46	17,3
DPHI-47	17,6
DPHE-46	17,4
DPHE-47	17,8
Option /S	+1,5
Option H, H9	+1,0

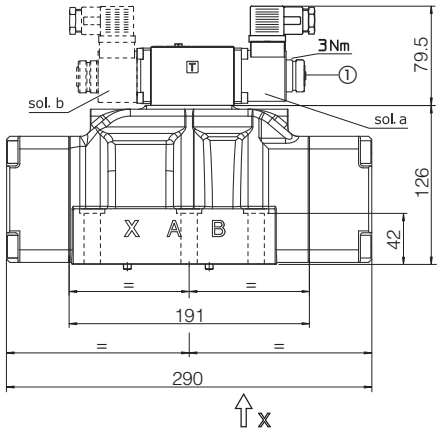
DPHI-4*
Stroke adjustment device for option /S

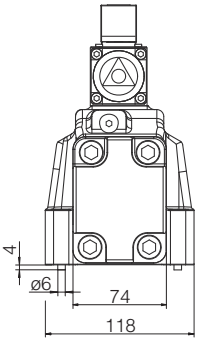


DPHI-4*/H /H9

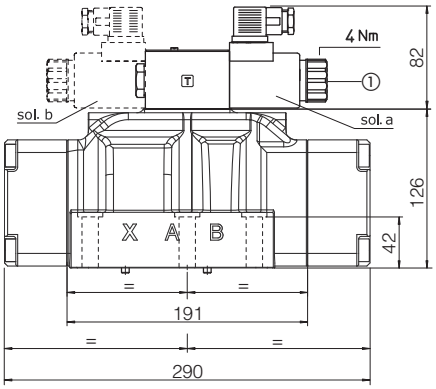


DPHI-4*





DPHE-4*



① Standard manual override PIN

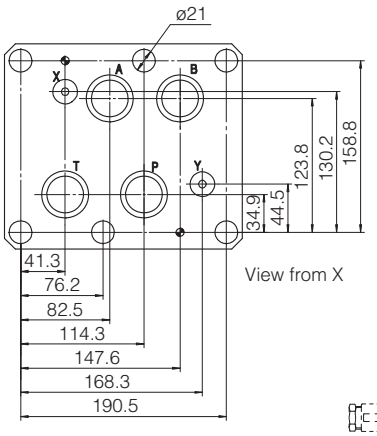
Overall dimensions refer to valves with connectors type 666

13 DIMENSIONS FOR DPH*-6 [mm]

DPH*-6*

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

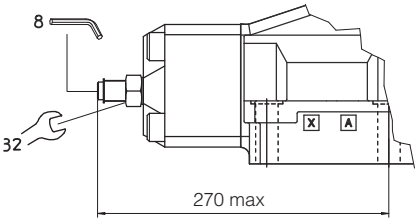
Fastening bolts:
6 socket head screws M20x80 class 12.9
Tightening torque = 600 Nm
Diameter of ports A, B, P, T: Ø = 34 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 144, 2 OR 3056



View from X

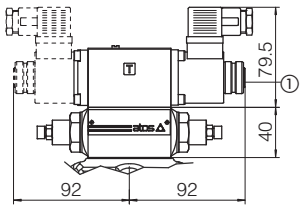
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

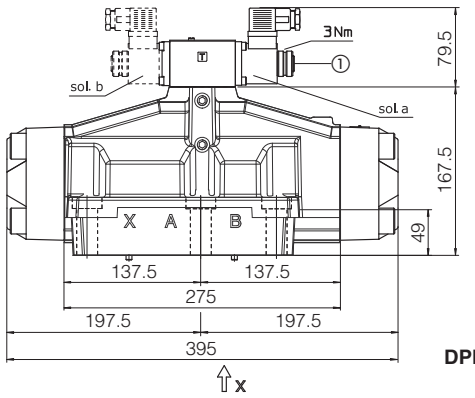
Stroke adjustment device for option/S



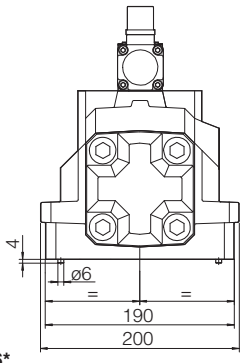
Mass (Kg)	
DPHI-66	43,8
DPHI-67	44,1
DPHE-66	44
DPHE-67	44,5
Option /S	+3,5
Option H, H9	+1,0

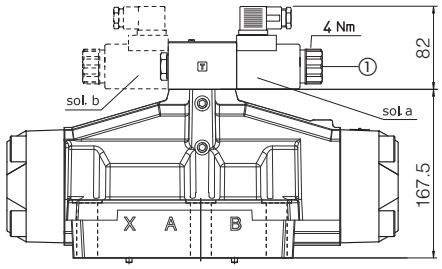
DPHI-6*/H /H9





DPHI-6*





DPHE-6*

① Standard manual override PIN

Overall dimensions refer to valves with connectors type 666

14 ELECTRONIC CONNECTORS ACCORDING TO DIN 43650 - the connectors must be ordered separately

Connector code	Function
666	Connector IP65, suitable for direct connection to electric supply source
667	As 666 connector IP65 but with built-in signal led, suitable for direct connection to electric supply source
669	With built-in rectifier bridge for supplying DC coils by alternating current (AC 110V and 230V - Imax 1A)

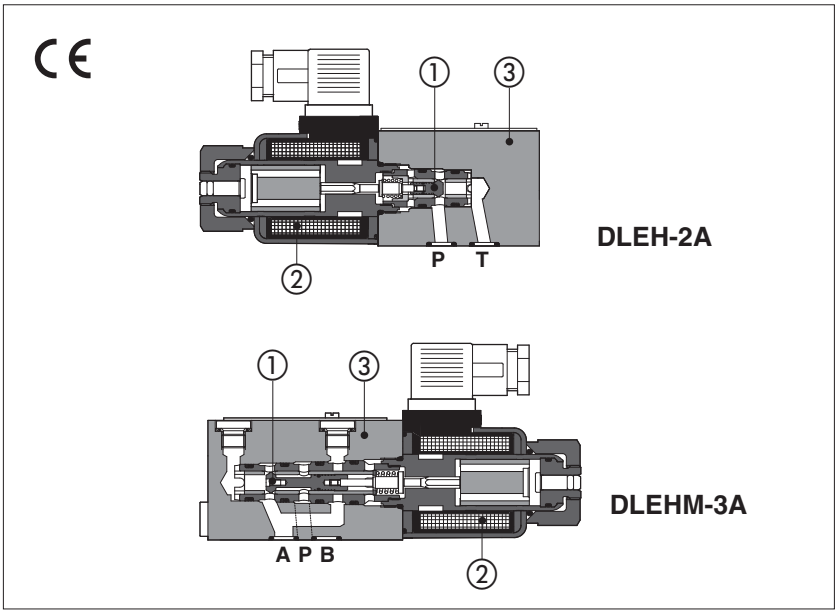
For other available connectors, see tab. E010, E015 and K500

15 MOUNTING SUBPLATES FOR DPH*-1, DPH*-2, DPH*-4 AND DPH*-6

Valve	Subplate model	Ports location	Ports		Ø Counterbore [mm]		Mass [Kg]
			A, B, P, T	X, Y	A, B, P, T	X, Y	
DPH*-1	BA-428	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	5,6
DPH*-1	BA-434	Ports P, T, X, Y underneath; ports A, B on lateral side	G 3/4"	G 1/4"	36,5	21,5	5,5
DPH*-2	BA-418	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	3,5
DPH*-2	BA-518	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	8
DPH*-2	BA-519	Ports P, T, X, Y underneath; ports A, B on lateral side	G 1"	G 1/4"	46	21,5	8
DPH*-4	BA-508	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	7
DPH*-4	BA-509	Ports P, T, X, Y underneath; ports A, B on lateral	G 1"	G 1/4"	46	21,5	12,5
DPH*-6	BA-708	Ports A, B, P, T, X, Y underneath;	G 11/2"	G 1/4"	63,5	21,5	17

Solenoid directional valves type DLEH and DLEHM

direct, poppet type, leak free



Poppet type ① direct operated valves, designed for applications in oil hydraulic systems with leak free requirements.

Following models are available in a wide range of configurations, see section 2

size 06 subplate version

- **DLEH**: two and three way execution, Qmax 12 l/min
- **DLEHM**: three way execution, Qmax 30 l/min

M20 screw-in cartridge version for easy assembling in hydraulic blocks

- **CART LEH**: two and three way execution, Qmax 12 l/min
- **CART LEHM**: three way execution, Qmax 30 l/min

They are operated by wet type, screwed solenoids ② for DC or RC (rectified) current supply and certified according to the North American standard **cURus**

Standard coils protection **IP65**

Max flow: **12 l/min (DLEH, LEH)**
30 l/min (DLEHM, LEHM)

Max pressure: **350 bar (DLEH, LEH)**
315 bar (DLEHM, LEHM)

1 MODEL CODE

DLEH	-	2	A	/	WP	-	X	24 DC	*	/	*

Directional control valve poppet type:
DLEH = ISO size 06, max flow: 12 l/min
DLEHM = ISO size 06, max flow: 30 l/min
CART LEH = cartridge version max flow12 l/min
CART LEHM = cartridge version max flow 30 l/min

2 = two way (only DLEH and LEH)
3 = three way

Valve configuration, see table 2

Options, see section 4

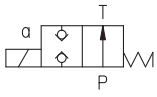
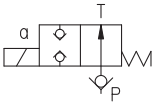
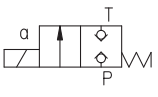
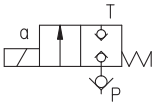
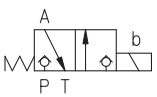
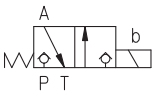
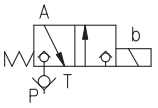
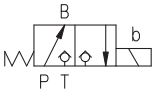
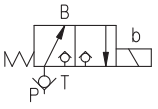
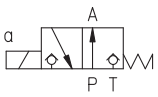
00-DC = DC solenoids without coils
X = without connector
See section 5 for available connectors, to be ordered separately

Voltage code, see section 6

Series number

Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 VALVE CONFIGURATION

DLEH-2A **CART LEH-2A**	**DLEH-2A/R**	**DLEH-2C** **CART LEH-2C**	**DLEH-2C/R**	**DLEHM-3A** **CART LEHM-3A**
				
DLEH-3A **CART LEH-3A**	**DLEH-3A/R**	**DLEH-3C** **CART LEH-3C**	**DLEH-3C/R**	**DLEHM-3C** **CART LEHM-3C**
				

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm^2/s - max allowed range 2.8 ÷ 500 mm^2/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	DLEH, LEH: Ports P, A, B **350 bar**; DLEHM, LEHM: Ports P, A **315 bar**; Port T **210** bar;		
Rated flow	See diagrams Q/Δp at section 7		
Max flow	DLEH, LEH: **12 l/min**, DLEHM, LEHM: **30 l/min**, see operating limits at section 8		
Internal leakage	Less than 5 drops/min (≤ 0,36 cm^3/min) at max working pressure		

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

4 NOTES

Options

WP = prolonged manual override protected by rubber cap

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar

R = (only for DLEH) with check valve on P port, see section 2.

S = (only for DLEH and CART LEH) poppet with positive overlapping in the intermediate position to reduce the internal leakage at the valve switching and without manual override pin for safety applications (blind locking ring)

5 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

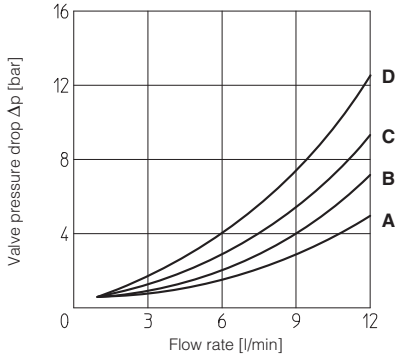
6 ELECTRIC FEATURES

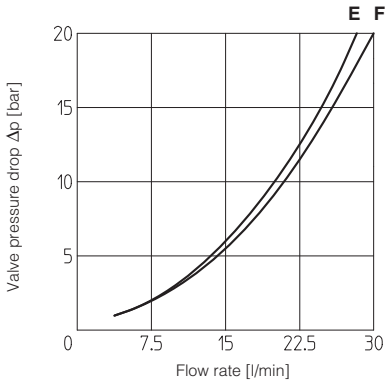
External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption	Code of spare coil
12 DC	**12 DC**	666 or 667	30 W	COE-12DC
14 DC	**14 DC**			COE-14DC
24 DC	**24 DC**			COE-24DC
28 DC	**28 DC**			COE-28DC
48 DC	**48 DC**			COE-48DC
110 DC	**110 DC**			COE-110DC
125 DC	**125 DC**			COE-125DC
220 DC	**220 DC**			COE-220DC
110/50 AC - 120/60 AC	**110 RC**	669		COE-110RC
230/50 AC - 230/60 AC	**230 RC**			COE-230RC

7 **Δp/Q DIAGRAM** based on mineral oil ISO VG 46 at 50°C

Flow direction / Valve type	P → A (1) (P → B)	A → T (B → T)
DLEH-2A	B	–
DLEH-2C	C	–
DLEH-3A	D	C
DLEH-3C	C	A
DLEHM-3A	F	E
DLEHM-3C	F	E

(1) For two-way valves, pressure drop refers to PØT





8 **OPERATING LIMITS** based on mineral oil ISO VG 46 at 50°C

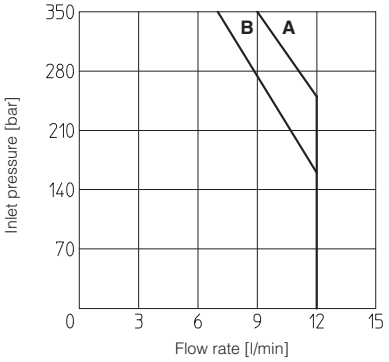
The diagram has been obtained with warm solenoids and power supply at lowest value (Vnom - 10%).

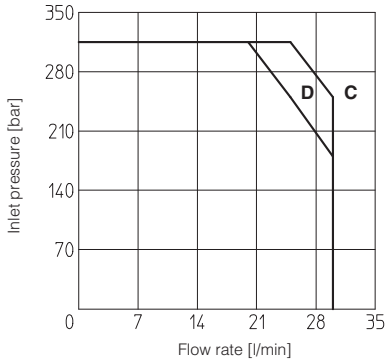
A = DLEH-3A, DLEH-2C

B = DLEH-2A, DLEH-3C

C = DLEHM-3A

D = DLEHM-3C





9 **SWITCHING TIMES (average values in msec)**

Valve type	Connector	Switch-on AC	Switch-on DC	Switch-off
DLEH(M)-* DC	666, 667	–	45	25
DLEH(M)-* RC	669	30	–	75

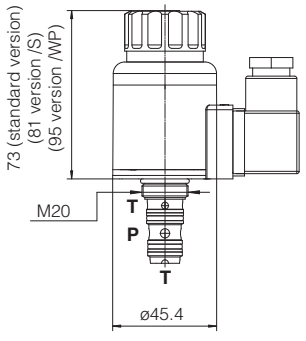
TEST CONDITIONS:

- 8 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- based on mineral oil ISO VG 46 at 50°C

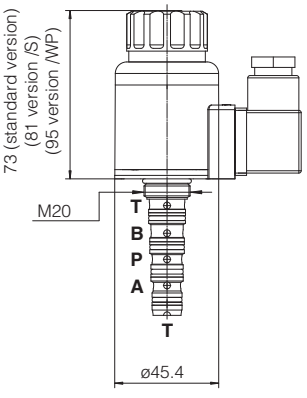
The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature

10 **DIMENSIONS OF CARTRIDGE VERSIONS [mm]** - for cavity dimensions see table P006

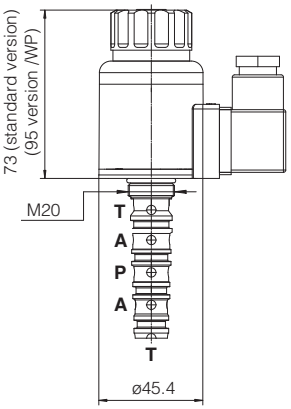
CART LEH-2A
CART LEH-2C



CART LEH-3A
CART LEH-3C

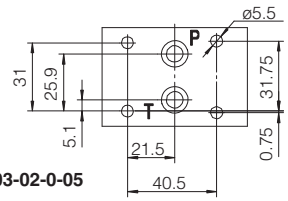


CART LEHM-3A
CART LEHM-3C



11 DIMENSIONS [mm]

DLEH-2*
DLEH-2*/R

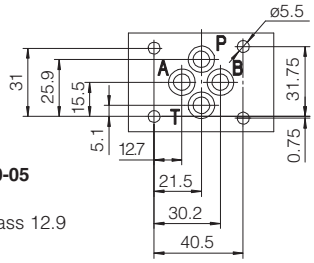


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
without A and B ports

Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 2 OR 108
Ports P, T: Ø = 7,5 mm (max)

P = PRESSURE PORT
T = USE PORT
For the max pressures on ports, see section 3

DLEH-3*
DLEH-3*/R
DLEHM-3*
DLEHM-3*/R

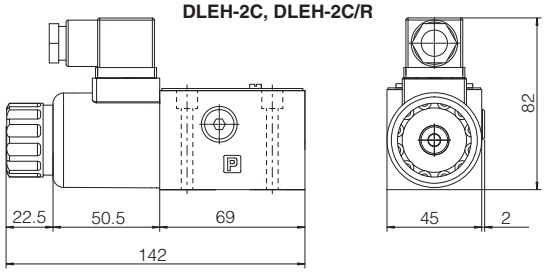


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P, A, B, T: Ø = 7,5 mm (max)

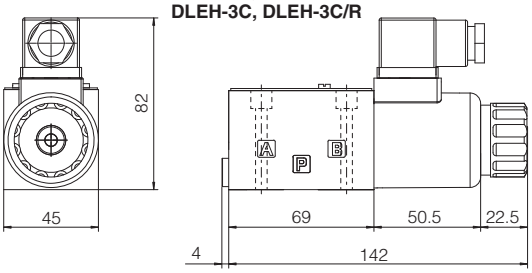
P = PRESSURE PORT
A = USE PORT (not used for DLEH and LEH -3C versions)
B = USE PORT (not used for DLEH and LEH -3A versions)
(not used for DLEHM and LEHM)
T = TANK PORT
For the max pressures on ports, see section 3

DLEH-2A, DLEH-2A/R
DLEH-2C, DLEH-2C/R



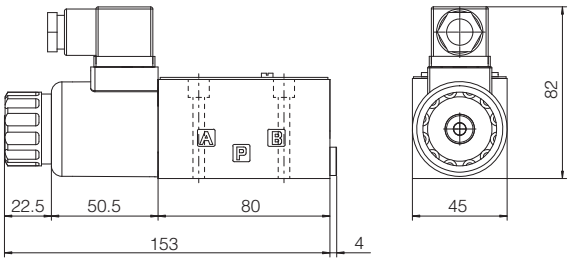
Mass: 1,5 Kg

DLEH-3A, DLEH-3A/R
DLEH-3C, DLEH-3C/R



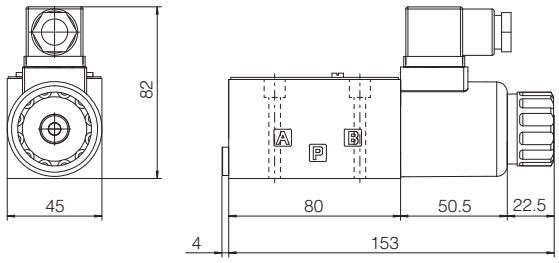
Mass: 1,5 Kg

DLEHM-3C



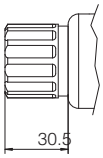
Mass: 1,7 Kg

DLEHM-3A

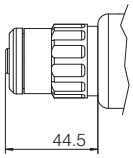


Mass: 1,7 Kg

Option /S



Option /WP



option /S = blind locking ring without manual override
option /WP = prolunged manual override, protected by rubber cap

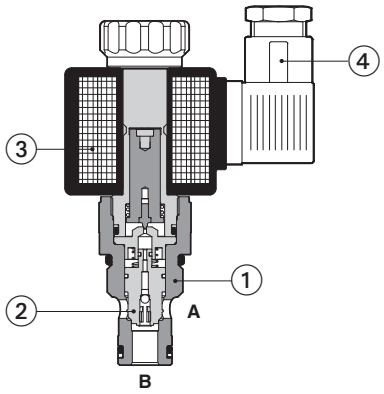
Overall dimensions refer to valves with connectors type 666

12 MOUNTING SUBPLATES - see table K280

Valve	Subplate model	Ports location	GAS ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [Kg]
DLEH-* DLEHM-*	BA-202	Ports A, B, P, T underneath;	3/8"	–	1,2
	BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
	BA-302	Ports A, B, P, T underneath;	1/2"	30	1,8

Solenoid cartridge valves

screw-in, 2-way, poppet type, leak free



① cartridge body
② poppet
③ coil
④ coil connector (to be ordered separately)

JO-DL-4-2-X 24DC

JO-DL

Leak free, poppet type solenoid cartridges in screw-in execution normally used to cut off the hydraulic power supply line. They are available in normally closed NC, or normally open NO configurations.

Max flow: **300 l/min**
Max pressure: **350 bar**

1 MODEL CODE

JO	-	D	L	-	4	-	2	/	NC	-	X	24 DC	**	/	*

Cartridge valve screw-in type UNF

D = Directional control

L = Poppet type

Size:
4 = 3/4”-16UNF-2A
6 = 7/8”-14UNF-2A
10 = 1 5/16”-12UNF-2A

2 = Two-way

Version:
NC = normally closed in rest position
NO = normally open in rest position

X = Without connector, see section 5 for available connector

Voltage code:
12DC = 12 VDC
24DC = 24 VDC

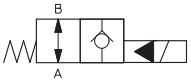
Series number

Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

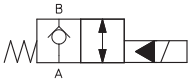
2 HYDRAULIC SYMBOL

Hydraulic symbols

/NO



/NC



3 GENERAL CHARACTERISTICS

Installation position	Any position
Cavity	JO-DL-4 = SAE-08-2N; JO-DL-6 = SAE-10-2N; JO-DL-10 = SAE-16-2N
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** execution = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Model			**JO-DL-4-2/NC**	**JO-DL-4-2/NO**	**JO-DL-6-2/NC**	**JO-DL-6-2/NO**	**JO-DL-10-2/NC**	**JO-DL-10-2/NO**
Operating pressure		[bar]	Ports A and B **350**					
Max flow		[l/min]	40		75		300	
Response time:	energizing	[ms]	35	50	30	50	35	150
	de-energizing	[ms]	50	35	60	35	70	35
Internal leakage			less than 5 drops/min (≤ 0,36 cm³/min) max at 350 bar					

5 ELECTRIC CHARACTERISTICS

Relative duty factor	100%	
Supply voltage	See model code at section 1	
Supply voltage tolerance	±10%	
Max power	19 Watt	
Power connector	666 (plastic - black); 3 pins, cable clamp PG11, cable max ø 11 mm	**to be ordered separately**
Connectors features	DIN 43650 - ISO 4400; IP65 (DIN 40050); VDE 0110C	

6 INSTALLATION NOTES

1) The assembling of cartridges inside manifolds must be done tightening the valve exagonal ring (for tightening torque, see section 10). Excessive values can cause anomalous deformation and poppet sticking.

2) The CE certification is valid only with shielded electric cables and connector. Consult also tab. P004.

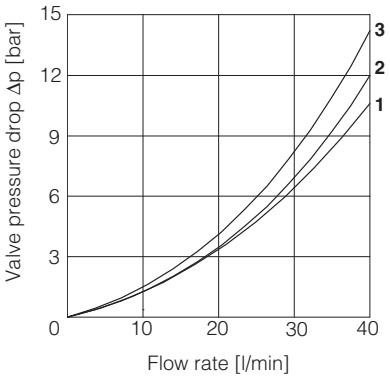
7 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

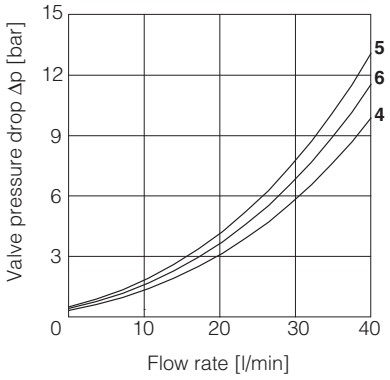
8 **DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

9.1 JO-DL-4

Valve pressure drop - NO version
1= A → B de-energized
2= B → A de-energized
3= B → A energized

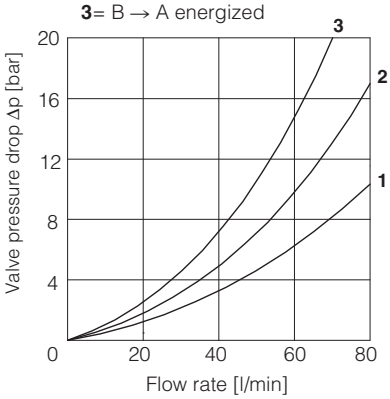


Valve pressure drop - NC version
4= A → B energized
5= B → A de-energized
6= B → A energized

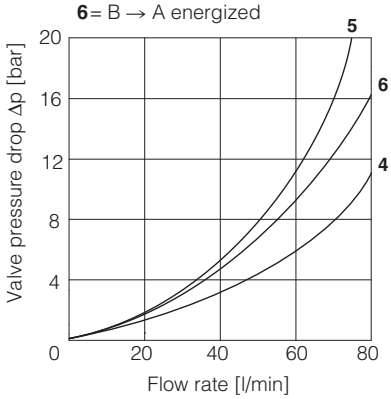


9.2 JO-DL-6

Valve pressure drop - NO version
1= A → B de-energized
2= B → A de-energized
3= B → A energized

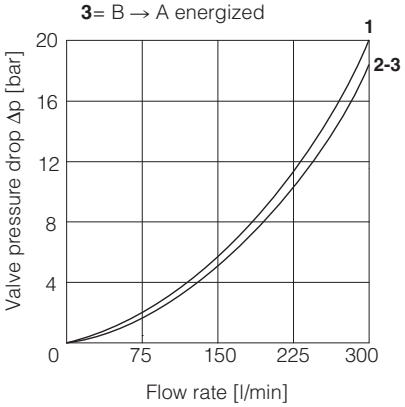


Valve pressure drop - NC version
4= A → B energized
5= B → A de-energized
6= B → A energized

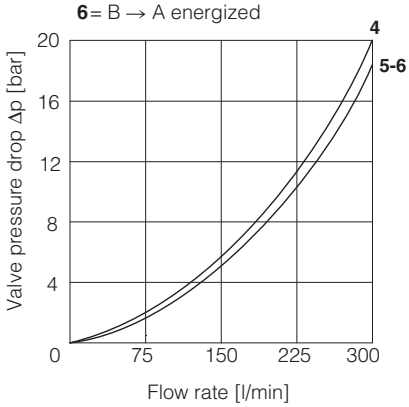


9.3 JO-DL-10

Valve pressure drop - NO version
1= A → B de-energized
2= B → A de-energized
3= B → A energized



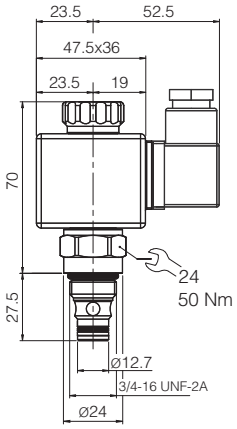
Valve pressure drop - NC version
4= A → B energized
5= B → A de-energized
6= B → A energized



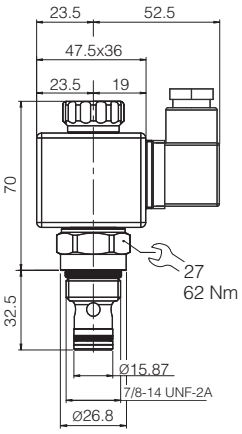
9 INSTALLATION DIMENSIONS [mm]

Version /NO and /NC

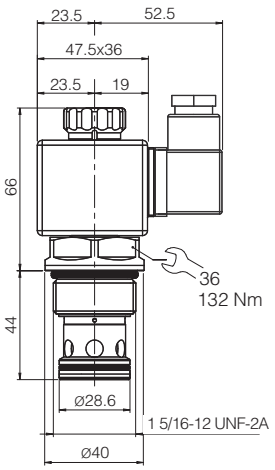
JO-DL-4-2/N*
Mass 0.35 Kg



JO-DL-6-2/N*
Mass 0.35 Kg

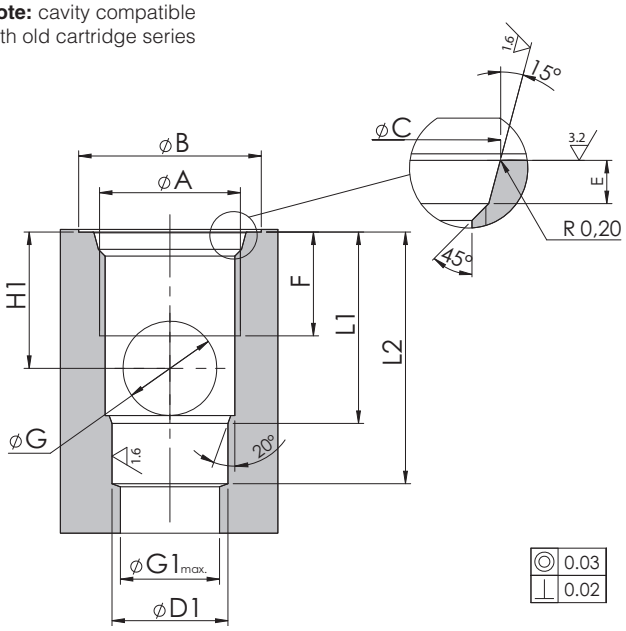


JO-DL-10-2/N*
Mass 0.4 Kg



10 CAVITY DIMENSIONS

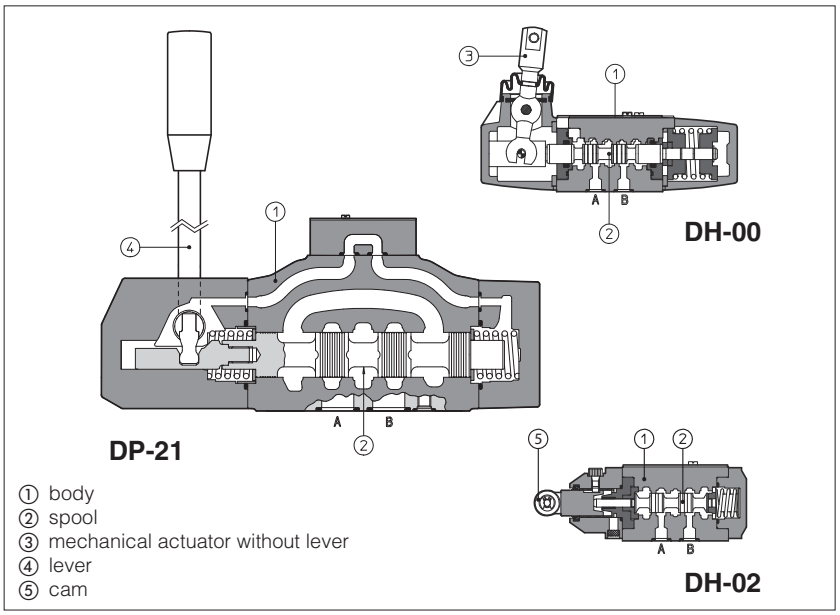
Note: cavity compatible with old cartridge series



	SAE-08-2N	SAE-10-2N	SAE-16-2N
A	3/4-16 UNF	7/8-14 UNF	1 5/16-12 UNF
B	26	30	42
C	20.6 $^{+0,1}_{0}$	23.9 $^{+0,1}_{0}$	35.5 $^{+0,1}_{0}$
D1	12.7 $^{+0,05}_{0}$	15.87 $^{+0,05}_{0}$	28.60 $^{+0,05}_{0}$
E	2.6 $^{+0,3}_{0}$	2.6 $^{+0,3}_{0}$	3.3 $^{+0,3}_{0}$
F	13	15	20
G	9	12	19
G1	12	15	24
H1	14	18	25
L1	20.5	25.5	36
L2	29	34.5	49

Hand & mechanical directional valves

ISO 4401 sizes 06, 10, 16 and 25



① body
② spool
③ mechanical actuator without lever
④ lever
⑤ cam

Hand & mechanical operated directional valves are spool type, three or four way, two or three position valves, available with following actuator types:
- mechanical actuator: general purpose execution for connection to customer device for the valve's remote operation
- hand-lever
- cam (only for DH and DK).

Valve sizes and max flow:

DH-0 = size 06, flow up to 50 l/min
DK-10 (11) = size 10, flow up to 100 l/min
DK-12 = size 10, flow up to 140 l/min
DP-2 = size 16, flow up to 300 l/min
DP-4 = size 25, flow up to 700 l/min

Max pressure:
350 bar for DH-0, DP-2, DP-4
315 bar for DK-1*

1 MODEL CODE

DH-0	1	1	3	/	C	/	A	**	/	*

DH-0
Directional control valve, size:
DH-0 = 06
DK-1 = 10
DP-2 = 16
DP-4 = 25

1
Type of actuator:
0 = mechanical, without lever
1 = hand-lever
2 = cam (only for DH-0 and DK-1)

1
Valve configuration, **see sections** 2 and 3
0 = free, without springs
1 = spring centered, without detent
2 = retun to internal position
3 = return to external position
4 = 3 position, with detent
5 = 2 external positions, with detent
6 = centre plus external positions, with detent
7 = return to external position from the centre position
8 = return to the centre position from the external position

3
Spool type, see section 3

C
Only for DH-01 hand-lever valves:
/C = short hand - lever and reducend actuation force

A
Options:
/A = actuator device mounted on side of port B
Lever position to be specified for DH-00, DH-01 and DK-00, DK-01 with configuration 6, 7, 8, see section 3 for hydraulic connections:
/I = in rest position the lever is inclined towards the valve body
/E = in rest position the lever is inclined in opposite side
Only for DK-1:
/Y = external drain

******
Series number

*****
Seals material:
- = NBR
PE = FKM

2 RANGE OF VALVE'S MODELS

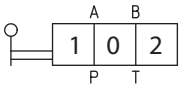
VALVE TYPE	SIZE	VALVE CONFIGURATION								
		0	1	2	3	4	5	6	7	8
DH-00	06	●	●	●	●	●	●	●	●	●
DH-01		●	●	●	●	●	●	●	●	●
DH-02					●				●	●
DK-10	10	●	●	●	●	●	●	●	●	●
DK-11		●	●	●	●	●	●	●	●	●
DK-12					●				●	●
DP-20	16		●		●	●	●			
DP-21			●		●	●	●			
DP-40	25		●		●	●	●			
DP-41			●		●	●	●			

3 **CONFIGURATIONS and SPOOLS** - for intermediate passages, see tab. E001

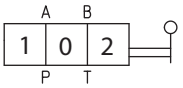
DH-00*, DH-01* and DK-10*, DK-11* - mechanical and hand lever actuator

Configurations

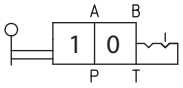
DH-000* DK-100* **DH-010* DK-110***



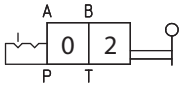
DH-000*/A DK-100*/A **DH-010*/A DK-110*/A**



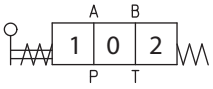
DH-006*/E DK-106*/E **DH-016*/E DK-116*/E**



DH-006*/EA DK-106*/EA **DH-016*/EA DK-116*/EA**



DH-001* DK-101* **DH-011* DK-111***



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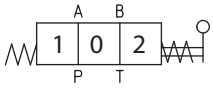
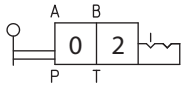
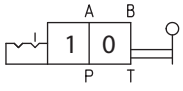


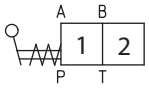
DH-006*/I DK-106*/I **DH-016*/I DK-116*/I**



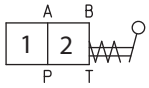
DH-006*/IA DK-106*/IA **DH-016*/IA DK-116*/IA**



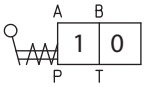
DH-002* DK-102* **DH-012* DK-112***



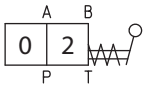
DH-002*/A DK-102*/A **DH-012*/A DK-112*/A**



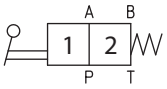
DH-007*/E DK-107*/E **DH-017*/E DK-117*/E**



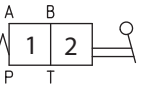
DH-007*/EA DK-107*/EA **DH-017*/EA DK-117*/EA**



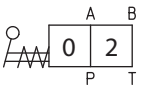
DH-003* DK-103* **DH-013* DK-113***



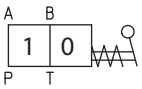
DH-003*/A DK-103*/A **DH-013*/A DK-113*/A**



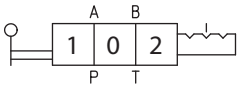
DH-007*/I DK-107*/I **DH-017*/I DK-117*/I**



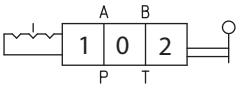
DH-007*/IA DK-107*/IA **DH-017*/IA DK-117*/IA**



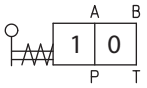
DH-004* DK-104* **DH-014* DK-114***



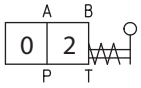
DH-004*/A DK-104*/A **DH-014*/A DK-114*/A**



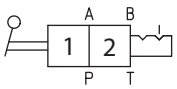
DH-008*/E DK-108*/E **DH-018*/E DK-118*/E**



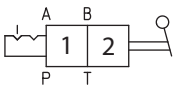
DH-008*/EA DK-108*/EA **DH-018*/EA DK-118*/EA**



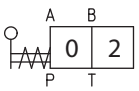
DH-005* DK-105* **DH-015* DK-115***



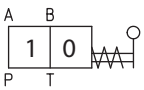
DH-005*/A DK-105*/A **DH-015*/A DK-115*/A**



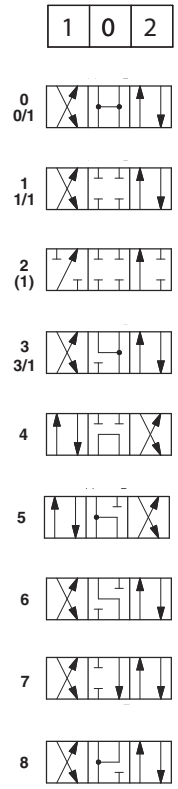
DH-008*/I DK-108*/I **DH-018*/I DK-118*/I**



DH-008*/IA DK-108*/IA **DH-018*/IA DK-118*/IA**



Spools

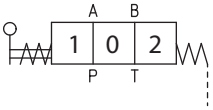


(1) Spool type 2 available only for DH

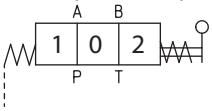
DP-20*, DP-21*, DP-40*, DP-41* - hand lever actuator

Configurations

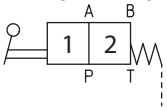
DP-201* DP-401* **DP-211* DP-411***



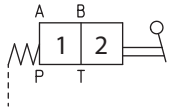
DP-201*/A DP-401*/A **DP-211*/A DP-411*/A**



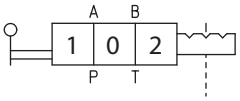
DP-203* DP-403* **DP-213* DP-413***



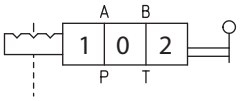
DP-203*/A DP-403*/A **DP-213*/A DP-413*/A**



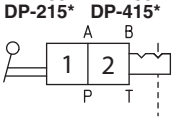
DP-204* DP-404* **DP-214* DP-414***



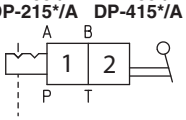
DP-204*/A DP-404*/A **DP-214*/A DP-414*/A**



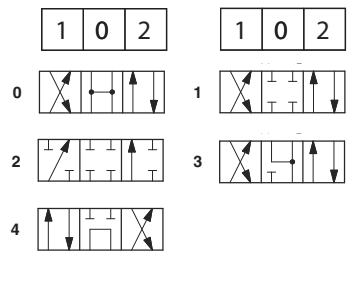
DP-205* DP-405* **DP-215* DP-415***



DP-205*/A DP-405*/A **DP-215*/A DP-415*/A**



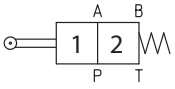
Spools



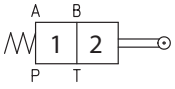
DH-02*, DK-12* - cam actuator

Configurations

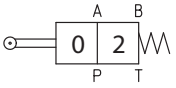
DH-023* DK-123*



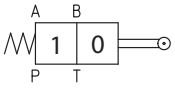
DH-023*/A DK-123*/A



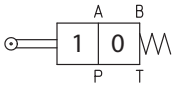
DH-027* DK-127*



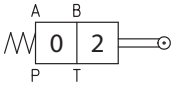
DH-027*/A DK-127*/A



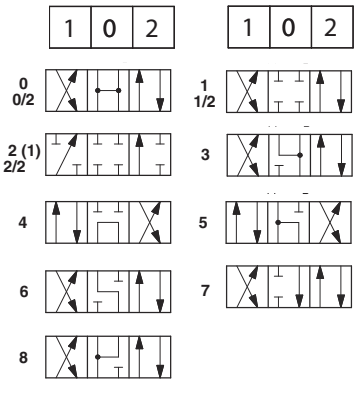
DH-028* DK-128*



DH-028*/A DK-128*/A



Spools



(1) Spool type 2 available only for DH

NOTE

- Spools type 0/2, 1/2, 2/2 are only used for valves type DH-023*/2 and DK 123*/2;

4 GENERAL CHARACTERISTICS

Assembly position		Any position except for configurtion 7 (without spring) that must be installed with horizontal axis
Subplate surface finishing to ISO 4401		Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849		150 years, see technical table P007
Ambient temperature range		**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range		**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C
Flow direction		As shown in the symbols of tables 3
Compliance		RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Operating pressure	**DH**	P, A, B = **350 bar** T = **160 bar**
	DK	P, A, B = **315 bar** T = **160 bar**
	DP	P, A, B, X = **350 bar** T = **250 bar** for external drain (standard); Ports Y = 0 bar
Maximum flow	**DH**	**50 l/min**
	DK-10, DK-11	**100 l/min**
	DK-12	**140 l/min**
	DP-2	**300 l/min**
	DP-4	**700 l/min**

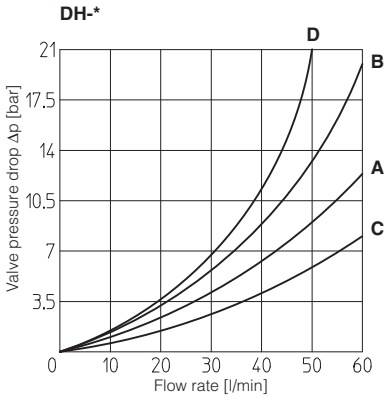
5 SEALS AND HYDRAULIC FLUIDS - For other fluids not included in above table, consult our technical office

Seals, recommended fluid temperature	NBR seals = (standard) -30°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals = (/PE option) -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

6 **Q/ΔP DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

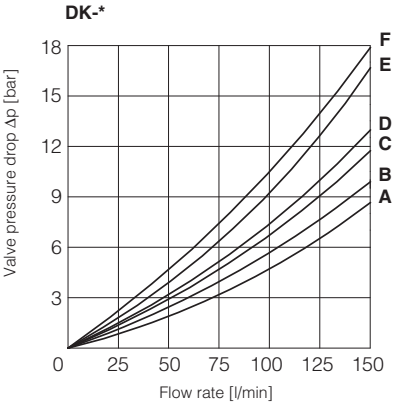
DH-*

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1, 0/2	C	C	C	C	
1, 1/1, 1/2	A	A	A	A	
2, 2/2, 3, 3/1	A	A	C	C	
4, 5	D	D	D	D	A
6, 7	A	A	C	A	
8	C	C	B	B	



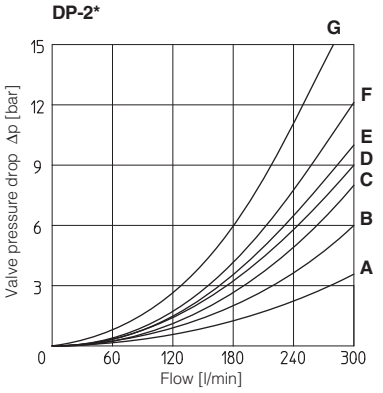
DK-*

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1, 0/2	A	A	B	B	
1, 1/1, 1/2, 6, 8	A	A	D	C	
3, 3/1, 7	A	A	C	D	
4	B	B	B	B	E
5	A	B	C	C	F



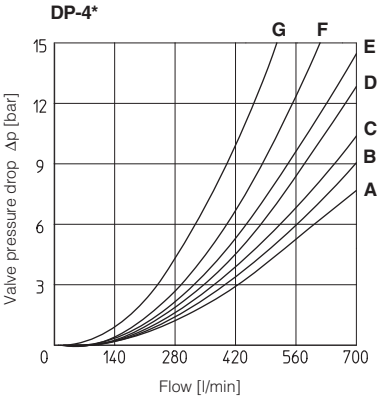
DP-2*

Spool type / Flow direction	P→A	P→B	A→T	B→T	P→T
1, 3	A	A	C	A	-
0	A	A	C	D	B
2	A	A	-	-	-
4	B	B	F	G	E



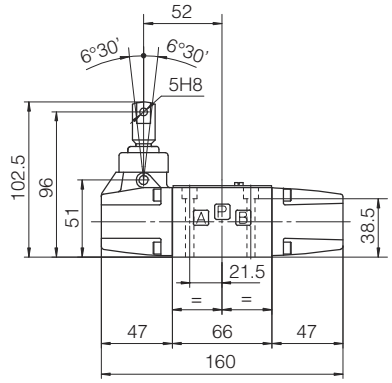
DP-4*

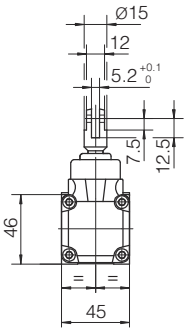
Spool type / Flow direction	P→A	P→B	A→T	B→T	P→T
1	A	A	A	C	-
0	C	B	C	D	E
2	A	A	-	-	-
3	A	A	C	E	-
4	B	B	F	G	G



7 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 06 [mm]

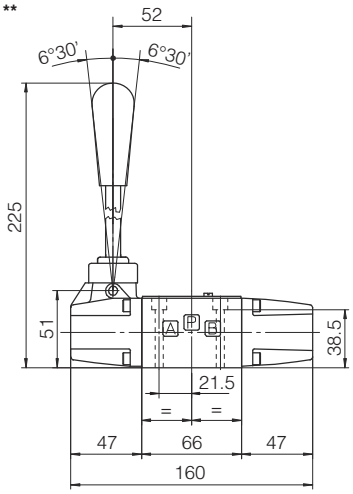
DH-00**

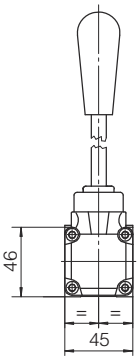




Mass: 1,2 Kg

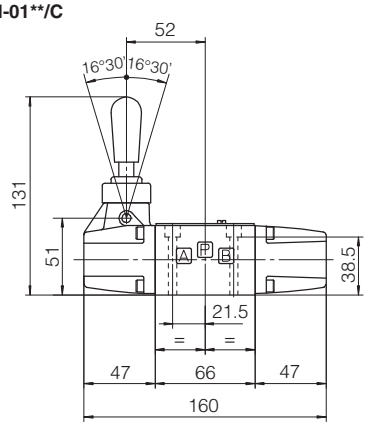
DH-01**

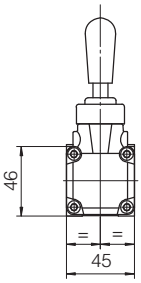




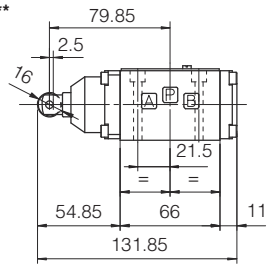
Mass: 1,6 Kg

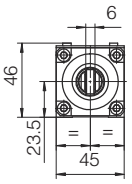
DH-01/C**





DH-02**





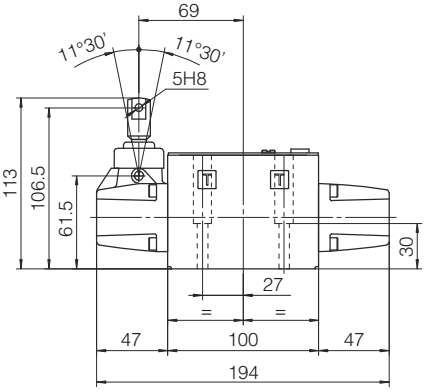
Mass: 1,2 Kg

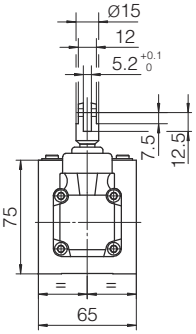
Working stroke: 2,5 mm; extra-stroke: 0,5 mm max.

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

8 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 10 [mm]

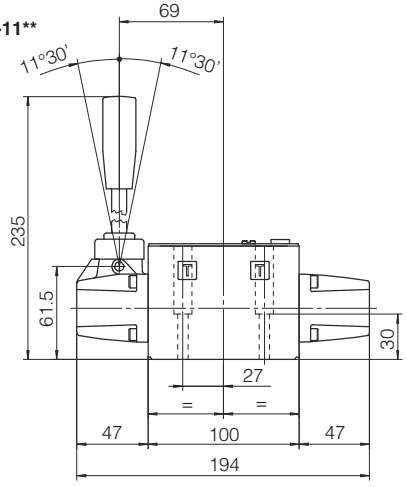
DK-10**

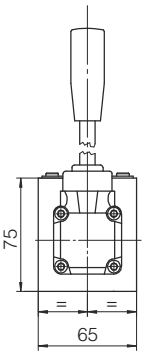




Mass: 2,5 Kg

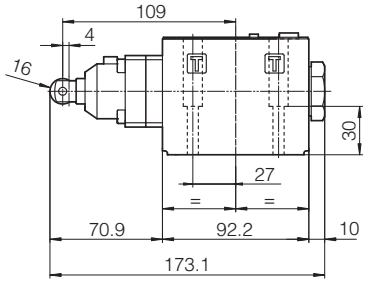
DK-11**

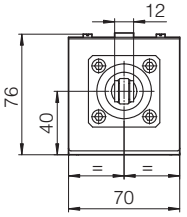




Mass: 2,8 Kg

DK-12**





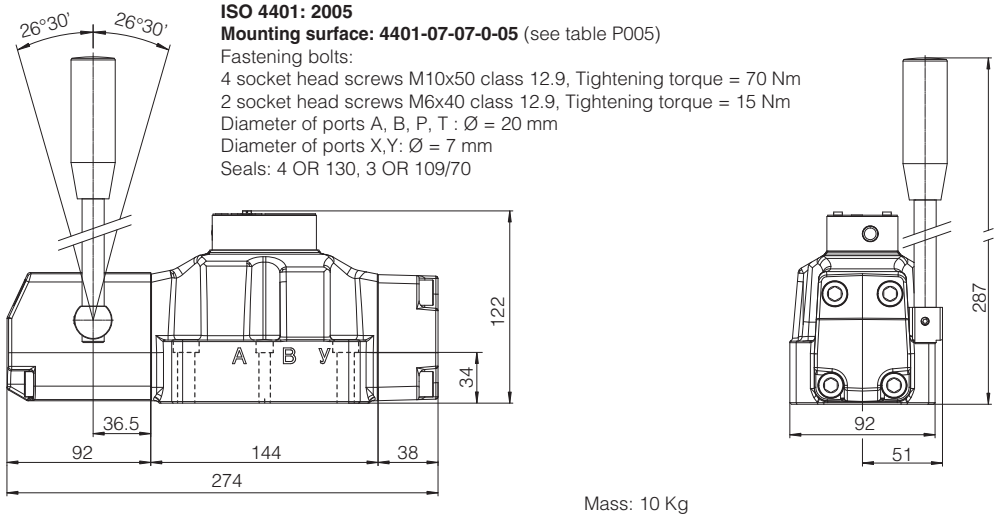
Mass: 2,5 Kg

Working stroke: 4 mm; extra-stroke: 0,5 mm max.

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)
(Without X port, Y port optional)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050

9 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 16 [mm]

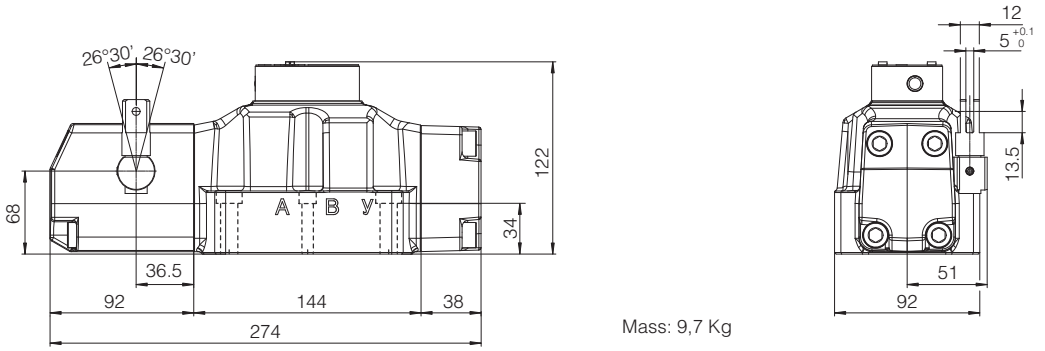
DP-21



ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)
Fastening bolts:
4 socket head screws M10x50 class 12.9, Tightening torque = 70 Nm
2 socket head screws M6x40 class 12.9, Tightening torque = 15 Nm
Diameter of ports A, B, P, T : Ø = 20 mm
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 130, 3 OR 109/70

Mass: 10 Kg

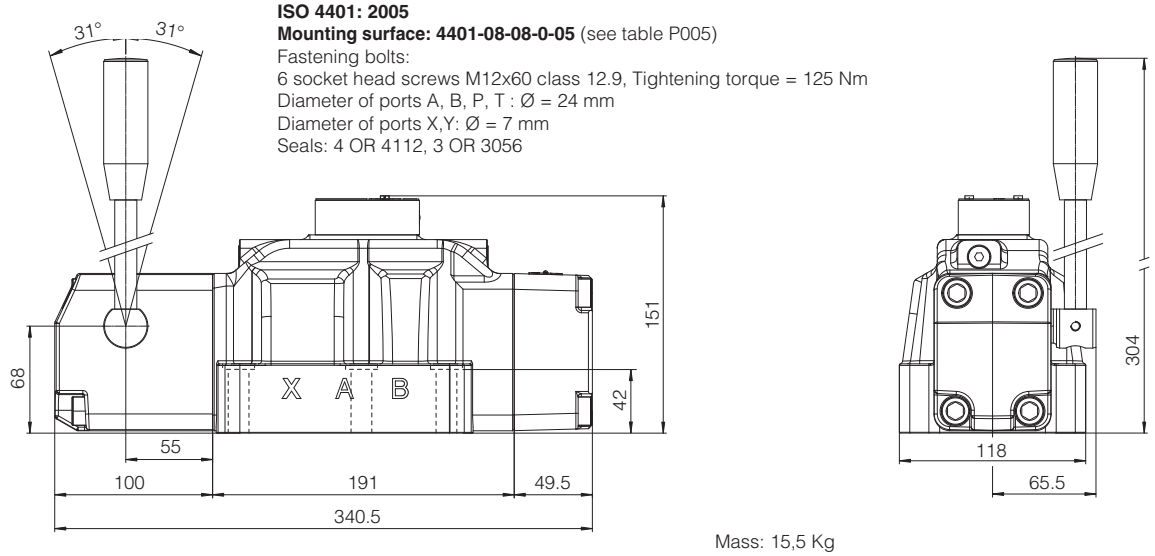
DP-20



Mass: 9,7 Kg

10 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 25 [mm]

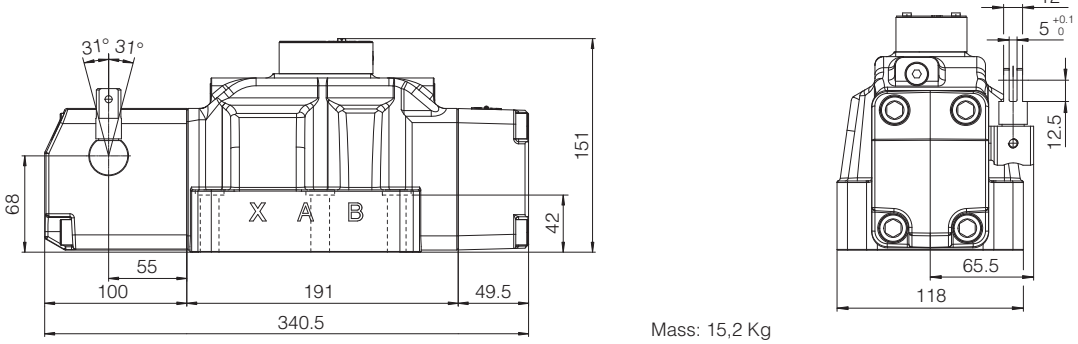
DP-41



ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)
Fastening bolts:
6 socket head screws M12x60 class 12.9, Tightening torque = 125 Nm
Diameter of ports A, B, P, T : Ø = 24 mm
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 4112, 3 OR 3056

Mass: 15,5 Kg

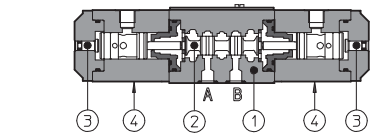
DP-40



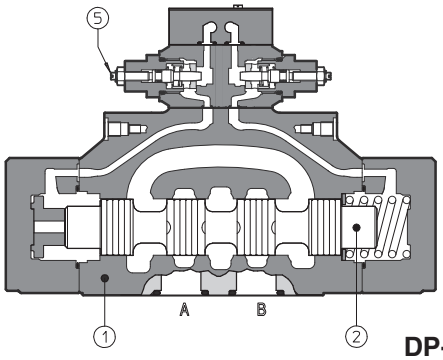
Mass: 15,2 Kg

Hydraulic operated directional valves

ISO 4401 size 06, 10, 16, 25 and 32



DH-0511



DP-4411/H

① Main body
② Spool
③ Manual override
④ Hydraulic actuator
⑤ Adjustable chokes (option /H)

Hydraulic operated directional valves are spool type, three or four way, two or three position, designed to operate in oil hydraulic systems.
Available with single or double hydraulic actuator.

Valve sizes and max flow:

DH-0 = size 06, flow up to 50 l/min
DK-1 = size 10, flow up to 160 l/min
DP-1 = size 10, flow up to 160 l/min
DP-2 = size 16, flow up to 300 l/min
DP-4 = size 25, flow up to 700 l/min
DP-6 = size 32, flow up to 1000 l/min

Max pressure:
350 bar for DH-0, DP-1, DP-2, DP-4, DP-6
315 bar for DK-1

1 MODEL CODE

DH-0	4	1	3	/	A	**	/	*

DH-0: Directional control valve, size:
DH-0 = 06
DK-1 = 10
DP-1 = 10
DP-2 = 16
DP-4 = 25
DP-6 = 32

4: Type of actuator:
4 = single actuator
5 = double actuator

1: Valve configuration, see section 5
0 = free, without springs
1 = spring centered, without detent
3 = spring offset external position
5 = 2 external positions, with detent (only for DH and DK)
7 = center and external positions

3: Spool type, see section 4

A: Options:
only for DH-04 and DK-14, see section 4:
/A = actuator device mounted on side of port B
only for DP:
/H = adjustable chokes for controlling the main spool shifting time (meter-out to the pilot chambers of the main valve)
/H9= adjustable chokes for controlling the main spool shifting time (meter-in to the pilot chambers of the main valve)
/R = with check valve on port P (not available for DP-1*)
/S = main spool stroke adjustment (not available for DP-1*)

******: Series number

*****: Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR (only for DP)

2 HYDRAULIC CHARACTERISTICS

Valve model		DH-0	DK-1	DP-1	DP-2	DP-4	DP-6
Max recommended flow	[l/min]	50	160	160	300	700	1000
Max pressure on port P, A, B	[bar]	350	315	350			
Max pressure on port T (also X, Y for DP)	[bar]	see note **(1)**		250			
Minimum pilot pressure	[bar]	3 (min) 5 (suggested)		4			
Max recommended pressure on piloting line	[bar]	70		250			

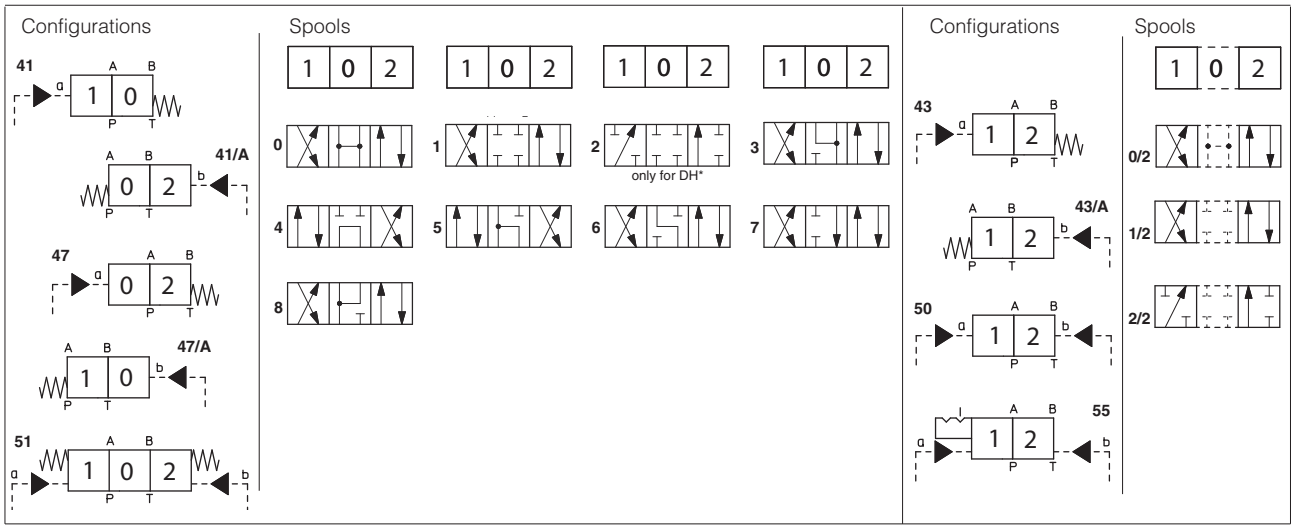
(1) The max pressure on port T has to be not over 50% of pilot pressure

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	any position except for valves type DH-050, DK-150, DP-*50 (without springs) that must be installed with their longitudinal axis horizontal
Subplate surface finishing	roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature range	standard execution = -30°C ÷ +70°C; /PE option = -20°C ÷ +70°C; /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

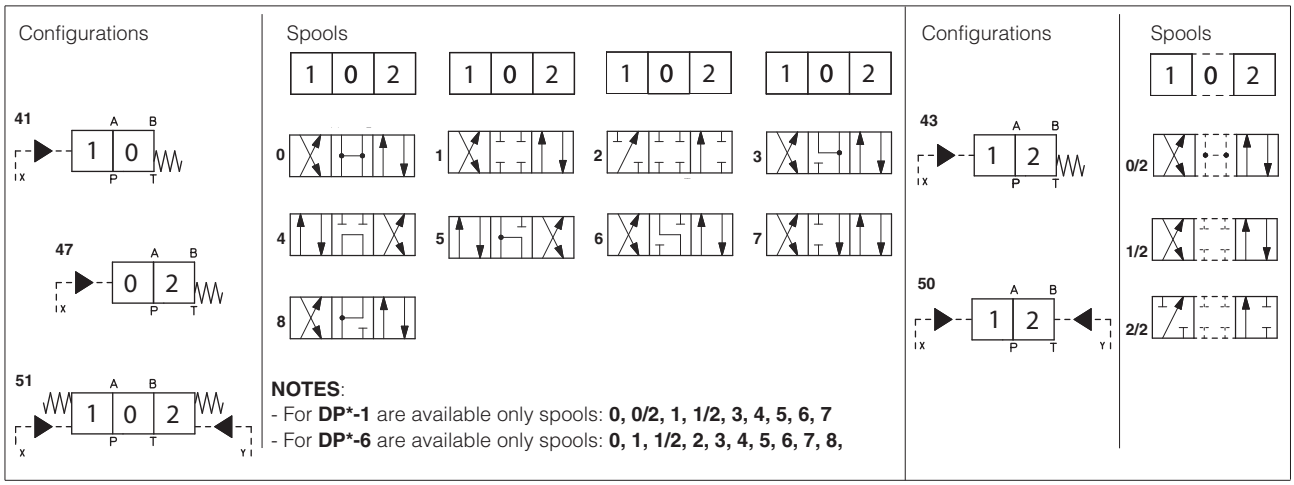
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 CONFIGURATIONS and SPOOLS valves type DH-*, DK-*



NOTES
- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4** and **5** are also available as **1/1, 4/8** (only for DH), and **5/1.** They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 1/2, 3, 8** are available as **1P, 1/2P, 3P, 8P** (only for DH-0) to limit valve internal leakages.

5 CONFIGURATIONS and SPOOLS valves type DP-*



NOTES:
- For **DP*-1** are available only spools: **0, 0/2, 1, 1/2, 3, 4, 5, 6, 7**
- For **DP*-6** are available only spools: **0, 1, 1/2, 2, 3, 4, 5, 6, 7, 8,**

Special shaped spools
- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4** and **5** are also available as **1/1, 4/8** and **5/1** are properly shaped to reduce water-hammer shocks during the switching.

6 Q/Δp DIAGRAMS

DH-0	See note and diagrams on table E010 relating the DH* valve from which DH-0* are derivated
DK-1	See note and diagrams on table E025 relating the DKE valve from which DK-1* are derivated
DP-1	See note and diagrams on table E085 relating the DPH*-1 valve from which DP-1* are derivated
DP-2	See note and diagrams on table E085 relating the DPH*-2 valve from which DP-2* are derivated
DP-4	See note and diagrams on table E085 relating the DPH*-4 valve from which DP-4* are derivated
DP-6	See note and diagrams on table E085 relating the DPH*-6 valve from which DP-6* are derivated

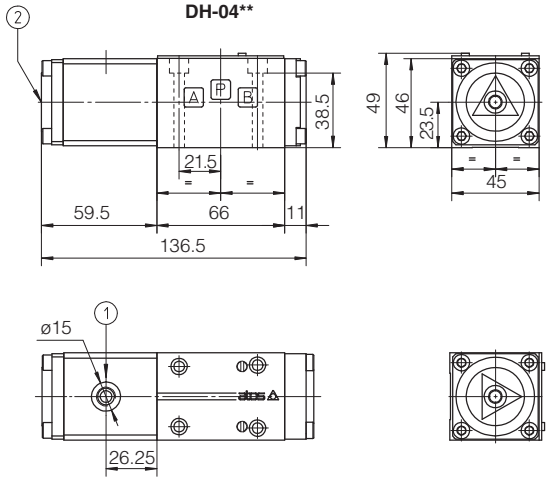
7 DIMENSIONS OF HYDRAULIC OPERATED VALVES ISO 4401 size 06 and 10 [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

① Pilot pressure port G1/8"
② Manual override

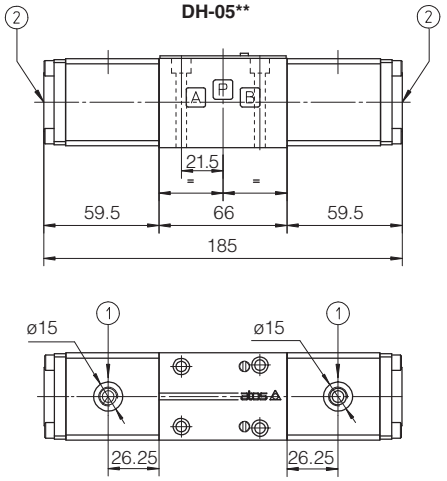
Mounting subplates: see tab. E010

DH-04**



Mass: 1,2 Kg

DH-05**



Mass: 1,6 Kg

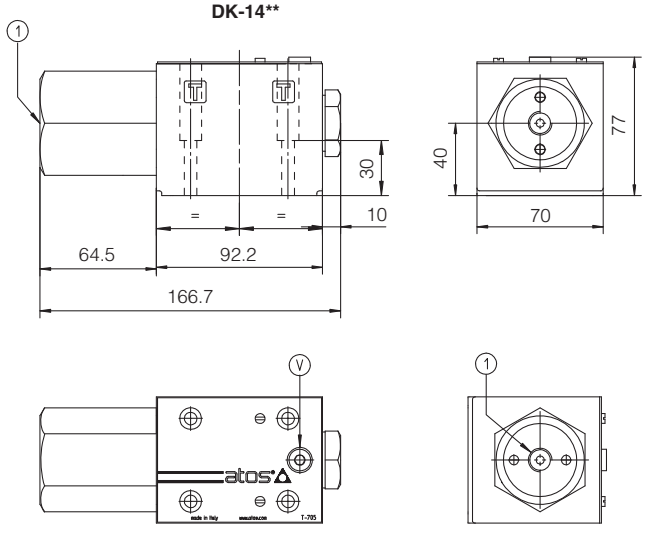
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)
(without X port)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 11,2 mm (max)
Diameter of port Y: Ø = 5 mm
Seals: 5 OR 2050, 1 OR 108

① Pilot pressure port G1/4"
Ⓥ Air bleed

Mounting subplates: see tab. E025 (only version /Y)

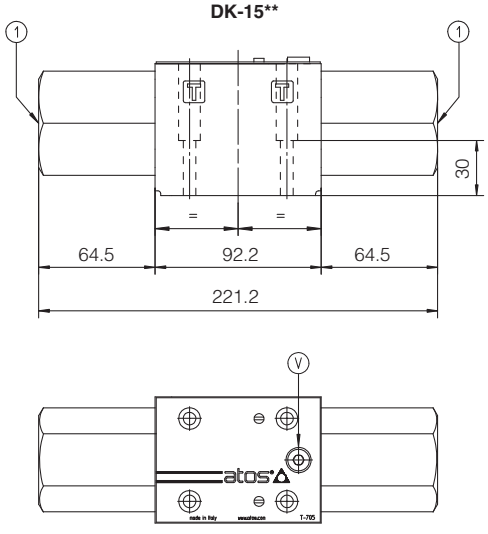
Note: Line Y must be always present and no counter pressure are allowed on this line.

DK-14**



Mass: 3,4 Kg

DK-15**

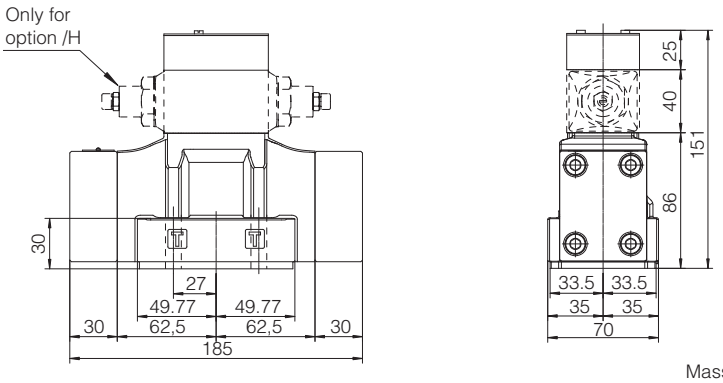


Mass: 4,2 Kg

8 DIMENSIONS OF HYDRAULIC OPERATED VALVES ISO 4401 size 16, 25 and 32 [mm]

DP-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T : Ø = 11
Diameter of ports X,Y: Ø = 5 mm
Seals: 5 OR 2050, 2 OR 108

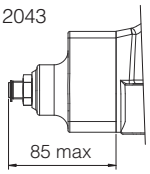


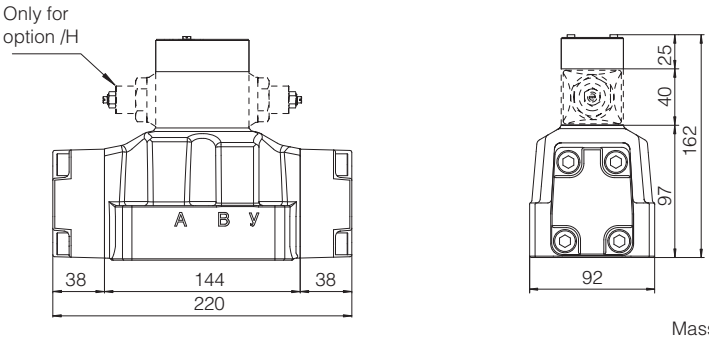
Mass: 7,1 Kg

DP-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20
Diameter of ports X,Y: Ø = 7 mm
Diameter of port L: Ø = 5 mm
Seals: 4 OR 130, 2 OR 2043

Stroke adjustment device for option /S



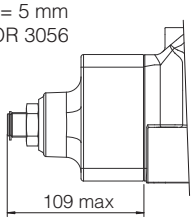


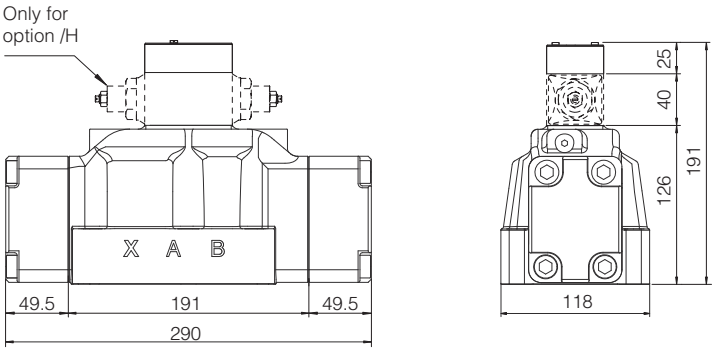
Mass: 10 Kg

DP-4

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Diameter of ports A, B, P, T : Ø = 24
Diameter of ports X,Y: Ø = 7 mm
Diameter of port L: Ø = 5 mm
Seals: 4 OR 4112, 2 OR 3056

Stroke adjustment device for option /S



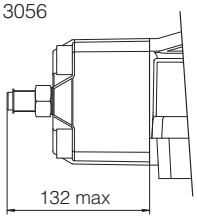


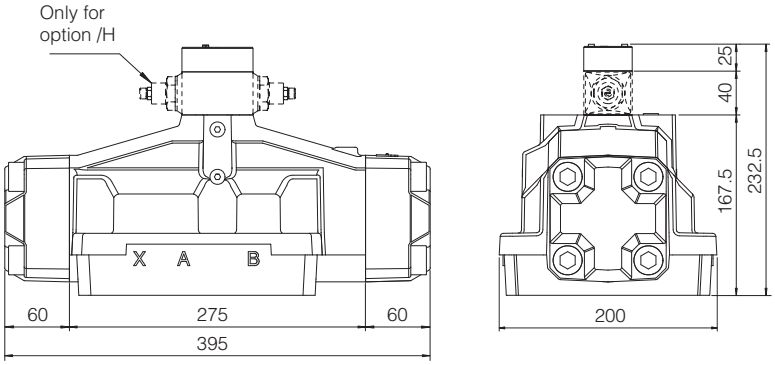
Mass: 16,5 Kg

DP-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
(port L optional)
Fastening bolts:
6 socket head screws M20x80 class 12.9
Tightening torque = 600 Nm
Diameter of ports A, B, P, T : Ø = 34 mm
Diameter of ports X,Y: Ø = 7 mm
Diameter of port L: Ø = 5 mm
Seals: 4 OR 144, 2 OR 3056

Stroke adjustment device for option /S



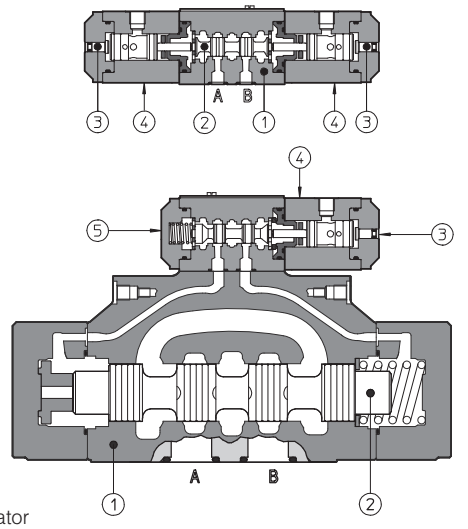


Mass: 38 Kg

Mounting subplates: see tab. K280

Pneumatic operated directional valves

ISO 4401 sizes 06, 10, 16, 25 and 32



DH-09*

DPH-48*

① Main body
② Spool
③ Manual override
④ Pneumatic actuator
⑤ Pilot valve

Pneumatic operated directional valves are spool type ②, three or four way, two or three position, designed to operate in oil hydraulic systems.
Available with single or double pneumatic actuator ④ with manual override.

Valve sizes and max flow:

DH-0 = size 06, flow up to 50 l/min
DK-1 = size 10, flow up to 160 l/min
DPH-2 = size 16, flow up to 300 l/min
DPH-4 = size 25, flow up to 700 l/min
DPH-6 = size 32, flow up to 1000 l/min

Max pressure:
350 bar for DH-0, DPH-2, DPH-4, DPH-6
315 bar for DK-1

1 MODEL CODE

DH-0	**8**	**1**	**3**	/	**A**	******	/	*****

Directional control valve, size:
DH-0 = 06
DK-1 = 10
DPH-2 = 16
DPH-4 = 25
DPH-6 = 32

Type of actuator:
8 = single actuator
9 = double actuator

Valve configuration, see sections 4 and 5
0 = free, without springs
1 = spring centered, without detent
3 = spring offset external position
5 = 2 external positions, with detent
7 = center and external positions

Spool type, see sections 4 and 5

Options:
only for valve with single actuator:
/A = Actuator device mounted on side of port B (for DH and DK). Actuator device mounted on side of port A of main body (for DPH)
only for DPH:
/D = internal drain
/E = external pressure
/H = adjustable chokes for controlling the main spool shifting time (meter-out to the pilot chambers of the main valve)
/H9= adjustable chokes for controlling the main spool shifting time (meter-in to the pilot chambers of the main valve)
/R = pilot pressure generator on port P at 4 bar
/S = main spool stroke adjustment

Series number

Seals material, see section 3:
- = NBR
PE = FKM

2 HYDRAULIC CHARACTERISTICS

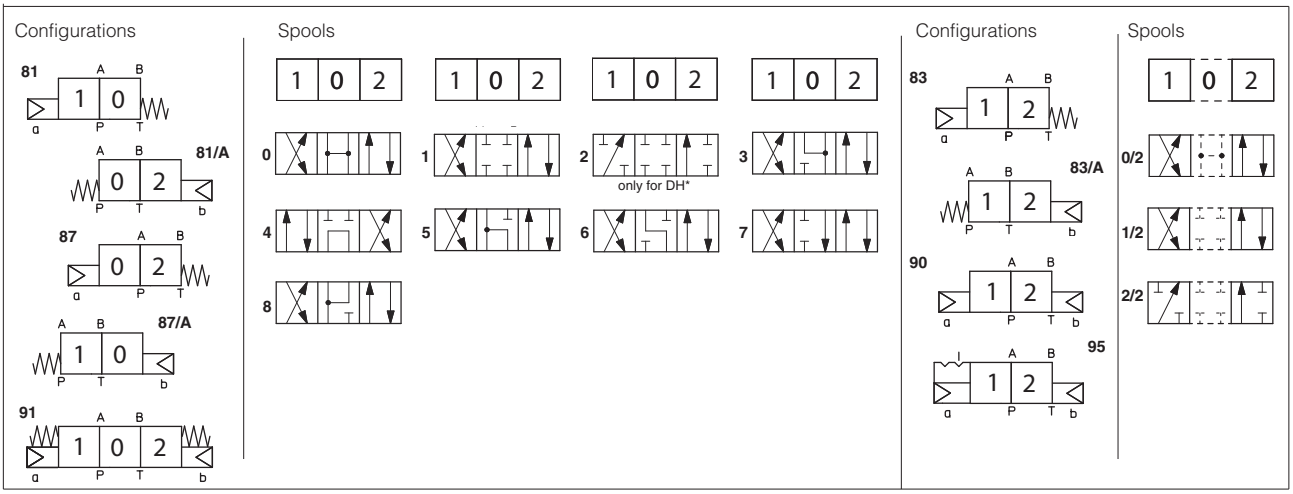
Valve model		**DH-0**	**DK-1**	**DPH-2**	**DPH-4**	**DPH-6**
Max recommended flow	[l/min]	50	160	300	700	1000
Max pressure on port P, A, B (also X for DP)	[bar]	350	315	350		
Max pressure on port T	[bar]		210	250		
Max pressure on port L and Y	[bar]	–		null pressure		
Recommended oil pressure on piloting line	[bar]	–		Min = 4 Max = 250 The device **/R** generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0, 0/1, 4, 4/8, 5.** The device **/R** has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.		
Recommended pneumatic pressure **(1)**	[bar]	Min = 2 Max = 12				

(1) filtered and lubricated air

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

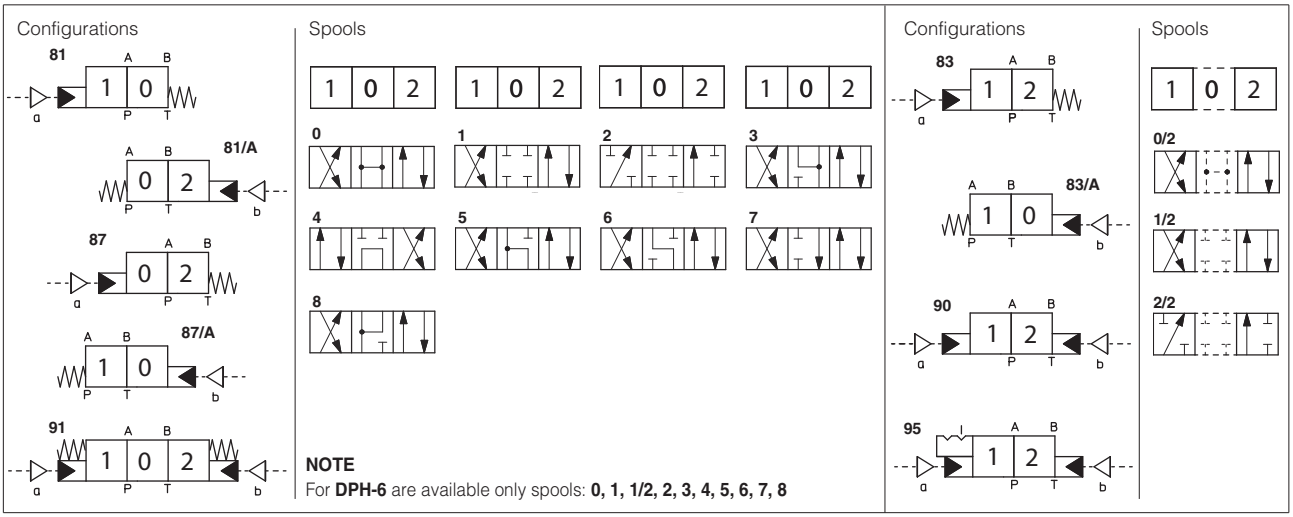
Assembly position / location	Any position for all valves except for type -*90 (without springs) that must be installed with horizontal axis if operated by impulses.		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C; /PE option = -20°C ÷ +70°C;		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

4 CONFIGURATIONS and SPOOLS of valves type DH-*, DK-*



NOTES
- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4** and **5** are also available as **1/1, 4/8** (only for DH-0) and **5/1.** They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 1/2, 3, 8** are available as **1P, 1/2P, 3P, 8P** (only for DH-0) to limit valve internal leakages.

5 CONFIGURATIONS and SPOOLS of valves type DPH-*



NOTE
For **DPH-6** are available only spools: **0, 1, 1/2, 2, 3, 4, 5, 6, 7, 8**

Special shaped spools
- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4,** and **5** are also available as **1/1, 4/8** and **5/1** are properly shaped to reduce water-hammer shocks during the switching.

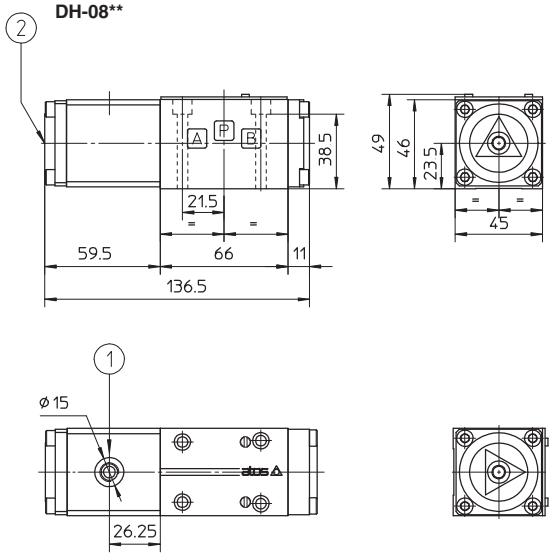
6 Q/Δp DIAGRAMS

DH-0	See note and diagrams on table E010 relating the DH* valve from which DH-0* are derivated
DK-1	See note and diagrams on table E025 relating the DKE valve from which DK-1* are derivated
DPH-2	See note and diagrams on table E085 relating the DPH*-2 valve from which DP-2* are derivated
DPH-4	See note and diagrams on table E085 relating the DPH*-4 valve from which DP-4* are derivated
DPH-6	See note and diagrams on table E085 relating the DPH*-6 valve from which DP-6* are derivated

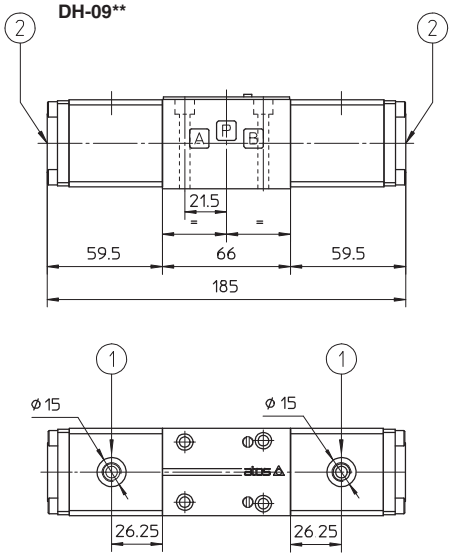
7 INSTALLATION DIMENSIONS of VALVES type DH and DK [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

DH-08**



DH-09**



Mass: 1,2 Kg

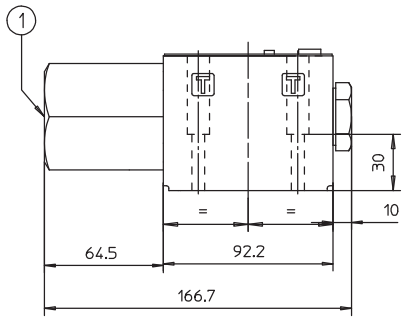
Mass: 1,6 Kg

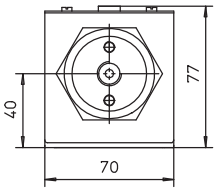
① Pilot pressure port G1/8”
② Manual override

Mounting subplates: see tab. E010

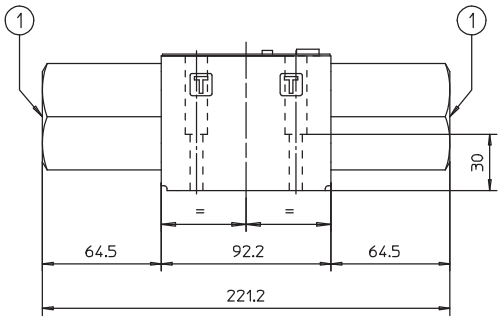
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050

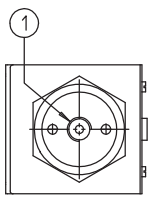
DK-18**





DK-19**





Mass: 3,4 Kg

Mass: 4,2 Kg

① Pilot pressure port G1/4”
Ⓥ Air bleed

Mounting subplates: see tab. E025

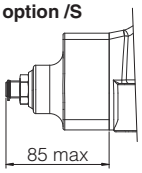
8 INSTALLATION DIMENSIONS of VALVES type DP [mm]

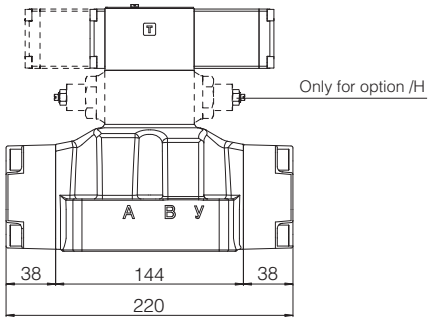
DPH-2

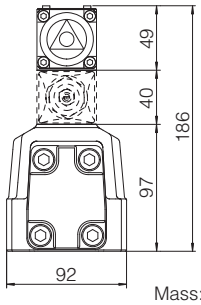
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05

Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T : Ø = 20
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 130, 2 OR 2043

Stroke adjustment device for option /S







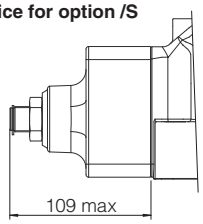
Mass: 11,5 Kg

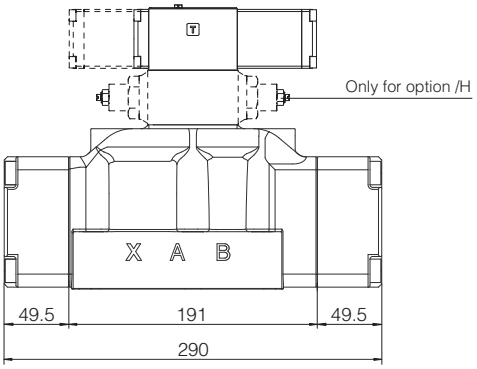
DPH-4

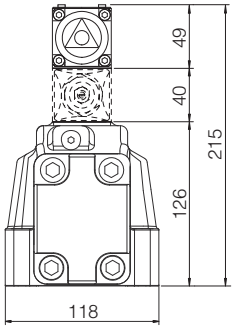
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05

Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Diameter of ports A, B, P, T: Ø = 24
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 4112, 2 OR 3056

Stroke adjustment device for option /S







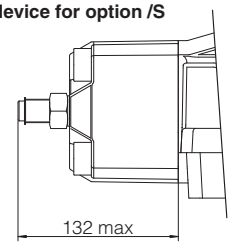
Mass: 18 Kg

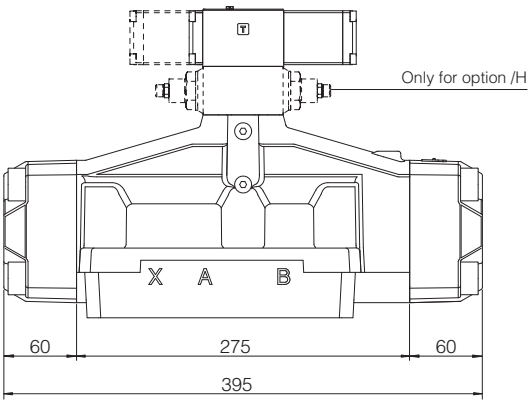
DPH-6

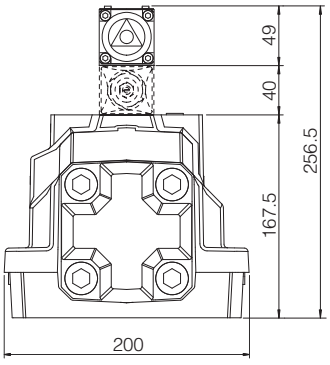
ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

Fastening bolts:
6 socket head screws M20x80 class 12.9
Tightening torque = 600 Nm
Diameter of ports A, B, P, T: Ø = 34 mm
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 144, 2 OR 3056

Stroke adjustment device for option /S



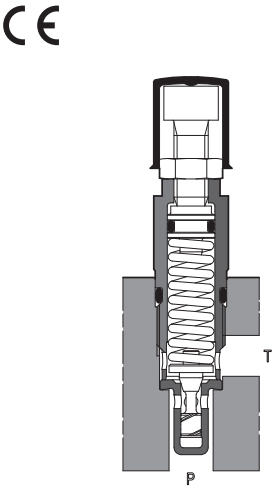




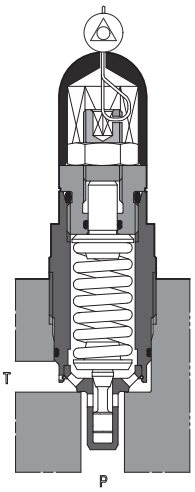
Mass: 39,5 Kg

Cartridge pressure relief valves type CART

screw-in mounting, direct operated



CART M-5/***



CART M-6/*/RS**

CART are screw-in, direct operated pressure relief valves.
They are used to limit the max pressure in the hydraulic systems or to protect part of the circuit from overpressure.
They are available in six sizes for different flow and pressure ranges.

The cartridge execution is specifically designed to reduce the dimension of blocks and manifolds, without penalizing the functional characteristics.

Option **RS**, conforms to the Machine Directive (2006/42/CE), with factory preset and lead sealed regulation.
The factory pressure setting required by the costumer corresponds to the valve's cracking pressure.

Max flow: **150 l/min**
Max pressure: up to **420 bar**

1 MODEL CODE

CART	M-6	/	420	/	RS	/	*	**	/	*

CART — Screw-in relief cartridges

M-6 — Size:
M-3 = G1/2 **(1)**
M-4 = M14x1
M-5 = M20x1,5
M-6 = M33x1,5 **(1)**
ARE-15 = M32x1,5
ARE-20 = M35x1,5 **(1)**

420 — Max pressure:
see section 3

RS — Options:
see section 5 for options availability and combination:
R = leak free execution **(2)**
RS = leak free execution plus lead sealed regulation conforming to 2006/42/CE

Manual override only for standard and /R option **(3)**:
V = regulating handwheel
VF = regulating knob
VS = regulating knob with safety locking

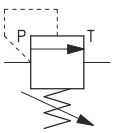
***** — Only for RS option:
280 = factory pressure setting to be defined by the customer
min step: 1 bar - min pressure setting: 25 bar
(example 280 = 280 bar)

****** — Series number

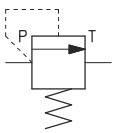
***** — Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

For **PED** version see technical table CY010
(1) Available also in stainless steel execution, see technical table CW010
(2) Standard execution of CART M-4 and CART ARE-20 provides the leak free feature, then the /R is always present in the valve model code, with the exception in case of RS options
(3) For handwheel and knob features, see sections 7, 8. For their availability see section 5

2 HYDRAULIC SYMBOLS



CART
CART **/R



CART **/RS

3 HYDRAULIC CHARACTERISTICS

Valve model		CART M-3	CART M-4	CART M-5	CART M-6	CART ARE-15	CART ARE-20
Max pressure setting [bar]	**STANDARD**	50 100 210 350 420	100 210 350 420	50 100 210 250 350	50 100 210 350 500	15 50 75 150 250 350 420	50 100 210 315 400
	R				50 100 210 350 500	15 50 75 150 250 420	
	RS		220 270 350		220 270 330 350	150 190 230	
Pressure range [bar]	**STANDARD (1)**	4÷50 6÷100 7÷210 8÷350 15÷420	6÷100 7÷210 8÷350 15÷420	2÷50 3÷100 5÷210 7÷250 8÷350	2÷50 3÷100 8÷210 15÷350 15÷500	2÷15 3÷50 4÷75 8÷150 8÷250 8÷350 15÷420	3÷50 5÷100 6÷210 8÷315 10÷400
	R (1)				2÷50 3÷100 10÷210 15÷350 15÷500	2÷15 3÷50 4÷75 8÷150 8÷250 15÷420	
	RS (1)		210÷260 260÷300 300÷370		200÷250 250÷290 290÷350 310÷370	130÷170 170÷210 210÷250	
Max pressure on port T [bar]		50	50	50	50	50	50
Max flow [l/min]	**STANDARD**	2,5	15	35	40	75	120
	RS	2,5	15	50	60	100	150

(1) The values correspond to the min and max regulation of the valve's craking pressure

4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

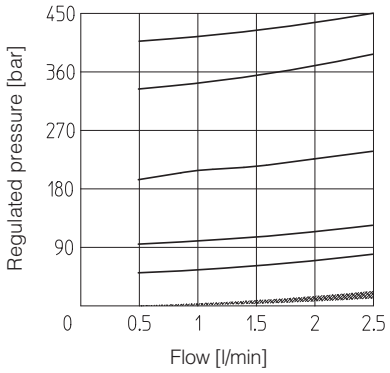
5 OPTIONS AVAILABILITY

Valve model		CART M-3	CART M-4	CART M-5	CART M-6	CART ARE-15	CART ARE-20
Option	**/R**		STANDARD		●	●	STANDARD
	/RS		●		●	●	
	/V	●			●	●	●
	/VF				●	●	
	/VS				●	●	
Combinated option **(1)**	**/RV**				●	●	●
	/RVF				●	●	
	/RVS				●	●	

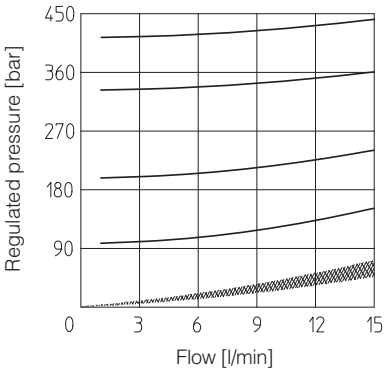
(1) RV = leak free and regulating handwheel
RVF = leak free and regulating knob
RVS = leak free and regulating knob with safety lock

6 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

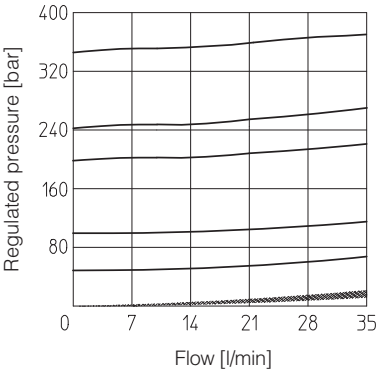
CART M-3



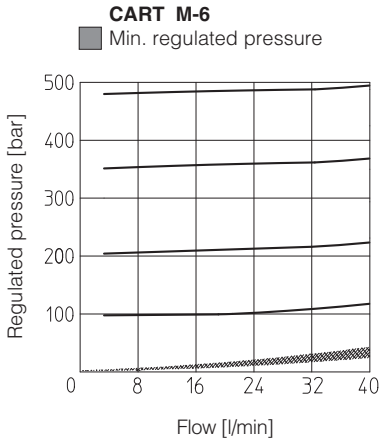
CART M-4 **/R



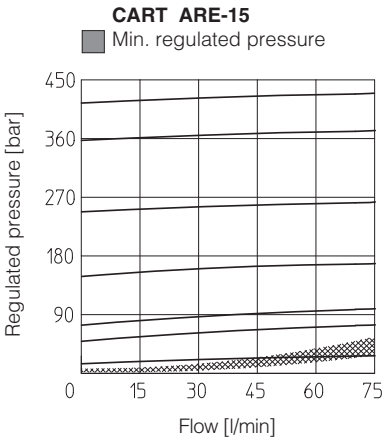
CART M-5



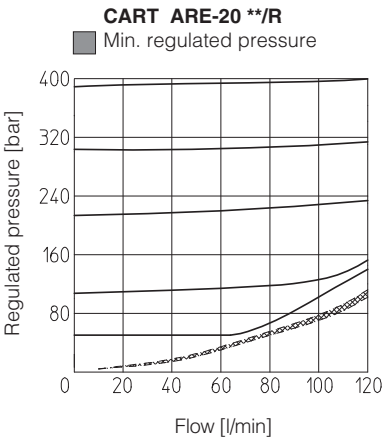
CART M-6



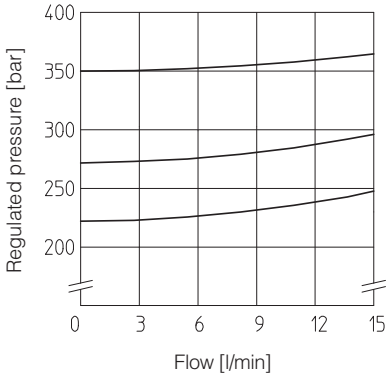
CART ARE-15



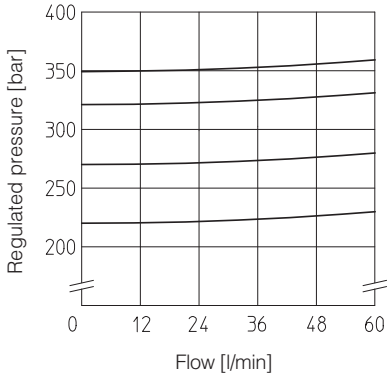
CART ARE-20 **/R



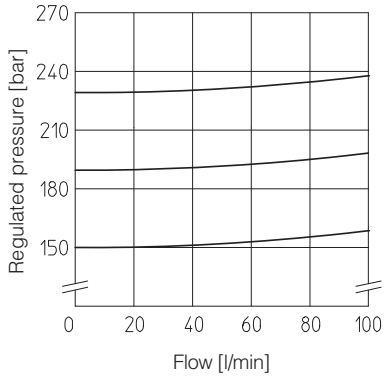
CART M-4 **/RS



CART M-6 **/RS

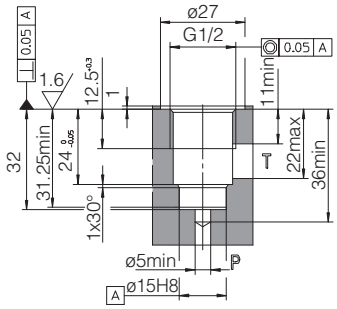


CART ARE-15 **/RS

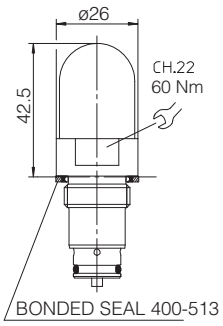


7 CAVITY AND DIMENSIONS FOR CART M-3, M-4 AND M-5 [mm]

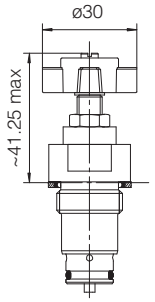
CART M-3



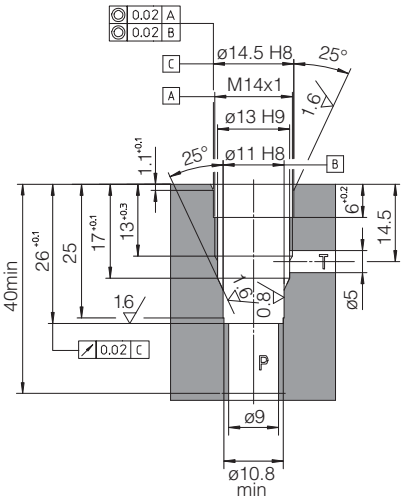
Standard



Option /V

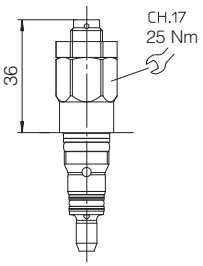


CART M-4

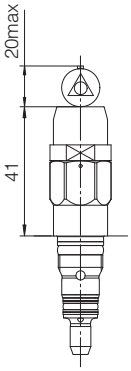


Cavity drawing not in scale
with the cartridge

Standard

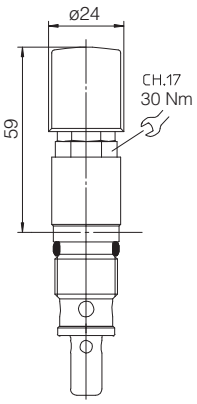


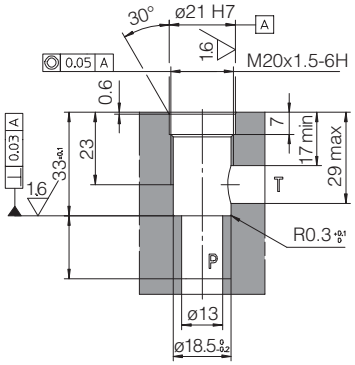
Option /RS



CART M-5

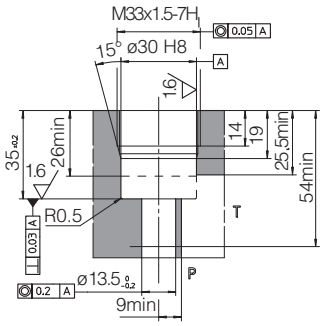
Standard



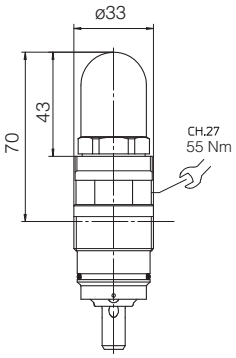


8 CAVITY AND DIMENSIONS FOR CART M-6, CART ARE-15 AND ARE-20 [mm]

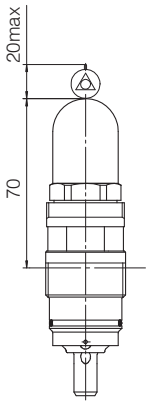
CART M-6



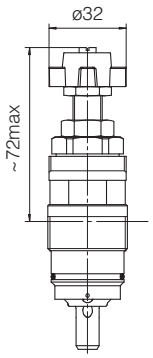
Standard



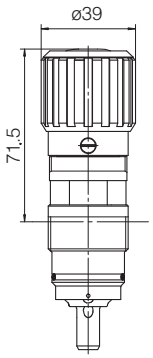
Option /RS



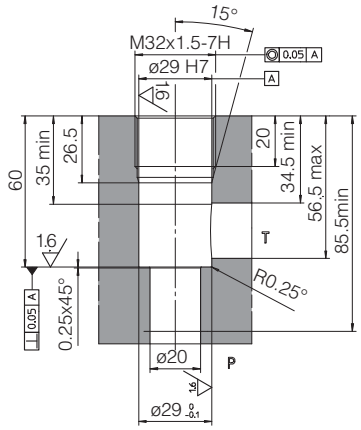
Option /V



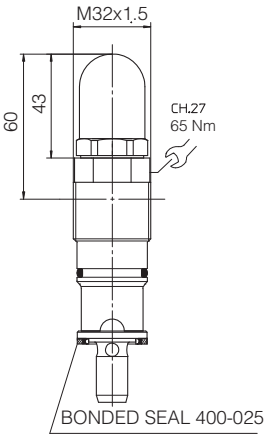
Option /VF /VS



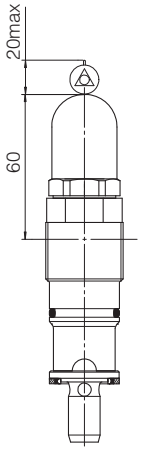
CART ARE-15



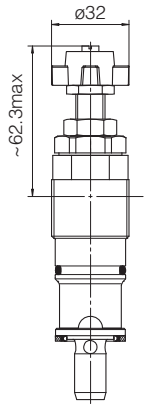
Standard



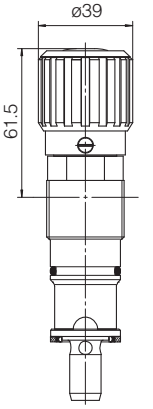
Option /RS



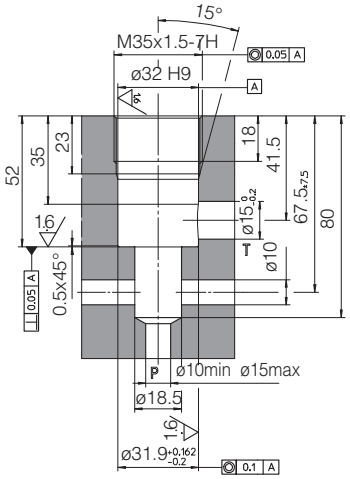
Option /V



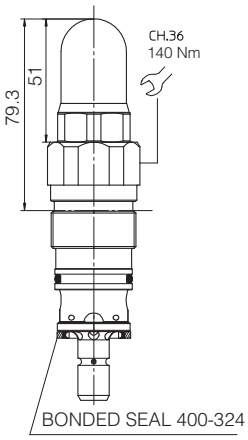
Option /VF /VS



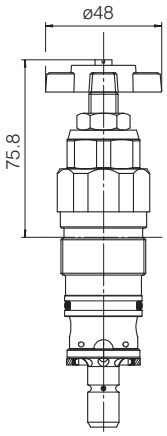
CART ARE-20



Standard

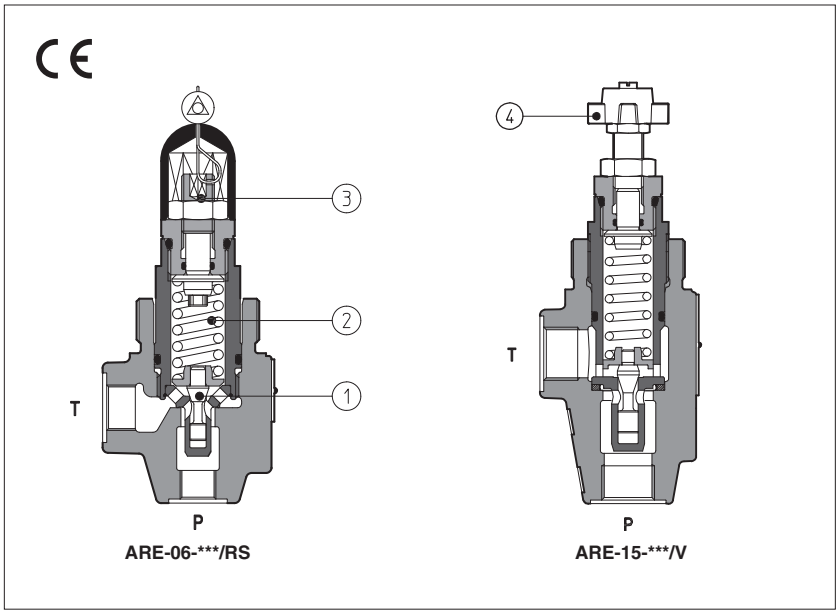


Option /V



Pressure relief valves type ARE

direct operated, in line mounting



ARE-06-*/RS** **ARE-15-***/V**

ARE are poppet type, directed operated pressure relief valves, with threaded ports for in line mounting.

The flow P→T is permitted when pressure force acting on the poppet ① overcomes the force of the spring ②.

Regulation is operated by means of a screw ③ or optionally by means of a handwheel ④ acting on the spring.

Clockwise rotation increases the pressure.

These valves are available in two sizes, with port P=G 1/4" or G 1/2".

Option **RS**, conforms to the Machine Directive (2006/42/CE), with factory preset and lead sealed regulation.
The factory pressure setting required by the costumer corresponds to the valve's cracking pressure.

Max flow: **100 l/min**:
Max pressure: ARE-06 up to **500 bar**
ARE-15 up to **420 bar**

1 MODEL CODE

ARE	-	06	/	350	/	RS	/	*	**	/	*

ARE = pressure relief valve with thread connections
Available also in cartridge execution, see tab. C010

Size:
06 = port P G 1/4"
15 = port P G 1/2"

Max pressure:
see section 3

Options **(2)**:
R = leak free execution **(2)**
RS = leak free execution plus lead sealed regulation conforming to 2006/42/CE

Manual override only for standard and /R option:
V = regulating handwheel
VF = regulating knob
VS = regulating knob with safety locking

Only for RS options:
280 = factory pressure setting to be defined depending to the customer requirement (example 280 = 280 bar)

Series number

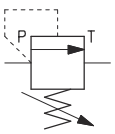
Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

For **PED** version see technical table CY020

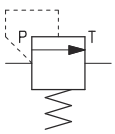
(1) Possible combined options:
RV = reduced leakages and regulating handweel
RVF = reduced leakages and regulating knob
RVS = reduced leakages and regulating knob with safety locking

2 HYDRAULIC SYMBOLS

Hydraulic symbol



ARE-06
ARE-15



ARE-06 **/RS
ARE-15 **/RS

3 HYDRAULIC CHARACTERISTICS

Valve model		ARE-06					ARE-15						
Max pressure setting [bar]	**Standard**	50	100	210	350	500	15	50	75	150	250	350	420
	/R	50	100	210	350	500	15	50	75	150	250		420
	/RS	220	270	330	350				150	190	230		
Pressure range [bar]	**Standard**	2÷50	3÷100	10÷210	15÷350	30÷500	2÷15	3÷50	4÷75	8÷150	8÷250	30÷350	30÷420
	/R (1)	2÷50	3÷100	10÷210	15÷350	30÷500	2÷15	3÷50	4÷75	8÷150	8÷250		30÷420
	/RS (1)	200÷250	250÷290	290÷350	310÷370				130÷170	170÷210	210÷250		
Max pressure port T [bar]		50					50						
Max flow [l/min]	**Standard, /R**	40					75						
	/RS	60					100						

(1) The values correspond to the min and max regulation of the valve's craking pressure

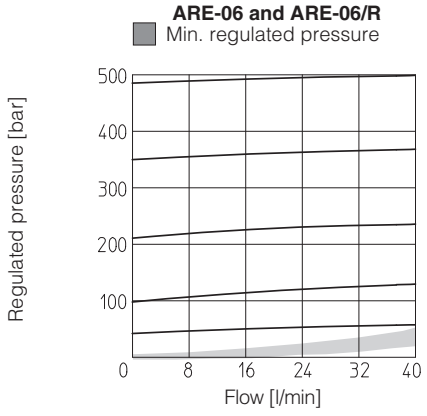
4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μm (β25 ≥75 recommended)

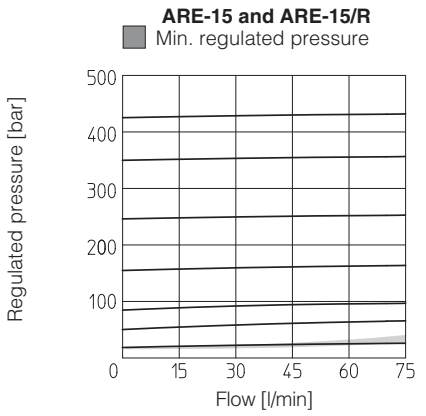
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

5 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

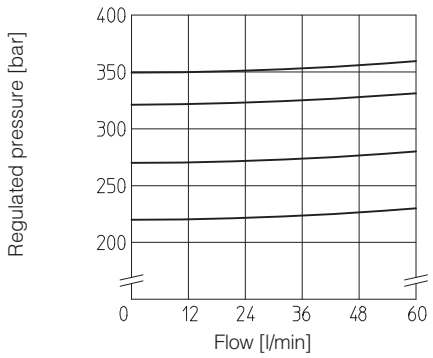
ARE-06 and ARE-06/R



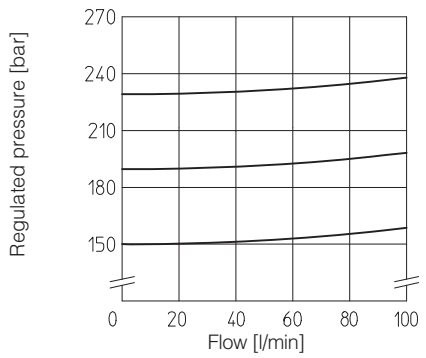
ARE-15 and ARE-15/R



ARE-06 /RS



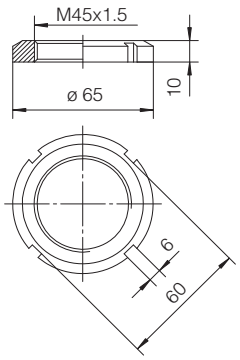
ARE-15 /RS

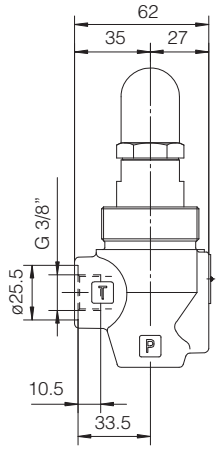


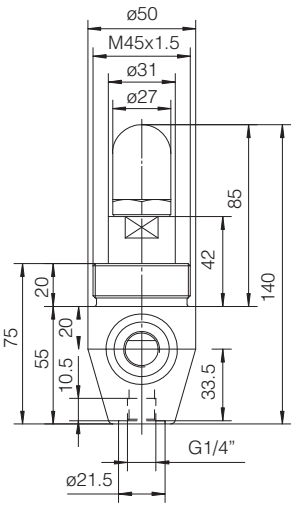
6 DIMENSIONS [mm]

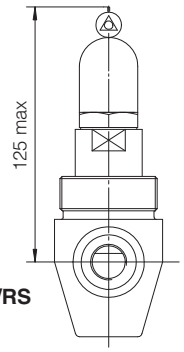
ARE-06

P = INLET PORT G 1/4”
T = OUTLET PORT G 3/8”
Locking ring for fastening the valve.
Model code: SP-6-RE-310030

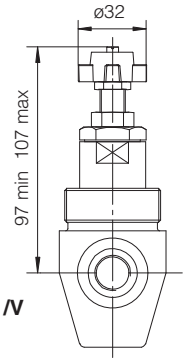




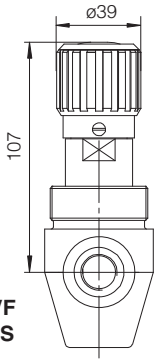




Option /RS



Option /V

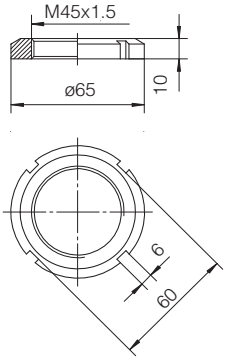


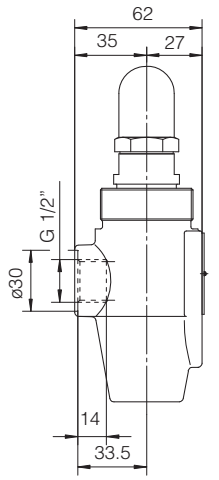
Option /VF /VS

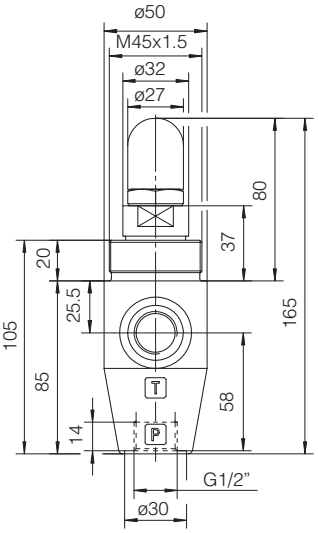
Mass: 1 Kg

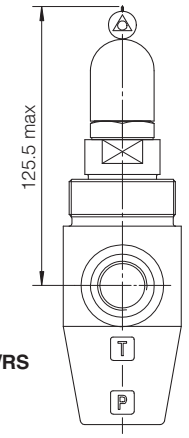
ARE-15

P = INLET PORT G 1/2”
T = OUTLET PORT G 1/2”
Locking ring for fastening the valve.
Model code: SP-6-RE-310030

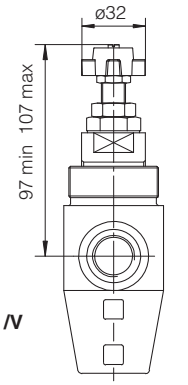




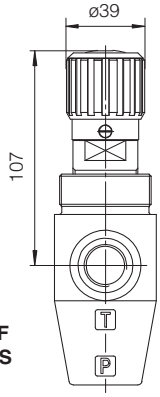




Option /RS



Option /V



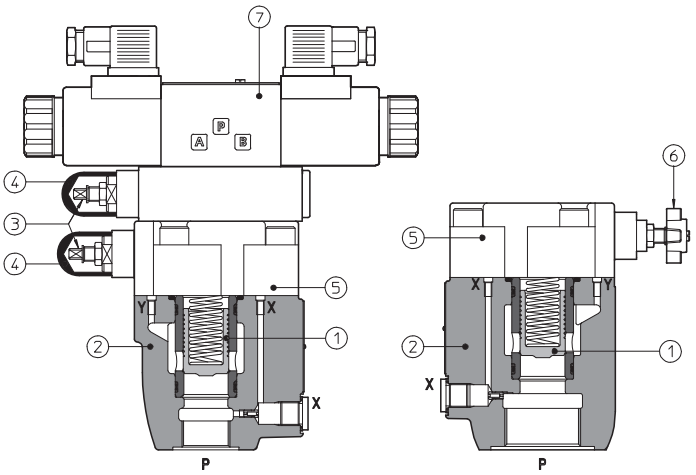
Option /VF /VS

Note:
For handwheel features, see technical table K150.

Mass: 1,3 Kg

Pressure relief valves type ARAM

two stage, in line mounting - G 3/4" and G 1¼" threaded ports



ARAM-20/20...-E **ARAM-32..../V**

ARAM are two stage pressure relief valves with balanced poppet, designed with threaded ports for in-line mounting.

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw ③ protected by cap ④ installed in the cover ⑤.

Optional versions with setting adjustment by handwheel ⑥ instead of the grub screw are available on request.
Clockwise rotation increases the pressure.

ARAM can be equipped with a pilot solenoid valve ⑦ for venting or for different pressure setting, type:

- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances with **cURus** certified solenoids

Threaded ports: **G 3/4", G 1¼"**
Max flow: **350, 500 l/min**
Max pressure up to **350 bar**

1 MODEL CODE

ARAM	-	20	/	20	/	210	/	100/100	/	V	-	I	X	24DC	**	/	*

ARAM = pressure relief valve threated port connections

Size:
20= port P - G 3/4"
32= port P - G 1¼"

Setting pressure and venting option **(1)**:
- = one setting pressure without option
10 = one setting pressure with venting, with de-energized solenoid
11 = one setting pressure with venting, with energized solenoid
20 = two setting pressure with venting, with de-energized solenoid
21 = two setting pressure with venting, with energized solenoid
22 = two setting pressure without venting
32 = three setting pressure without venting

Setting: see section 3 for available setting

Pressure range of second/third setting **(1)**:
50 = 4÷50 bar **100** = 6÷100 bar
210 = 7÷210 bar **350** = 8÷350 bar

Options, see section 5
E V WP Y

Pilot valve **(1)**:
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(1):**
See section 6 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section 7 **(1)**:

Series number

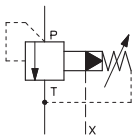
Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

For **PED** version see technical table CY045

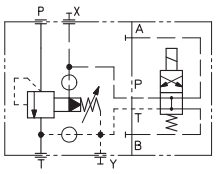
(1) Only for ARAM with solenoid valve for venting and/or for the selection of the setting pressure.

2 HYDRAULIC SYMBOL

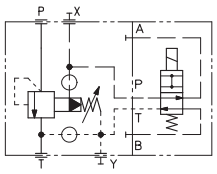
ARAM



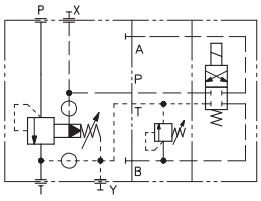
ARAM-/10**

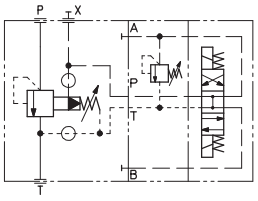


ARAM-/11**

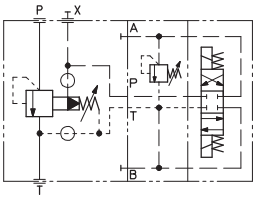


ARAM-/22**

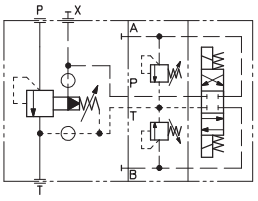




ARAM-/20**



ARAM-/21**



ARAM-/32**

3 HYDRAULIC CHARACTERISTICS

Valve model	**ARAM-20**	**ARAM-32**
Setting [bar]	50; 100; 210; 350	
Pressure range [bar]	4÷50; 6÷100; 7÷210; 8÷350	
Max pressure [bar]	ports P, X = 350 Ports T, Y = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E010 and E015	
Max flow [l/min]	350	500

4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 µm (β25 ≥75 recommended)		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4.1 Coils characteristics (for ARAM with pilot solenoid valve)

Insulation class	DHI pilot	**H** (180°C)	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)	
Relative duty factor		100%	
Supply voltage and frequency		See electric feature 7	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

5 OPTIONS

/E = external pilot
/V = regulating handwheel instead of grub screw protected by cap (for handwheel features, see table K150)
/WP = prolunged manual override protected by rubber cap (only for ARAM with pilot solenoid valve)
/Y = external drain (only for ARAM with pilot solenoid valve)

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR ARAM WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors see tab. E010 and K500

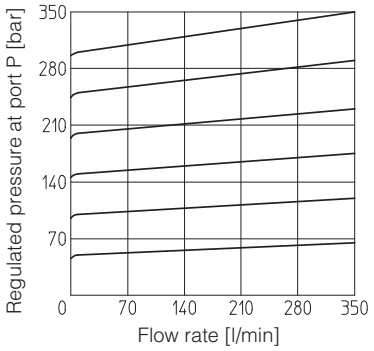
7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption **(3)** DHI	DHE	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC **(2)** 115/60 AC 120/60 AC 230/50 AC **(2)** 230/60 AC	**110/50/60 AC** **115/60 AC (5)** **120/60 AC (6)** **230/50/60 AC** **230/60 AC**	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

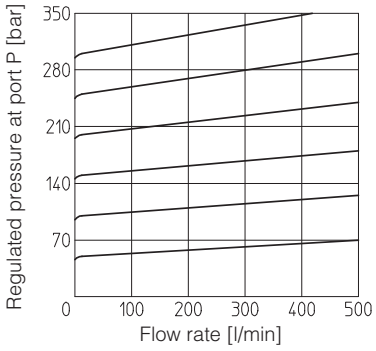
(1) For other supply voltages available on request see technical tables E010, E015.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When solenoid is energized, the inrush current is approx 3 times the holding current.
(5) Only for DHE
(6) Only for DHI

8 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

ARAM-20

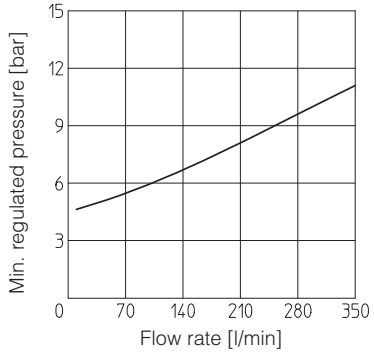


ARAM-32

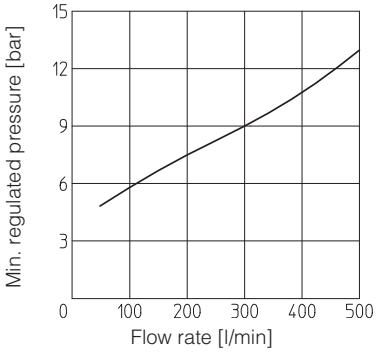


9 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

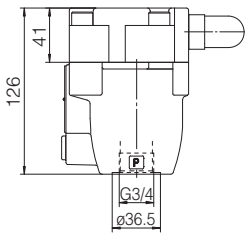
ARAM-20

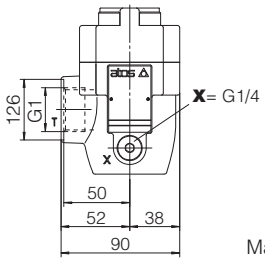


ARAM-32

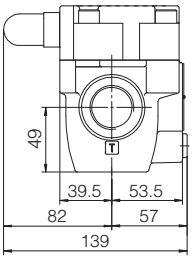


ARAM-20

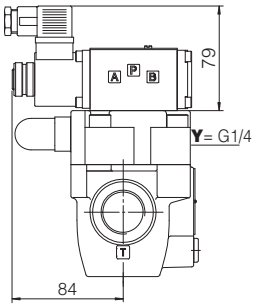




Mass: 3,9 Kg

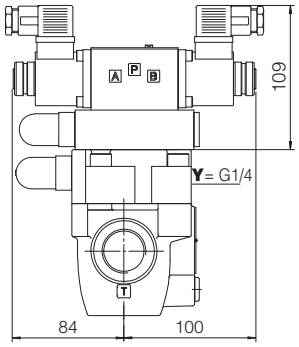


X = port connection for external pilot
Y = port connection for external drain



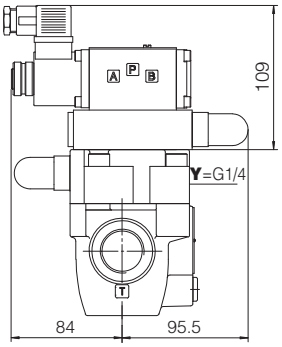
ARAM-20/10/-IX**
ARAM-20/11/-IX**

Mass: 5,4 Kg



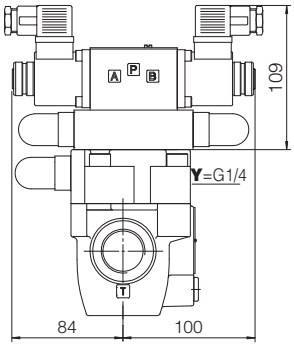
ARAM-20/20/-IX**
ARAM-20/21/-IX**

Mass: 7,1 Kg



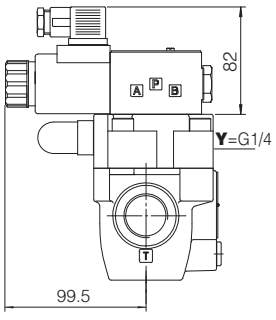
ARAM-20/22/-IX**

Mass: 6,8 Kg



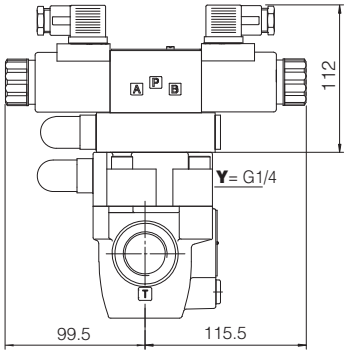
ARAM-20/32/-IX**

Mass: 7,4 Kg



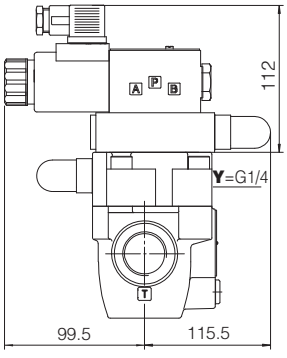
ARAM-20/10/-EX**
ARAM-20/11/-EX**

Mass: 5,7 Kg



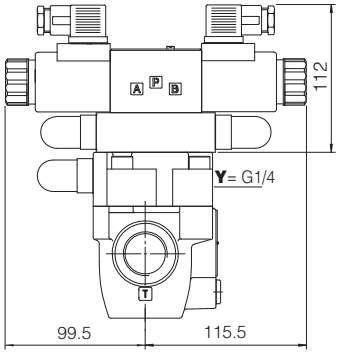
ARAM-20/20/-EX**
ARAM-20/21/-EX**

Mass: 7,7 Kg



ARAM-20/22/-EX**

Mass: 7,2 Kg

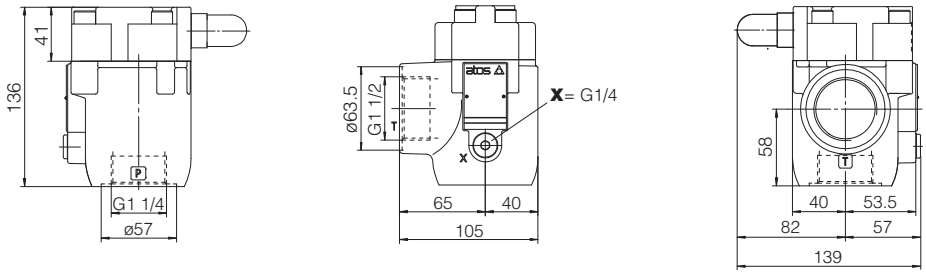


ARAM-20/32/-EX**

Mass: 8 Kg

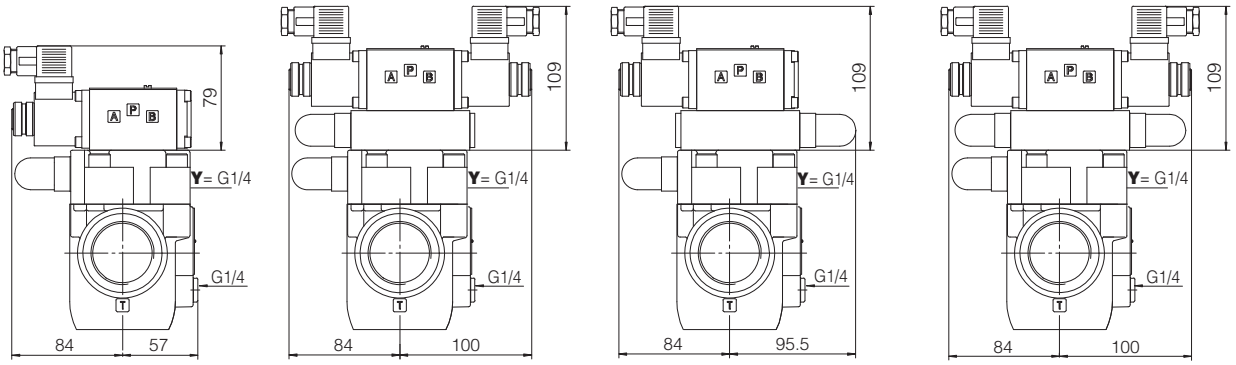
Overall dimensions refer to valves with connectors type 666

ARAM-32



X = port connection for external pilot
Y = port connection for external drain

Mass: 4,7 Kg



ARAM-32/10/-IX**
ARAM-32/11/-IX**

Mass: 6,2 Kg

ARAM-32/20/-IX**
ARAM-32/21/-IX**

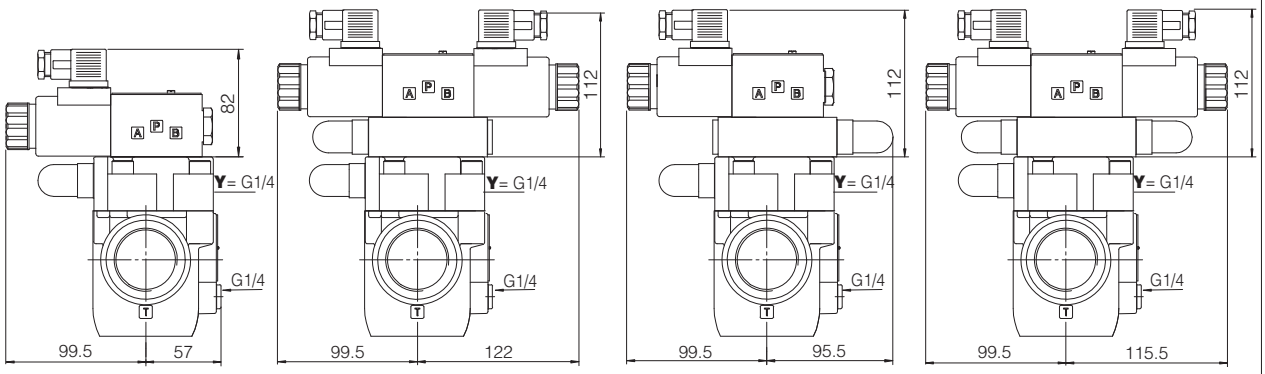
Mass: 7,9 Kg

ARAM-32/22/-IX**

Mass: 7,6 Kg

ARAM-32/32/-IX**

Mass: 8,2 Kg



ARAM-32/10/-EX**
ARAM-32/11/-EX**

Mass: 6,5 Kg

ARAM-32/20/-EX**
ARAM-32/21/-EX**

Mass: 8,5 Kg

ARAM-32/22/-EX**

Mass: 7,9 Kg

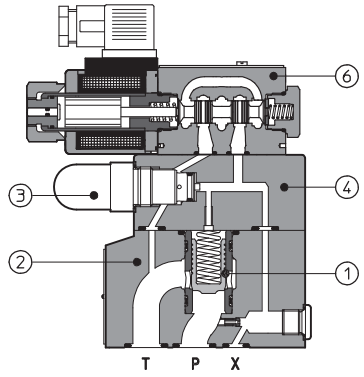
ARAM-32/32/-EX**

Mass: 8,8 Kg

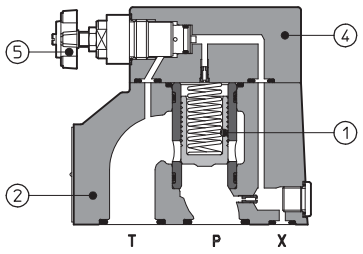
Overall dimensions refer to valves with connectors type 666

Pressure relief valves type AGAM

two stage, subplate mounting - ISO 6264 size 10, 20 and 32



AGAM-10/11...-E



AGAM-20/..../V

AGAM are two stage pressure relief valves with balanced poppet, designed to operate in oil hydraulic systems.

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw protected by cap ③ in the cover ④.

Optional versions with setting adjustment by handwheel ⑤ instead of the grub screw are available on request.

Clockwise rotation increases the pressure.

AGAM can be equipped with a pilot solenoid valve ⑥ for venting or for different pressure setting type:

- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances with **cURus** certified solenoids

Mounting surface: **ISO 6264 size 10, 20** and **32**
Max flow: **200, 400** and **600 l/min**
Max pressure up to **350 bar**

1 MODEL CODE

AGAM	-	20	/	20	/	210	/	100/100	/	V	-	I	X	24DC	**	/	*

AGAM = pressure relief valve subplate mounting

Size:
10 20 32

Setting pressure and venting option:
- = one setting pressure without option
10 = one setting pressure with venting, with de-energized solenoid
11 = one setting pressure with venting, with energized solenoid
20 = two setting pressure with venting, with de-energized solenoid
21 = two setting pressure with venting, with energized solenoid
22 = two setting pressure without venting
32 = three setting pressure without venting

Setting: see section 3 for available setting **(1)**

Pressure range of second/third setting **(1)**:
50 = 4÷50 bar
100 = 6÷100 bar
210 = 7÷210 bar
350 = 8÷350 bar

Options, see section 5
E V WP Y

Pilot valve **(1)**:
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(1):**
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section 8 **(1)**:

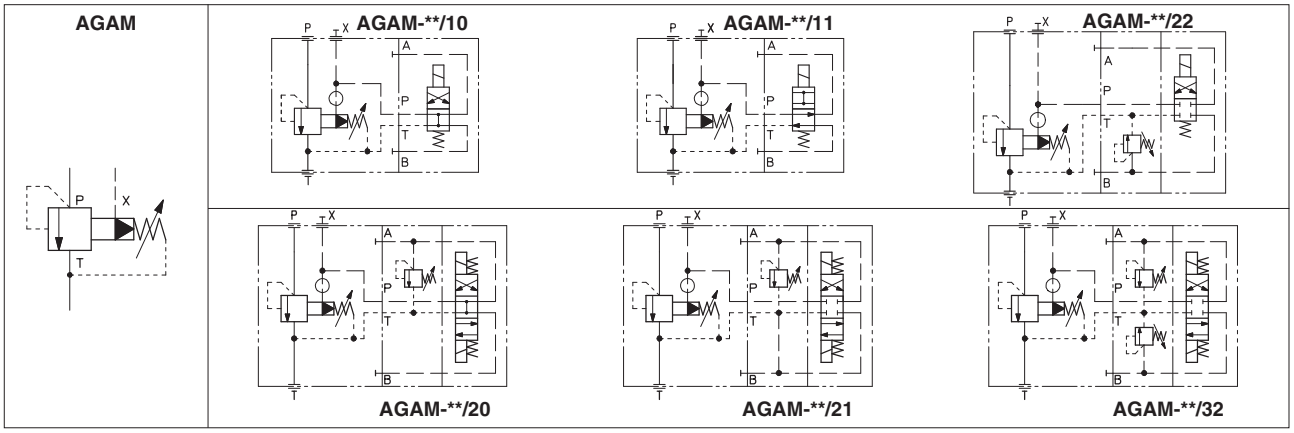
Series number

Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

For **PED** version see technical table CY066

(1) Only for AGAM with solenoid valve for venting and/or for the selection of the setting pressure

2 HYDRAULIC SYMBOLS



3 HYDRAULIC CHARACTERISTICS

Valve model	AGAM-10	AGAM-20	AGAM-32
Setting [bar]	50; 100; 210; 350		
Pressure range [bar]	4÷50; 6÷100; 7÷210; 8÷350		
Max pressure [bar]	ports P, X = 350 Ports T, Y = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E010 and E015		
Max flow [l/min]	200	400	600

4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4.1 Coils characteristics (for AGAM with pilot solenoid valve)

Insulation class	DHI pilot	**H** (180°C)	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)	
Relative duty factor		100%	
Supply voltage and frequency		See electric feature 7	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

5 OPTIONS

/E = external pilot
/V = regulating handwheel instead of grub screw protected by cap (for handwheel features, see table K150)
/WP = prolunged manual override protected by rubber cap (only for AGAM with pilot solenoid valve)

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR AGAM WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tab. E010 and K500

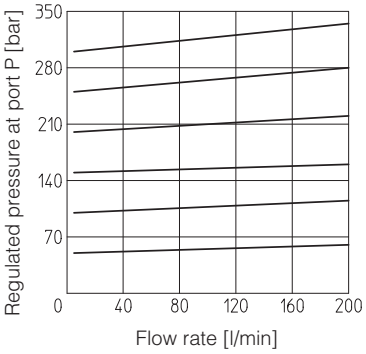
7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption **(3)** DHI	Power consumption **(3)** DHE	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
DHI DHE	DC	12 DC	**12 DC**	666 or 667	33 W	30 W	COU-12DC	green	COE-12DC
		24 DC	**24 DC**				COU-24DC	red	COE-24DC
		110 DC	**110 DC**				COU-110DC	black	COE-110DC
		220 DC	**220 DC**				COU-220DC	black	COE-220DC
	AC	110/50 AC **(2)**	**110/50/60 AC**	666 or 667	60 VA	58 VA	COI-110/50/60AC	yellow	COE-110/50/60AC
		115/60 AC	**115/60 AC (5)**		-	80 VA	-	-	COE-115/60AC
		120/60 AC	**120/60 AC (6)**		60 VA	-	COI-120/60AC	white	-
		230/50 AC **(2)**	**230/50/60 AC**		60 VA	58 VA	COI-230/50/60AC	light blue	COE-230/50/60AC
		230/60 AC	**230/60 AC**		60 VA	80 VA	COI-230/60AC	silver	COE-230/60AC

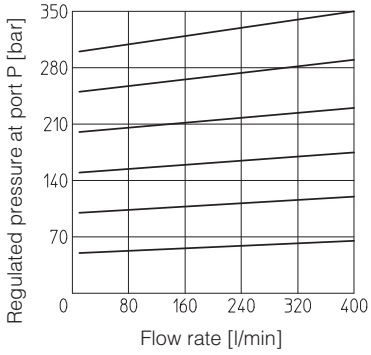
(1) For other supply voltages available on request see technical tables E010, E015.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When AC solenoid is energized, the inrush current is approx 3 times the holding current.
(5) Only for DHE
(6) Only for DHI

8 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

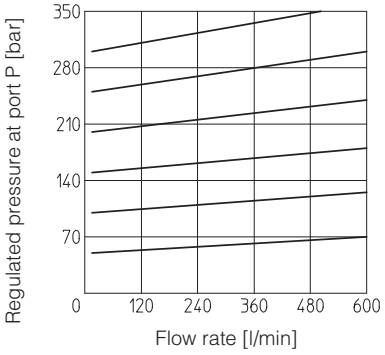
AGAM-10



AGAM-20

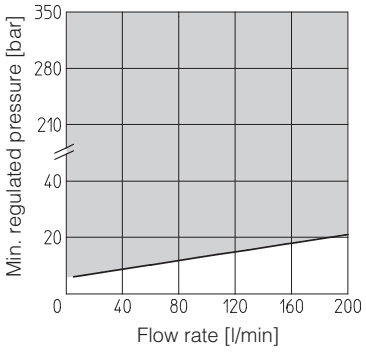


AGAM-32

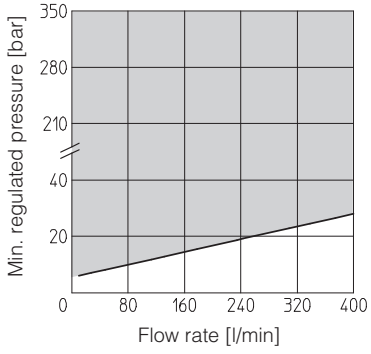


9 PERMISSIBLE RANGE (shared area) based on mineral oil ISO VG 46 at 50°C

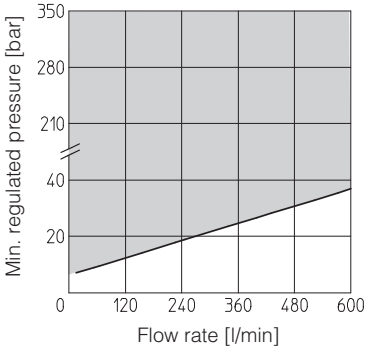
AGAM-10



AGAM-20

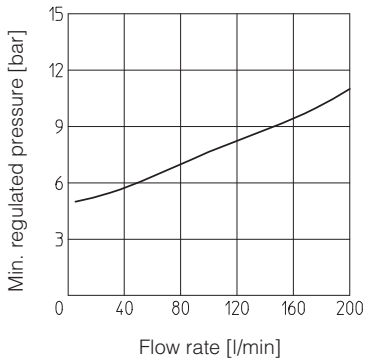


AGAM-32

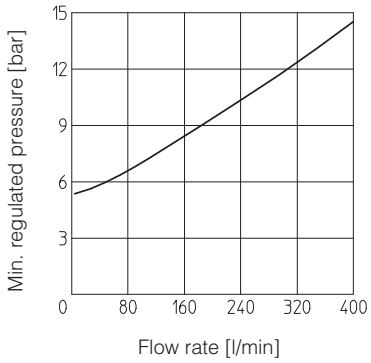


10 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

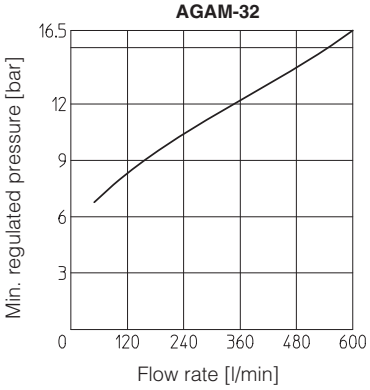
AGAM-10



AGAM-20

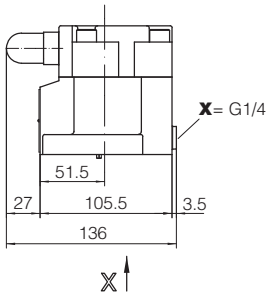


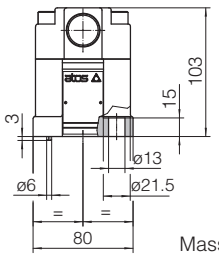
AGAM-32



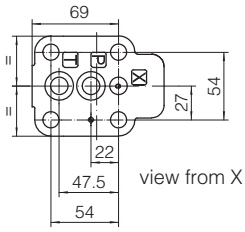
11 DIMENSIONS [mm]

AGAM-10

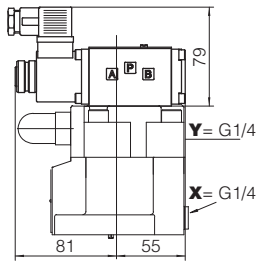




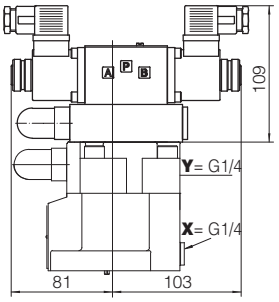
Mass: 3,6 Kg



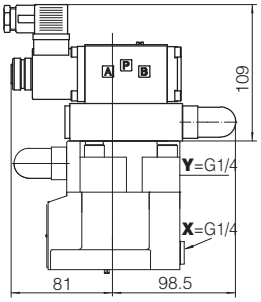
ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
Fastening bolts:
4 socket head screws
M12x35 class 12.9
Tightening torque = 125 Nm
Seals: 2 OR 123; 1 OR 109/70
Ports P, T: Ø = 14,5 mm
Ports X: Ø = 3,2 mm



AGAM-10/10/-IX**
AGAM-10/11/-IX**
Mass: 5,1 Kg

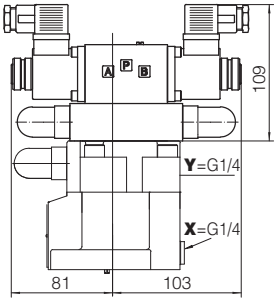


AGAM-10/20/-IX**
AGAM-10/21/-IX**
Mass: 6,2 Kg



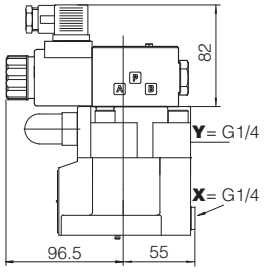
AGAM-10/22/-IX**

Mass: 5,9 Kg

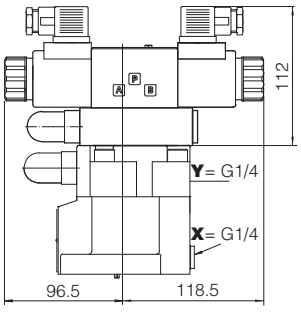


AGAM-10/32/-IX**

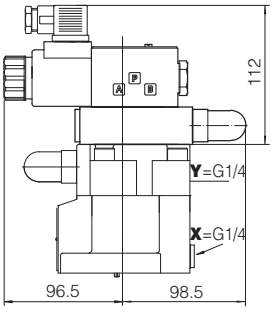
Mass: 6,3 Kg



AGAM-10/10/-EX**
AGAM-10/11/-EX**
Mass: 5,1 Kg

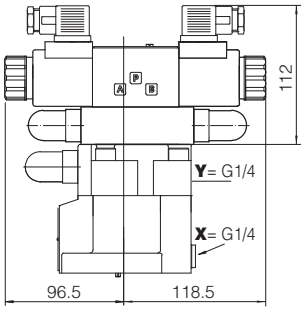


AGAM-10/20/-EX**
AGAM-10/21/-EX**
Mass: 6,2 Kg



AGAM-10/22/-EX**

Mass: 5,9 Kg

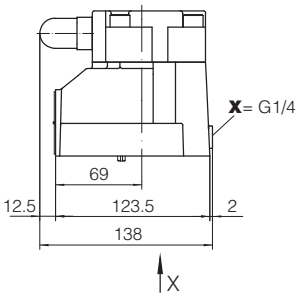


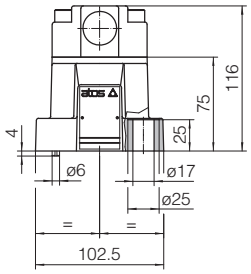
AGAM-10/32/-EX**

Mass: 6,3 Kg

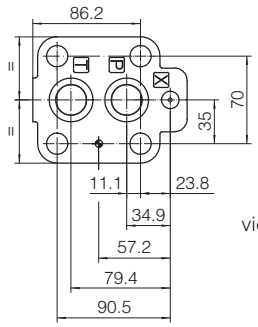
Overall dimensions refer to valves with connectors type 666

AGAM-20



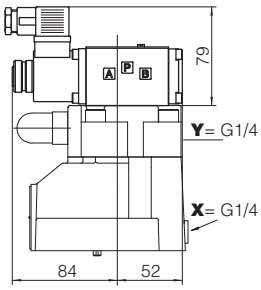


Mass: 4,8Kg



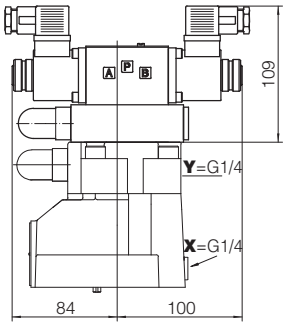
view from X

ISO 6264: 2007
Mounting surface: 6264-08-11-1-97
Fastening bolts:
4 socket head screws M16x50 class 12.9
Tightening torque = 300 Nm
Seals: 2 OR 4112; 1 OR 109/70
Ports P, T: Ø = 24 mm
Ports X: Ø = 3,2 mm



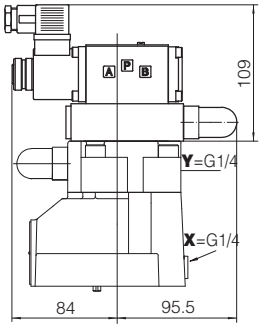
AGAM-20/10/-IX**
AGAM-20/11/-IX**

Mass: 6,3 Kg



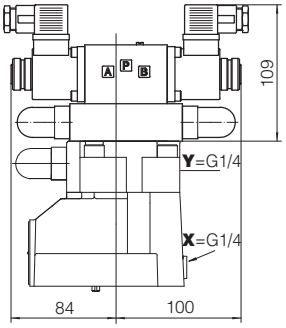
AGAM-20/20/-IX**
AGAM-20/21/-IX**

Mass: 7,4Kg



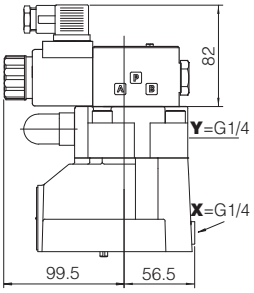
AGAM-20/22/-IX**

Mass: 7,1 Kg



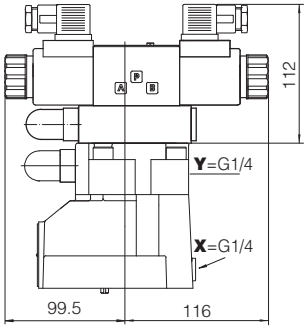
AGAM-20/32/-IX**

Mass: 7,5 Kg



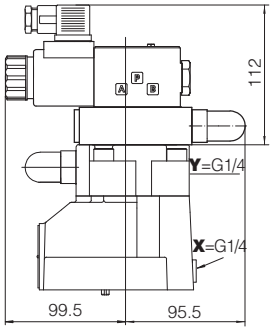
AGAM-20/10/-EX**
AGAM-20/11/-EX**

Mass: 6,3 Kg



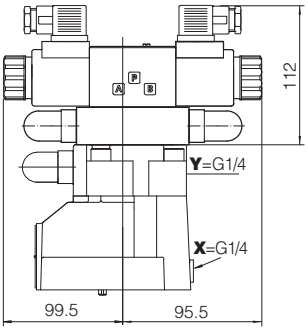
AGAM-20/20/-EX**
AGAM-20/21/-EX**

Mass: 7,4 Kg



AGAM-20/22/-EX**

Mass: 7,1 Kg

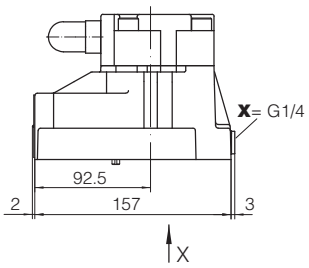


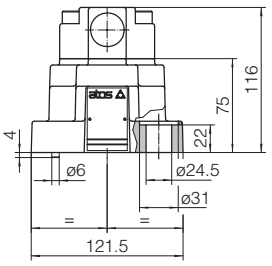
AGAM-20/32/-EX**

Mass: 7,5 Kg

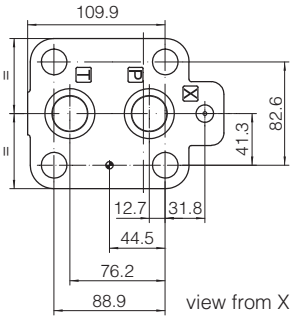
Overall dimensions refer to valves with connectors type 666

AGAM-32



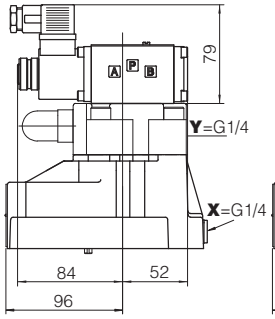


Mass: 6,2 Kg

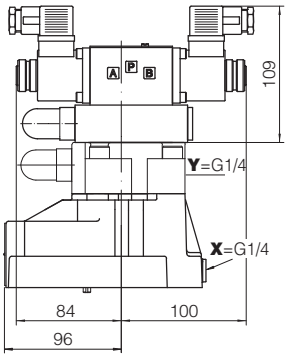


view from X

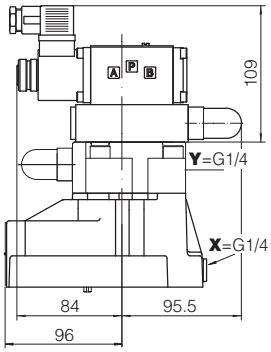
ISO 6264: 2007
Mounting surface: 6264-10-17-1-97 (with M20 fixing holes instead of standard M18)
Fastening bolts:
4 socket head screws
M20x60 class 12.9
Tightening torque = 600 Nm
Seals: 2 OR 4131; 1 OR 109/70
Ports P, T: Ø = 28,5 mm
Ports X: Ø = 3,2 mm



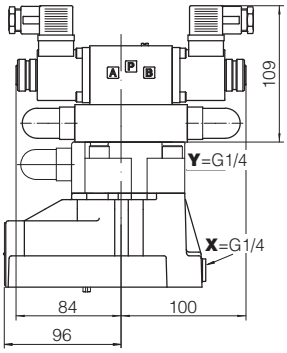
AGAM-32/10/-IX**
AGAM-32/11/-IX**
Mass: 7,7 Kg



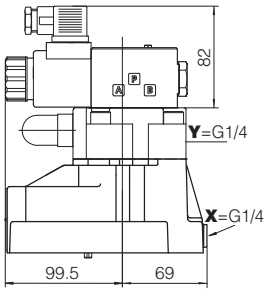
AGAM-32/20/-IX**
AGAM-32/21/-IX**
Mass: 8,8 Kg



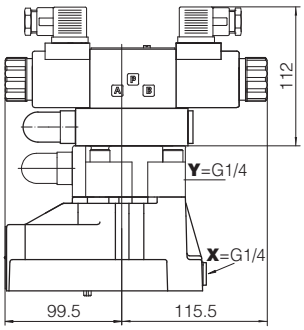
AGAM-32/22/-IX**
Mass: 8,5 Kg



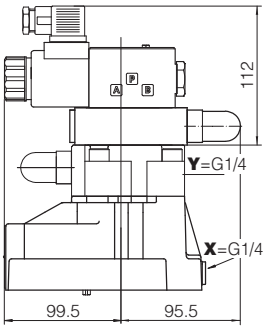
AGAM-32/32/-IX**
Mass: 8,9 Kg



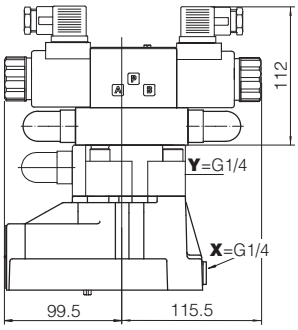
AGAM-32/10/-EX**
AGAM-32/11/-EX**
Mass: 7,7 Kg



AGAM-32/20/-EX**
AGAM-32/21/-EX**
Mass: 8,8 Kg



AGAM-32/22/-EX**
Mass: 8,5 Kg



AGAM-32/32/-EX**
Mass: 8,9 Kg

Overall dimensions refer to valves with connectors type 666

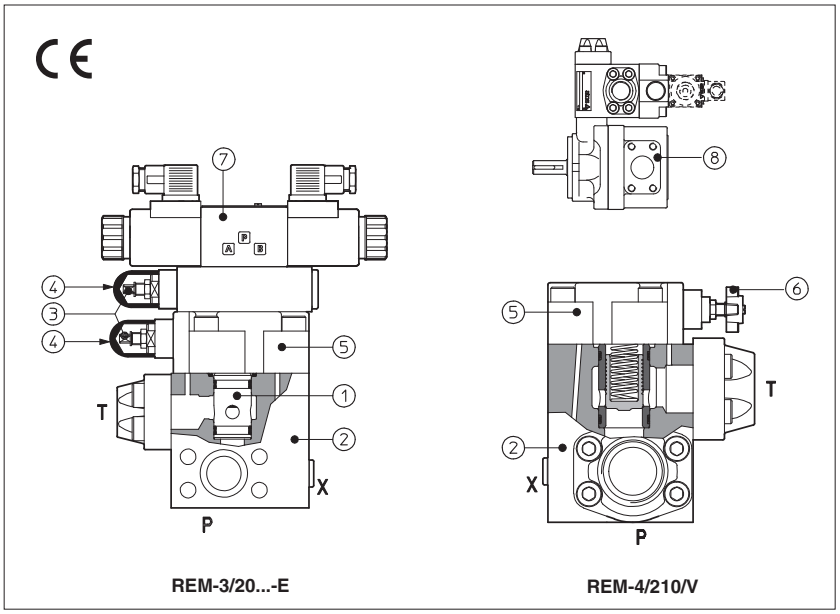
12 MOUNTING SUBPLATES

Valve	Subplate model	Port location	Ports			Ø Counterbore [mm]			Mass [Kg]
			P	T	X	P	T	X	
AGAM-10	BA-306	Ports P, T, X underneath;	G 1/2"	G 3/4"	G 1/4"	30	36,5	21,5	1,5
AGAM-20	BA-406		G 3/4"	G 3/4"	G 1/4"	36,5	36,5	21,5	3,5
	BA-506		G 1"	G 1"	G 1/4"	46	46	21,5	3,5
AGAM-32	BA-706		G 1 1/2"	G 1 1/2"	G 1/4"	63,5	63,5	21,5	6

The subplates are supplied with fastening bolts. For further details see table K280

Pressure relief valves type REM

two stage, flange mounting SAE 3/4", 1", 1¼"



REM-3/20...-E **REM-4/210/V**

REM are two stage pressure relief valves with balanced poppet and SAE flange connection, designed to operate in oil hydraulic systems.

They can be directly mounted with SAE flange attachments on the pumps outlet ports ⑧ and, in particular, on the PFE pumps (see tab. A005, A007).

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw ③ protected by cap ④ in the cover ⑤.

Optional versions with setting adjustment by handwheel ⑥ instead of the grub screw are available on request.

Clockwise rotation increases the pressure.

REM can be equipped with a venting solenoid valve ⑦ type:

- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances, with **cURus** certified solenoids

Mounting surface:
SAE flange connection: **3/4", 1", 1¼"**
Max flow: **200, 400** and **600 l/min** respectively
Pressure up to **350 bar** (depending on models)

1 MODEL CODE

REM	-	4	/	20	210	/	100/100	/	V	-	I	X	24DC	**	/	*

REM = pressure relief valve SAE flange mounting

Size:
3 = SAE 3/4"
4 = SAE 1"
5 = SAE 1¼"

Setting pressure and venting option (1):
- = one setting pressure without option
10 = one setting pressure with venting, with de-energized solenoid
11 = one setting pressure with venting, with energized solenoid
20 = two setting pressure with venting, with de-energized solenoid
21 = two setting pressure with venting, with energized solenoid
22 = two setting pressure without venting
32 = three setting pressure without venting

Pressure range:
50 = 4÷50 bar;
100 = 6÷100 bar;
210 = 7÷210 bar;
350 = 8÷350 bar (only for REM-3)

Pressure range of second/third setting **(1)**:
50 = 4÷50 bar;
100 = 6÷100 bar;
210 = 7÷210 bar;
350 = 8÷350 bar (only for REM-3)

Options **(2)**:
WP = prolonged manual override protected by rubber cap (1)
V = regulating by handwheel instead of a grub screw protected by cap

Pilot valve **(1)**:
-I = DHI for AC and DC supply with **cURus** certified solenoids
-E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(1):**
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section 7

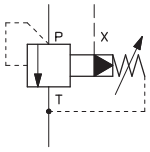
Series number

Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

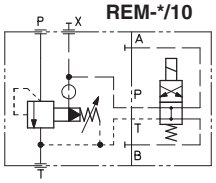
(1) Only for REM with solenoid valve for venting and/or for the selection of the setting pressure
(2) For handwheel features, see technical table K150

2 HYDRAULIC CHARACTERISTICS

REM



REM-*/10



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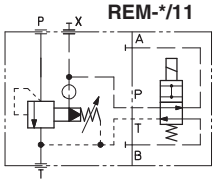
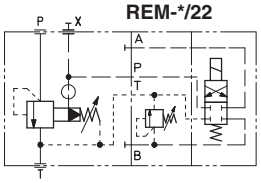
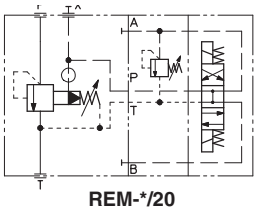
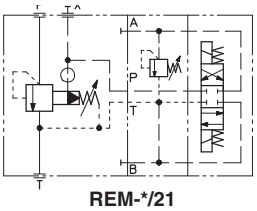


REM-*/22

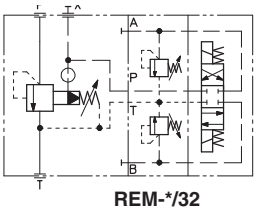




REM-*/20



REM-*/21



REM-*/32

Valve model		**REM-3**	**REM-4**	**REM-5**
Max flow	[l/min]	200	400	600
Pressure range	[bar]	4-50; 6-100; 7-210; 8-350	4÷50; 6÷100; 7÷210	
Max pressure	[bar]	ports P, X = 350 Port T = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E010 and E015		

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in above table, consult our technical office

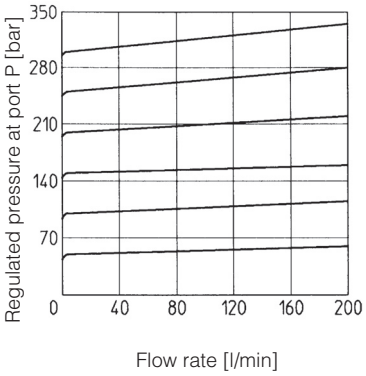
Assembly position	Any position		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

3.1 Coils characteristics (for ARAM with pilot solenoid valve)

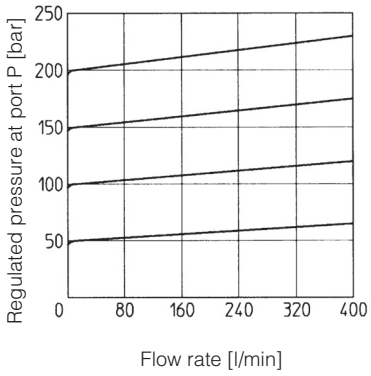
Insulation class	DHI pilot	**H** (180°C)	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)	
Relative duty factor		100%	
Supply voltage and frequency		See electric feature [8]	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on fluid viscosity of 25 mm²/s at 40°

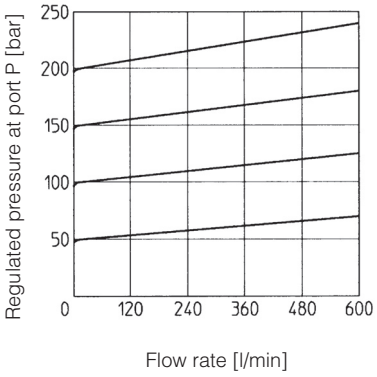
REM-3



REM-4

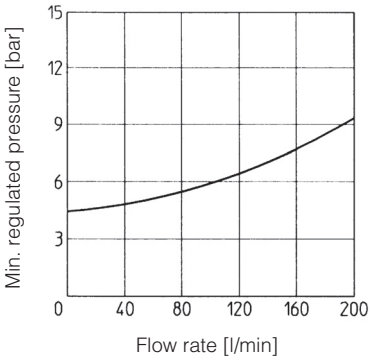


REM-5

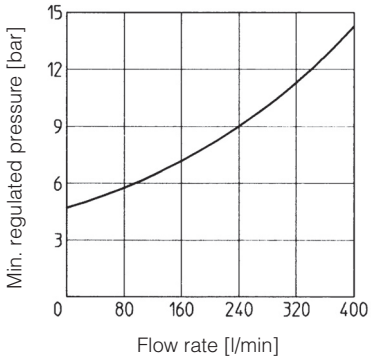


5 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on fluid viscosity of 25 mm²/s at 40° C

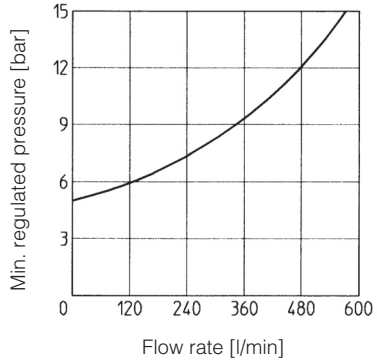
REM-3



REM-4



REM-5



6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR REM WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tab. E010 and K500.

7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

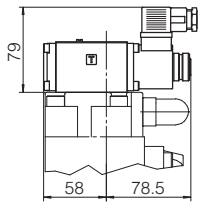
Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption **(3)** DHI	Power consumption **(3)** DHE	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC **(2)** 115/60 AC 120/60 AC 230/50 AC **(2)** 230/60 AC	**110/50/60 AC** **115/60 AC (5)** **120/60 AC (6)** **230/50/60 AC** **230/60 AC**	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

(1) For other supply voltages available on request see technical tables E010, E015.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When solenoid is energized, the inrush current is approx 3 times the holding current.
(5) Only for DHE
(6) Only for DHI

8 DIMENSIONS [mm]

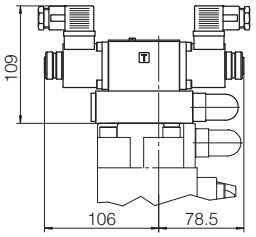
REM-3

REM-3/10/-IX**
REM-3/11/-IX**



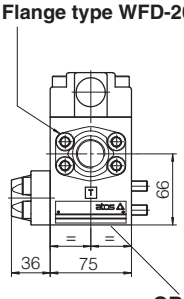
Mass: 8,1 Kg

REM-3/20/-IX**
REM-3/21/-IX**

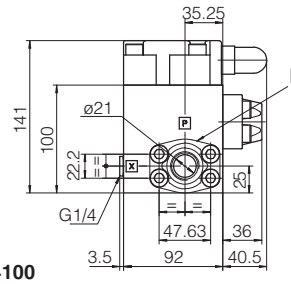


Mass: 9,2 Kg

Flange type WFD-20



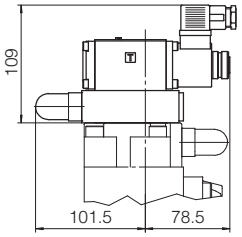
OR-4100



Flange type WFD-20

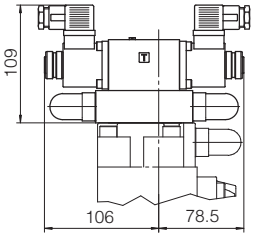
Mass: 6,6 Kg

REM-3/22/-IX**



Mass: 8,9 Kg

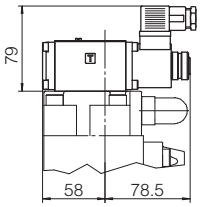
REM-3/32/-IX**



Mass: 9,3 Kg

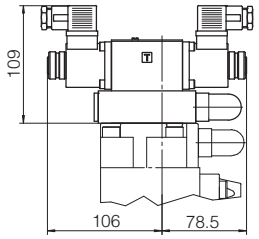
REM-4

REM-4/10/-IX**
REM-4/11/-IX**



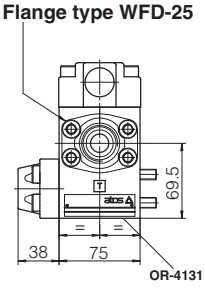
Mass: 8,3 Kg

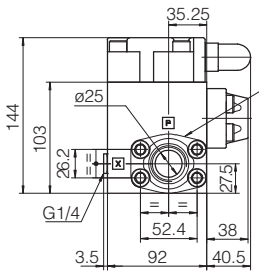
REM-4/20/-IX**
REM-4/21/-IX**



Mass: 9,4 Kg

Flange type WFD-25

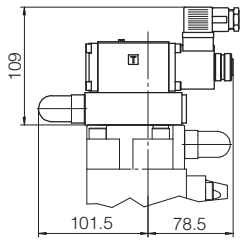




Flange type WFD-25

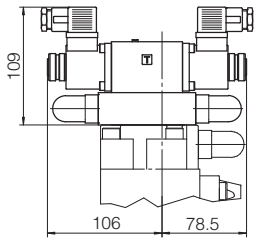
Mass: 6,8 Kg

REM-4/22/-IX**



Mass: 9,1 Kg

REM-4/32/-IX**

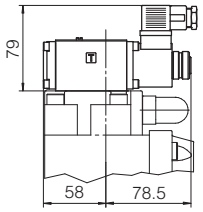


Mass: 9,5 Kg

Overall dimensions refer to valves with connectors type 666.

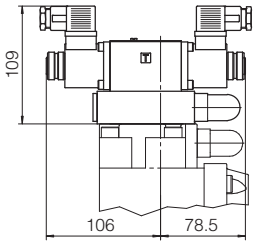
REM-5

REM-5/10/-IX**
REM-5/11/-IX**



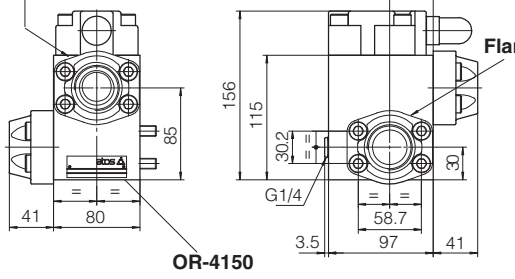
Mass: 9,7 Kg

REM-5/20/-IX**
REM-5/21/-IX**



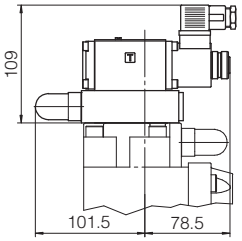
Mass: 10,8 Kg

Flange type WFD-32



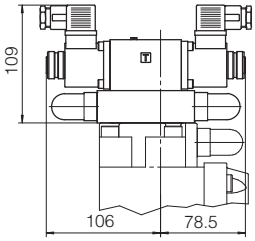
Mass: 8,2 Kg

REM-5/22/-IX**



Mass: 10,5 Kg

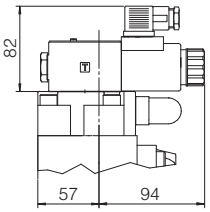
REM-5/32/-IX**



Mass: 10,9 Kg

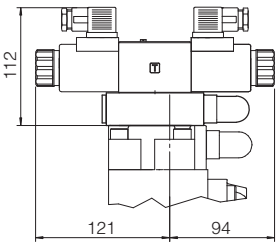
REM-3

REM-3/10/-EX**
REM-3/11/-EX**



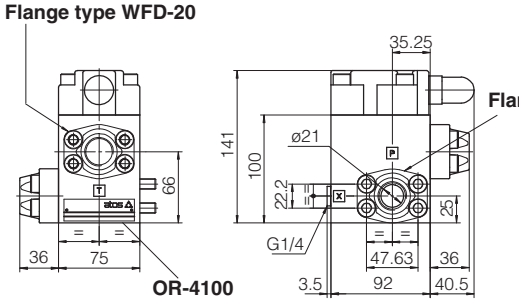
Mass: 8,1 Kg

REM-3/20/-EX**
REM-3/21/-EX**



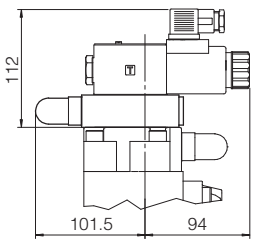
Mass: 9,2 Kg

Flange type WFD-20



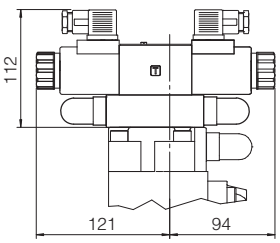
Mass: 6,6 Kg

REM-3/22/-EX**



Mass: 8,9 Kg

REM-3/32/-EX**

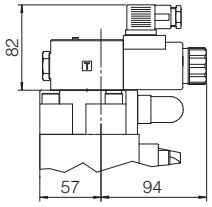


Mass: 9,3 Kg

9 DIMENSIONS [mm]

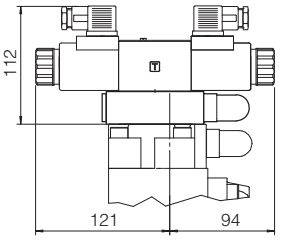
REM-4

REM-4/10/-EX**
REM-4/11/-EX**



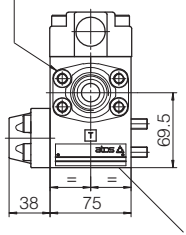
Mass: 8,3 Kg

REM-4/20/-EX**
REM-4/21/-EX**

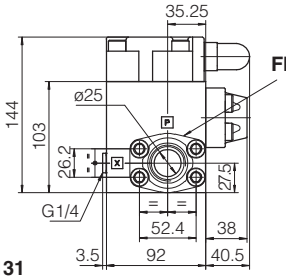


Mass: 9,4 Kg

Flange type WFD-25



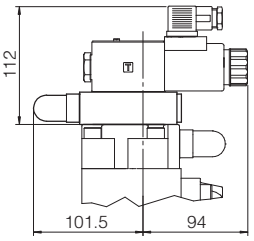
OR-4131



Flange type WFD-25

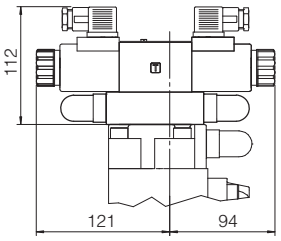
Mass: 6,8 Kg

REM-4/22/-EX**



Mass: 9,1 Kg

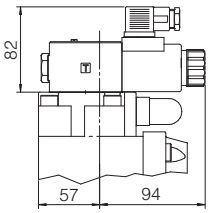
REM-4/32/-EX**



Mass: 9,5 Kg

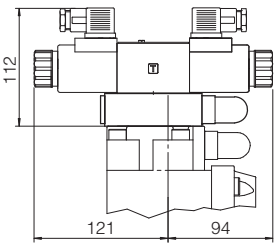
REM-5

REM-5/10/-EX**
REM-5/11/-EX**



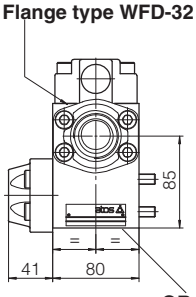
Mass: 9,7 Kg

REM-5/20/-EX**
REM-5/21/-EX**

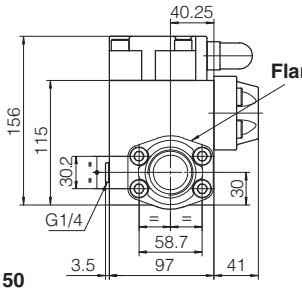


Mass: 10,8 Kg

Flange type WFD-32



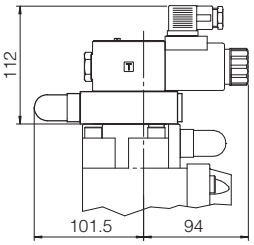
OR-4150



Flange type WFD-32

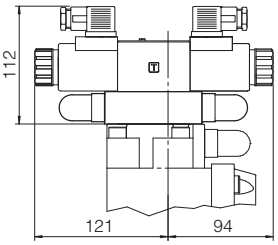
Mass: 8,2 Kg

REM-5/22/-EX**



Mass: 10,5 Kg

REM-5/32/-EX**

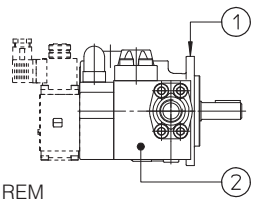


Mass: 10,9 Kg

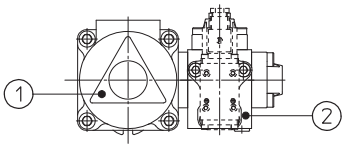
Overall dimensions refer to valves with connectors type 666

10 ASSEMBLY EXAMPLE OF A REM VALVE ON A PFE PUMP

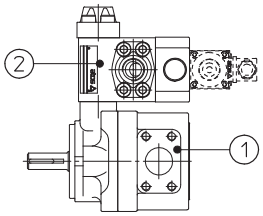
LATERAL VIEW OF PUMP



REAR VIEW OF PUMP



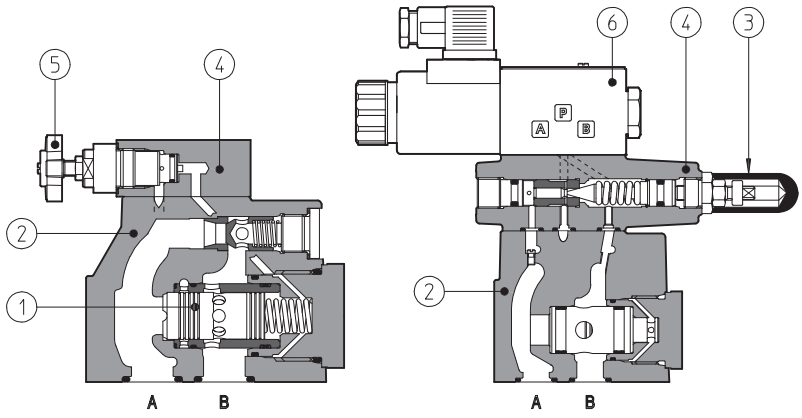
TOP VIEW OF PUMP



① Pump type PFE
② Relief valve type REM

Pressure control valves type AGIR, AGIS, AGIU

two stage, subplate mounting, ISO 5781 sizes 10, 20 and 32



AGIRR-20/*/V** **AGIU-10/11...-E**

Two stage pressure control valves with balanced poppet designed to operate in oil hydraulic systems.
AGIR: pressure reducing;
AGIS: sequence;
AGIU: unloading.

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw protected by cap ③ in the cover ④.
Optional versions with setting adjustment by handwheel ⑤ instead of the grub screw are available on request.
Clockwise rotation increases pressure.

Unloading valves AGIU can be equipped with a venting solenoid valve ⑥ type:
- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances with **cURus** certified solenoids

Mounting surface: **ISO 5781 size 10, 20 and 32**
Max flow:
AGIR = 160, 300, 400 l/min
AGIS = 200, 400, 600 l/min
AGIU = 100, 200, 300 l/min
Pressure up to **350 bar**

1 MODEL CODE

AGIU	*	-	20	/	10	/	210	/	V	-	I	X	24DC	**	/	*

AGIU
Pressure control valves subplate mounting
AGIR = pressure reducing
AGIS = sequence
AGIU = unloading

*****
Only for AGIR and AGIS:
R = with check valve
- = without check valve

20
Size: **10** **20** **32**

10
Optional solenoid valve for venting **(1)**
10 = venting with de-energized solenoid
11 = venting with energized solenoid

210
Pressure range:
50 = 4÷50 bar (AGIR*); **100** = 6÷100 bar;
210 = 7÷210 bar; **350** = 8÷350 bar

V
Options **(2)**:
V = regulating handwheel instead of a grub screw protected by cap
VF = regulating knob instead of a grub screw protected by cap (only for AGIS, AGIU)
VS = manual override with safety locking instead of a grub screw protected by cap (only for AGIS, AGIU)
Only for AGIU:
D = internal drain
WP = prolonged manual override protected by rubber cap (1)
- = standard unloading characteristics
5, 6, 7 = other unloading characteristics, see section 5

I
Pilot valve **(1)**:
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X
X = without connector **(1):**
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

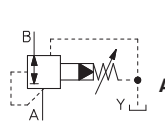
24DC
Voltage code, see section 7 **(1)**

******
Series number

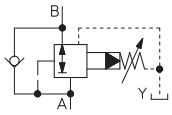
*****
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

(1) Only for AGIU with solenoid valve for venting **(2)** For handwheel features, see technical table K150

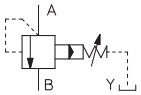
2 HYDRAULIC CHARACTERISTICS



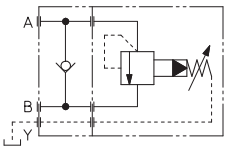
AGIR



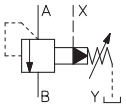
AGIRR



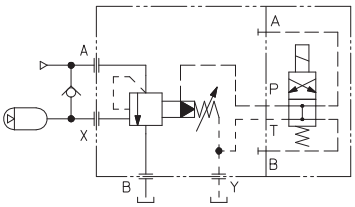
AGIS



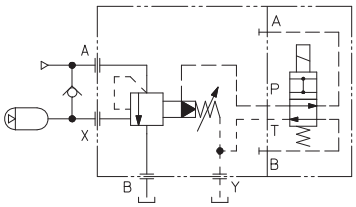
AGISR



AGIU



AGIU-/10**



AGIU-/11**

Valve model		AGIR-10	AGIR-20	AGIR-32	AGIS-10	AGIS-20	AGIS-32	AGIU-10	AGIU-20	AGIU-32
Max flow	[l/min]	160	300	400	200	400	600	100	200	300
Pressure range	[bar]	4÷50 (AGIR*); 6÷100; 7÷210; 8÷350								
Max pressure	[bar]	Ports A, B, X = 350 bar Port Y = 0								

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

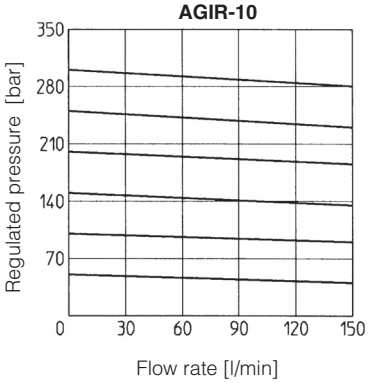
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

3.1 Coils characteristics

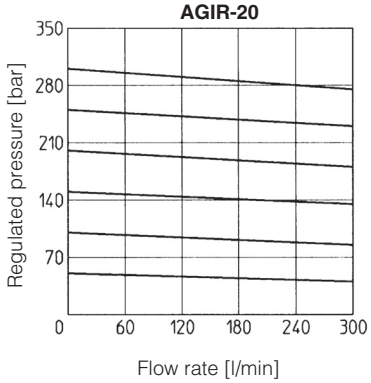
Insulation class	DHI pilot	**H** (180°C)
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils
Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account		
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)
Relative duty factor		100%
Supply voltage and frequency		See electric feature 8
Supply voltage tolerance		± 10%
Certification		**cURus** North American standard

4 **REGULATED PRESSURE VERSUS FLOW DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

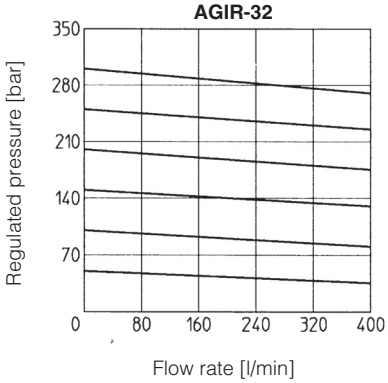
AGIR-10



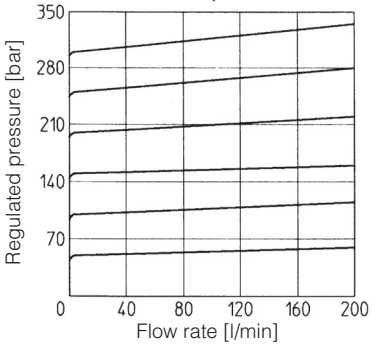
AGIR-20



AGIR-32

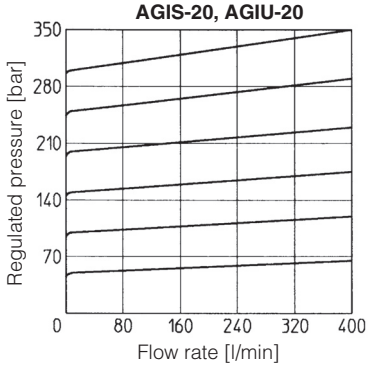


AGIS-10, AGIU-10



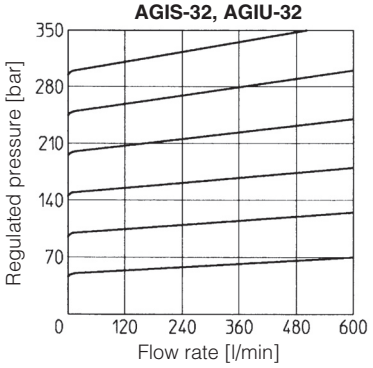
Note: for AGIU-10, the max flow rate is 100 l/min

AGIS-20, AGIU-20



Note: for AGIU-20, the max flow rate is 200 l/min

AGIS-32, AGIU-32

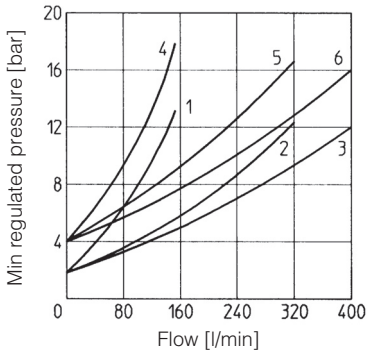


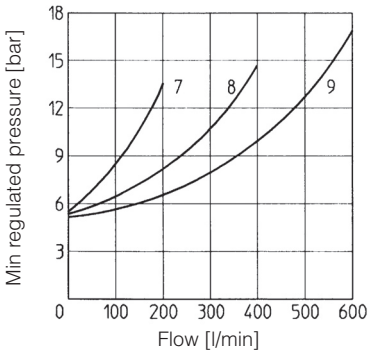
Note: for AGIU-32, the max flow rate is 300 l/min

5 **OPERATING DIAGRAM**
based on mineral oil ISO VG 46 at 50°C

1 = AGIR-10 A → B
2 = AGIR-20 A → B
3 = AGIR-32 A → B
4 = AGIR-10 B → A
5 = AGIR-20 B → A
6 = AGIR-32 B → A

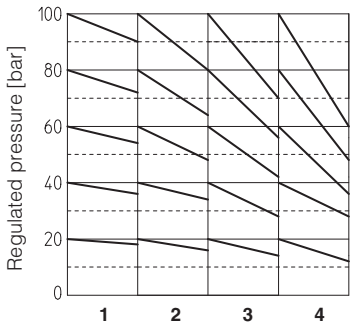
7 = AGIS-10
8 = AGIS-20
9 = AGIS-32

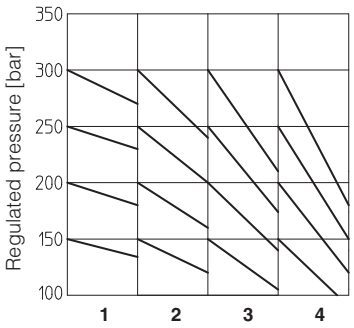




Opening/closing diagram for AGIU

1 = AGIU-**/...(standard) **3** = AGIU-**/.../6
2 = AGIU-**/.../5 **4** = AGIU-**/.../7





NOTES

1)Short pipes with low resistance must be used between the unloading valve and the accumulator;
2)When the resistance is high, the hydraulic pilot signal must be taken as closed as possible to the accumulator;
3)With high pump flow and small valve differential pressure of intervention it is advisable to use the version with external drain;
4)When to use the BA-*25 subplates:
a) in applications with working frequencies >10 Hz use subplates type BA-*25/4 (spring with 4 bar of cracking pressure);
b) in applications with working frequencies <10 Hz use subplates type BA-*25/2 (spring with 2 bar of cracking pressure);

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR AGIU WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tab. E010 and K500

7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

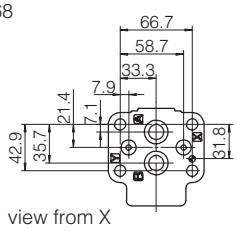
Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption **(3)** DHI	DHE	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC **(2)** 115/60 AC 120/60 AC 230/50 AC **(2)** 230/60 AC	**110/50/60 AC** **115/60 AC (5)** **120/60 AC (6)** **230/50/60 AC** **230/60 AC**	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

(1) For other supply voltages available on request see technical tables E010, E015.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When solenoid is energized, the inrush current is approx 3 times the holding current.
(5) Only for DHE
(6) Only for DHI

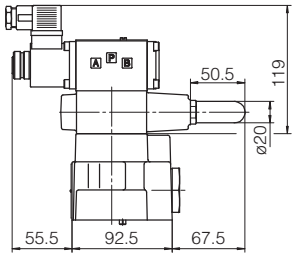
8 DIMENSIONS [mm]

AGIR, AGIS, AGIU size 10

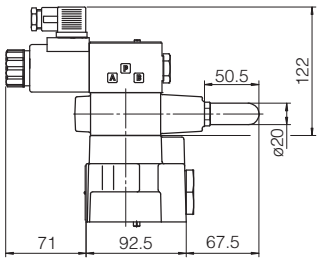
ISO 5781: 2000
Mounting surface: 5781-06-07-0-00
Fastening bolts:
4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 109/70, 2 OR 3068
Ports A, B: Ø = 14 mm
Ports X, Y: Ø = 5 mm



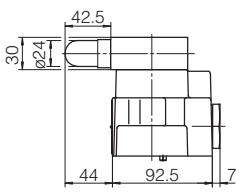
view from X

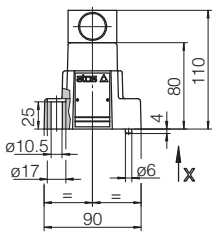


AGIU-10/10/-IX**
Mass = 5,3 Kg

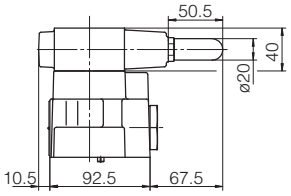


AGIU-10/10/-EX**
Mass = 5,6 Kg

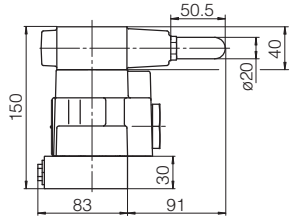




AGIR-10; Mass= 3,3 Kg
AGIRR-10; Mass= 3,5 Kg



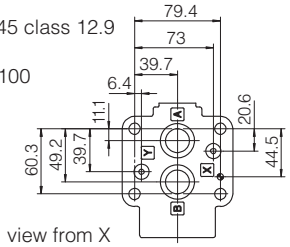
AGIS-10; Mass= 3,8 Kg
AGIU-10; Mass= 3,8 Kg

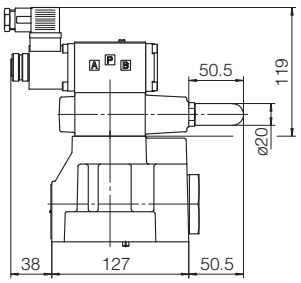


AGISR-10; Mass= 5,3 Kg

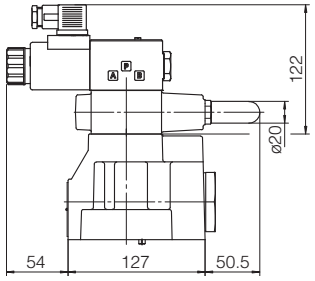
AGIR, AGIS, AGIU size 20

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00
Fastening bolts:
4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 109/70, 2 OR 4100
Ports A, B: Ø = 22 mm
Ports X, Y: Ø = 5 mm

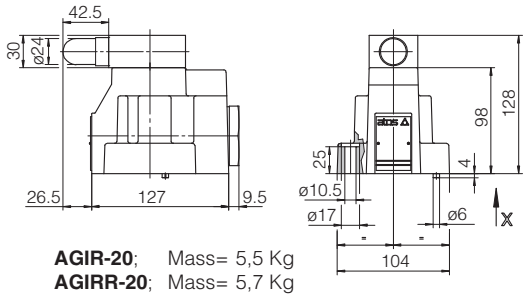




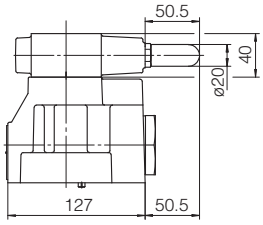
AGIU-20/10/-IX**
Mass = 7,5 Kg



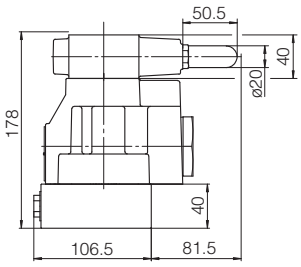
AGIU-20/10/-EX**
Mass = 7,8 Kg



AGIR-20; Mass= 5,5 Kg
AGIRR-20; Mass= 5,7 Kg



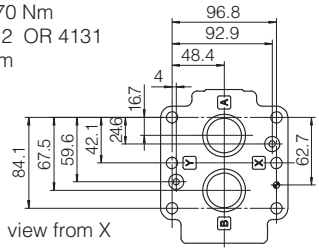
AGIS-20; Mass= 6 Kg
AGIU-20; Mass= 6 Kg

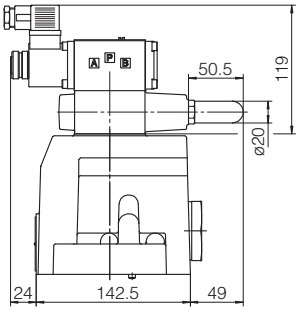


AGISR-20; Mass= 9 Kg

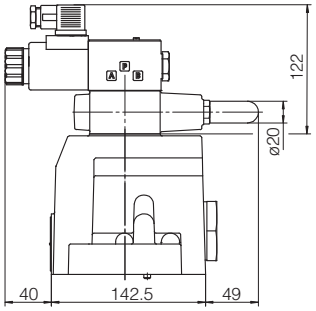
AGIR, AGIS, AGIU size 32

ISO 5781: 2000
Mounting surface: 5781-10-13-0-00
Fastening bolts:
6 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 109/70, 2 OR 4131
Ports A, B: Ø = 28 mm
Ports X, Y: Ø = 5 mm

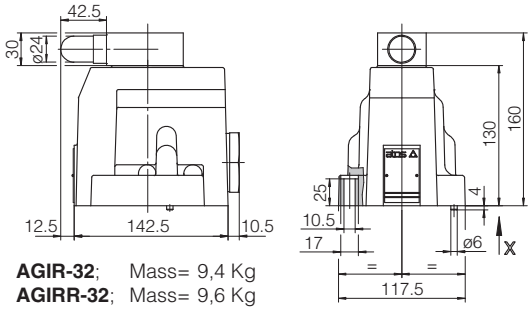




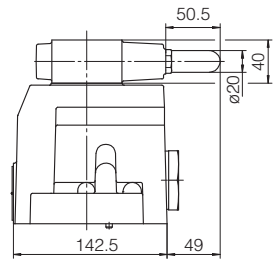
AGIU-32/10/-IX**
Mass = 11,4 Kg



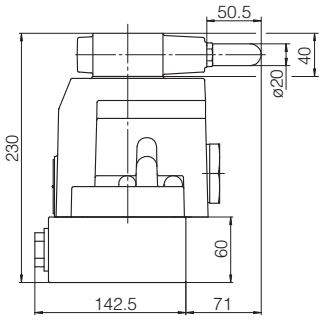
AGIU-32/10/-EX**
Mass = 11,7 Kg



AGIR-32; Mass= 9,4 Kg
AGIRR-32; Mass= 9,6 Kg



AGIS-32; Mass= 9,9 Kg
AGIU-32; Mass= 9,9 Kg



AGISR-32; Mass= 15.5 Kg

Overall dimensions refer to valves with connectors type 666

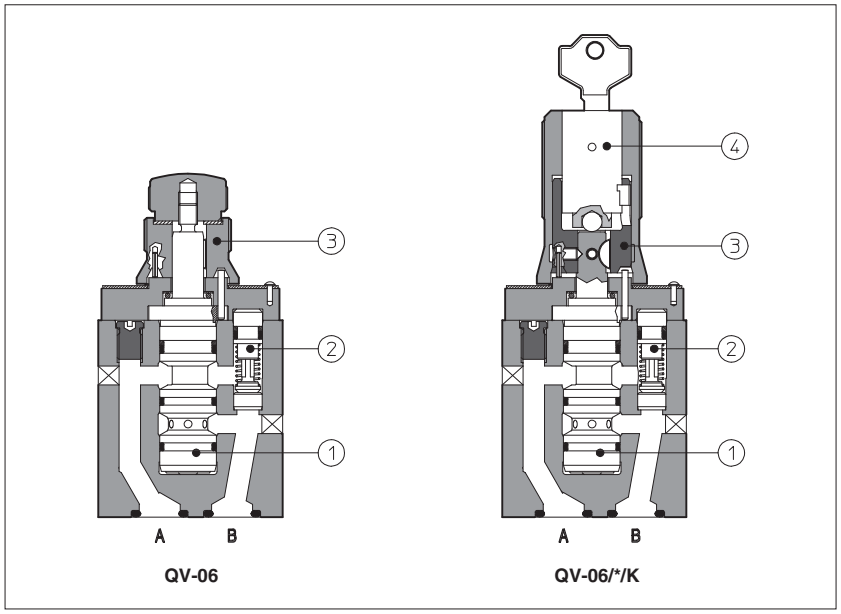
9 MOUNTING SUBPLATES

Valves	Subplate model	Port location	Ports				Ø Counterbore [mm]				Mass [Kg]
			A	B	X-Y	OUT	A	B	X-Y	OUT	
AGI*-10	BA-305	Ports A, B, Y underneath;	G 1/2"	G 1/2"	G 1/4"	-	30	30	21,5	-	1
AGI*-20	BA-505		G 1"	G 1"	G 1/4"	-	46	46	21,5	-	2
AGI*-32	BA-705		G 1 1/2"	G 1 1/2"	G 1/4"	-	63,5	63,5	21,5	-	7,5
AGIU-10	BA-325 (with incorporated check valve)	G 1/2"	G 3/4"	G 1/4"	G 1/2"	30	36,5	21,5	30	5	
AGIU-20	BA-425 (with incorporated check valve)	Ports A, B, Y underneath;	G 1"	G 1"	G 1/4"	G 1"	46	46	21,5	46	6,5
AGIU-32	BA-625 (with incorporated check valve)		G 1 1/2"	G 1 1/2"	G 1/4"	G 1 1/2"	63,5	63,5	21,5	63,5	13

The subplates are supplied with fastening bolts. For further details see table K280

Flow control valves type QV-06

pressure compensated, two way, ISO 4401 size 06



QV are flow control valves with pressure compensator ①: the controlled flow rate is independent of pressure variations.

They are usually supplied with a built-in check valve ② to allow the free flow in the opposite direction.

The flow is regulated by turning a graduate micrometer knob ③. Clockwise rotation increases the flow regulation.
Optional versions with locking key ④ on the adjustment knob are available on request.

ISO 4401 size 06.

Flow up to 1,5; 6; 11; 16; 24 l/min (depending on models).
Pressure up to 250 bar.

Valves designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE

QV	-	06	/	6	/	K	**	/	*

QV: Pressure compensated flow control valve

06: Size 06

6: Maximum adjustable flow rate:
1 = 1,5 l/min; **6** = 6 l/min; **11** = 11 l/min; **16** = 16 l/min; **24** = 24 l/min

K: Options:
K = with lock key for the setting knob
V = without by-pass check valve

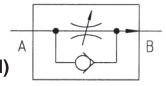
******: Series number

*****: Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

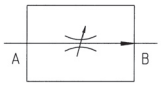
2 HYDRAULIC CHARACTERISTICS

Hydraulic symbols

with check valve (standard)



without check valve (option /V)



Valve model		QV-06/1	QV-06/6	QV-06/11	QV-06/16	QV-06/24
Max regulated flow	[l/min]	1,5	6	11	16	24
Min regulated flow	[cm³/min]	50				
Max flow B→A through check valve	[l/min]	24				
Regulating Δp	[bar]	3	3	5	6,5	8
Max flow on port A	[l/min]	24				
Max pressure	[bar]	250				

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

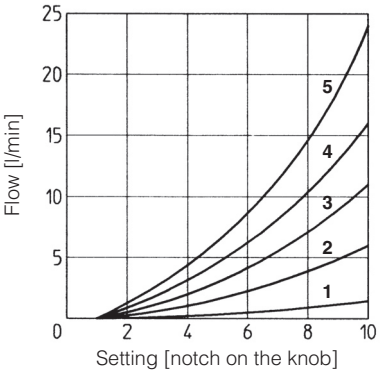
Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

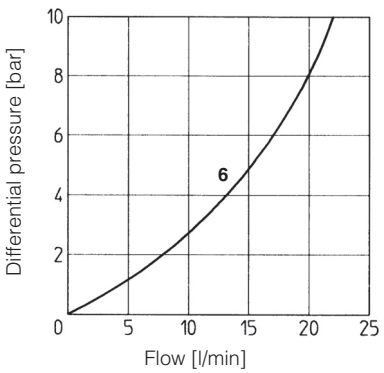
4.1 Regulation diagram

1 = QV-06/1
2 = QV-06/6
3 = QV-06/11
4 = QV-06/16
5 = QV-06/24

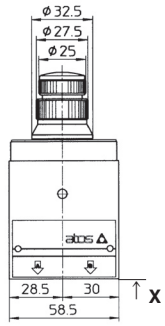


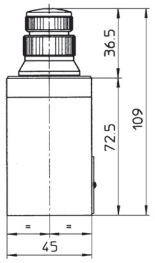
4.2 Q/Δp diagram through the check valve for free flow B→A

6 = QV-06/*

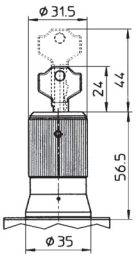


5 DIMENSIONS [mm]

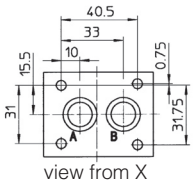




Mass: 1,2 Kg



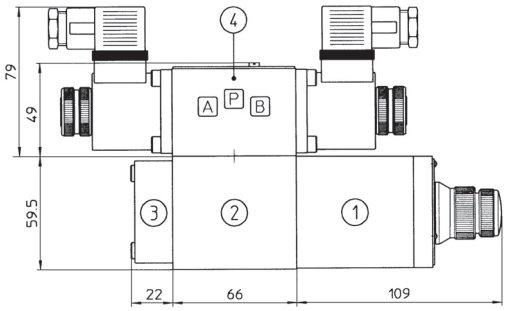
Option /K



view from X

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see note 1)
Fastening bolts:
4 socket head screws M5x60 class 12.9
Tightening torque = 8 Nm
Seals: 2 OR 117
Diameter of ports A, B: Ø = 7 mm

ASSEMBLY IN MODULAR STACK
see section 6



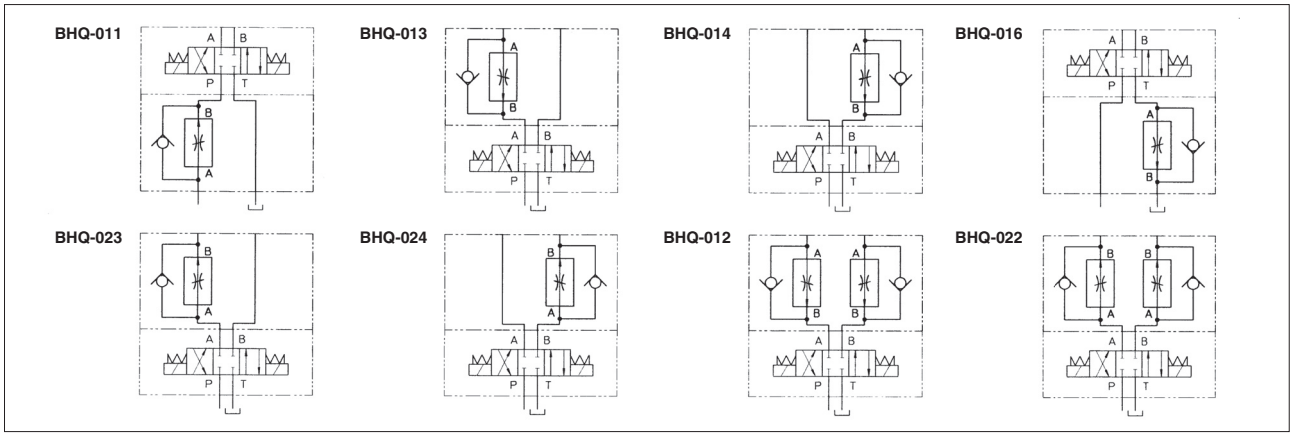
① = Flow control valve type QV-06
Note that the valve(s) is (are) mounted:
- on side port A for BHQ-011, BHQ-013, BHQ-016 and BHQ-023
- on side port B for BHQ-014 and BHQ-024
- on both sides for BHQ-012 and BHQ-022

② = Modular plate type BHQ, see section 6
③ = Closing element. This element can be on side port A or side port B depending on models. It is not present on BHQ-011, BHQ-016, BHQ-012 and BHQ-022
④ = Directional valve type DH* (ISO 4401 size 06)

note 1: the manifold interface has to be provided only of the A and B ports.
The valve cannot be installed on manifolds with ISO 4401-AB-03 interface with P and T ports.

6 MODULAR PLATES TYPE BHQ

The modular plates type BHQ allow the assembling of valves type QV-06 in a modular stack with other components having ISO 4401 size 06 mounting surface. See below for model code and functional sketches; see section 5 for dimensions and example of assembly.



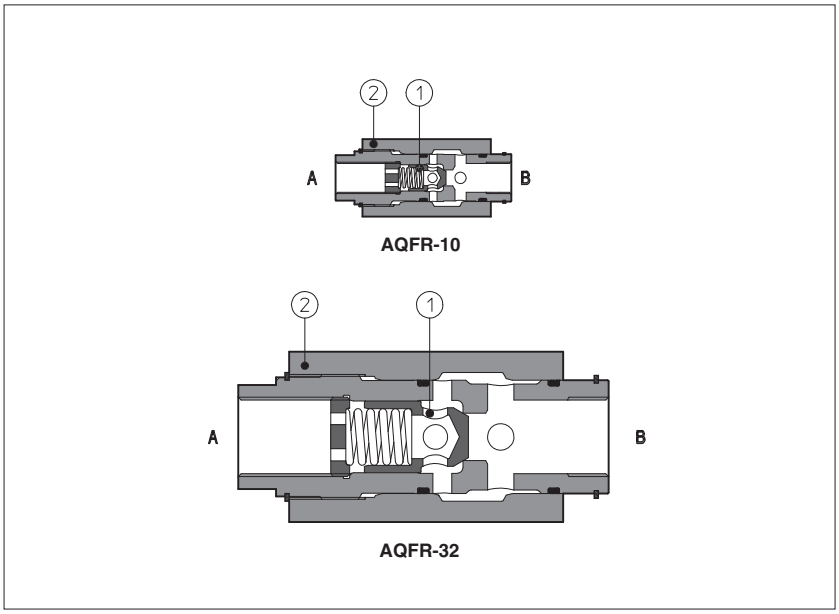
Available also version for phosphate ester (add /PE at the end of the model code).

7 MOUNTING PLATES TYPE BA

Valve	Subplate model	Ports location	Ports A, B, P, T	Ø Counterbore [mm] A, B, P, T	Mass [Kg]
QV-06	BA-202/Q	Ports A, B, P, T underneath;	G 3/8"	–	1,2
	BA-204/Q	Ports P, T underneath; Ports A, B on lateral side	G 3/8"	25,5	1,2
	BA-302/Q	Ports A, B, P, T underneath;	G 1/2"	30	1,8

Flow restrictor valves type AQFR

in-line mounting - from G 3/8" to G 1¼" threaded ports



AQFR are not compensated flow throttling valves with a built-in check valve ① to allow the free flow in the opposite direction.

The flow adjustement is done by turning the external exagon ②. Clockwise rotation increases the throtting (reduced passage). The regulated flow is a function of the pressure drop existing between the inlet and outlet ports.

They are available in five sizes: from 3/8" to 1 ¼" GAS with flow up 30, 50, 80, 160, 250 l/min respectively and pressure up to 400/350 bar (depending on size).

Max pressure: **350 bar**

1 MODEL CODE

AQF	R	-	10	**	/	*

Throtting valve in-line mounting

R = with check valve for free reverse flow

Size and ports dimensions:

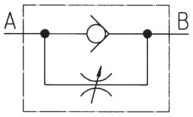
10 = G 3/8" **15** = G 1/2" **20** = G 3/4" **25** = G 1" **32** = G 1 ¼"

Series number

Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol



Valve model		AQFR-10	AQFR-15	AQFR-20	AQFR-25	AQFR-32
Max recommended flow	[l/min]	30	50	80	160	250
Max pressure	[bar]	400	350			

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

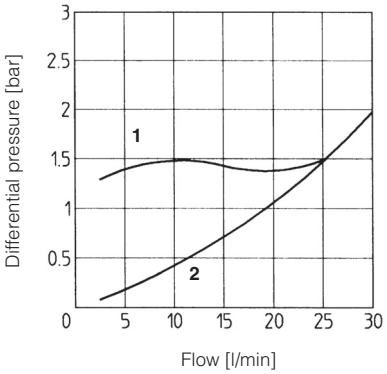
Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard execution = -30°C ÷ +70°C; /PE option = -20°C ÷ +70°C; /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

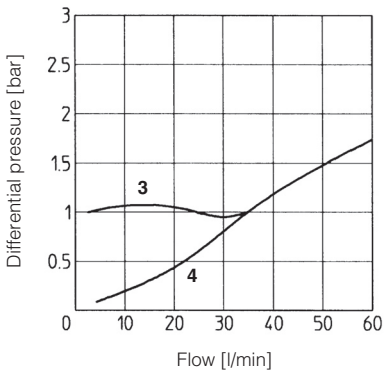
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

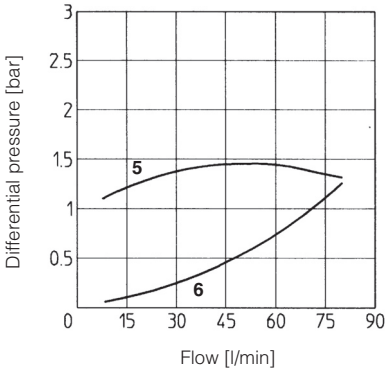
4 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

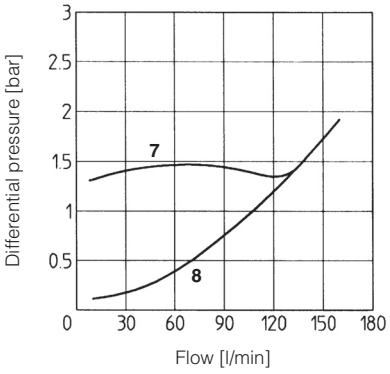
4.1 Q/Δp diagram through the chec valve for free flow B→A with the throttle valve fully open and fully closed

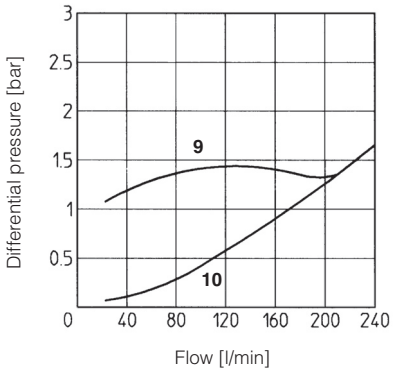
1 = AQFR-10 fully closed
2 = AQFR-10 fully open
3 = AQFR-15 fully closed
4 = AQFR-15 fully open
5 = AQFR-20 fully closed
6 = AQFR-20 fully open
7 = AQFR-25 fully closed
8 = AQFR-25 fully open
9 = AQFR-32 fully closed
10 = AQFR-32 fully open



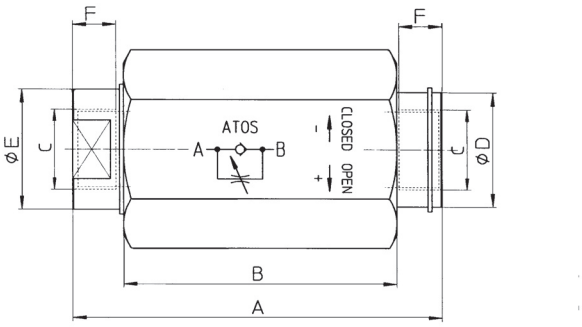


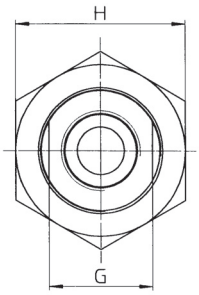






5 DIMENSIONS [mm]

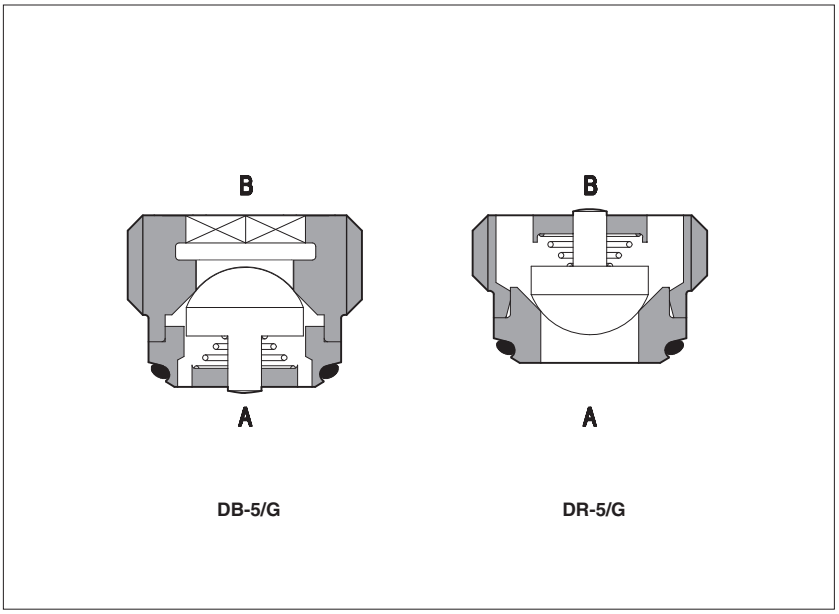




Valve model	A	B	C	ØD	ØE	F	G	H	Mass [Kg]
AQFR-10	93	68	G 3/8"	28	25	13	24	41	0,7
AQFR-15	105	78	G 1/2"	32	30	15	27	46	1
AQFR-20	127	95,5	G 3/4"	36	34	17	32	55	1,6
AQFR-25	153	112	G 1"	48	45	19	42	75	3,5
AQFR-32	196	145	G 1 1/4"	63	60	21	55	90	6,5

Cartridge check valves type DB, DR

screw-in mounting - from G1/4" to G1/2"



DB-5/G **DR-5/G**

DB, **DR** are direct operated check valves for screw-in mounting in cavities from G1/4" to G1/2".
They are specifically designed to reduce the manifold dimensions and simplify the installation.
Cartridge designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

Flow up to **95 l/min**.
Max pressure: **350 bar**

1 MODEL CODE

D	B	-	10	/	G	**	/	*

D = Screw-in check valve

B = function A → B
R = function B → A

Size/threated connections:
5 = G 1/4" **10** = G 3/8" **15** = G 1/2"

G = Gas threading

Series number

Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC CHARACTERISTICS

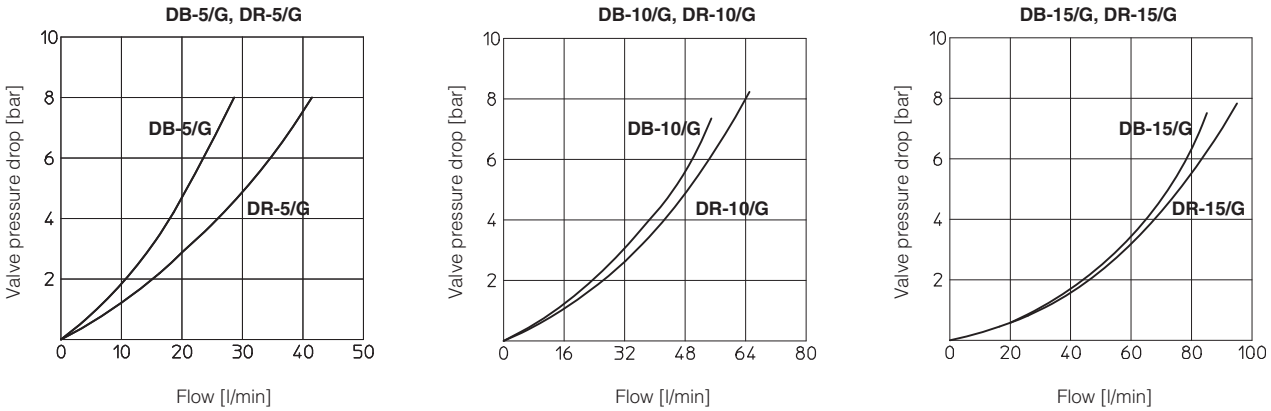
Hydraulic symbol		**DB-*/G** 			**DR-*/G** 		
Valve model		**DB-5/G**	**DR-5/G**	**DB-10/G**	**DR-10/G**	**DB-15/G**	**DR-15/G**
Nominal flow (at Δp = 8 bar)	[l/min]	25	35	55	65	85	95
Max pressure	[bar]	350					
Cracking pressure	[bar]	0,3					

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

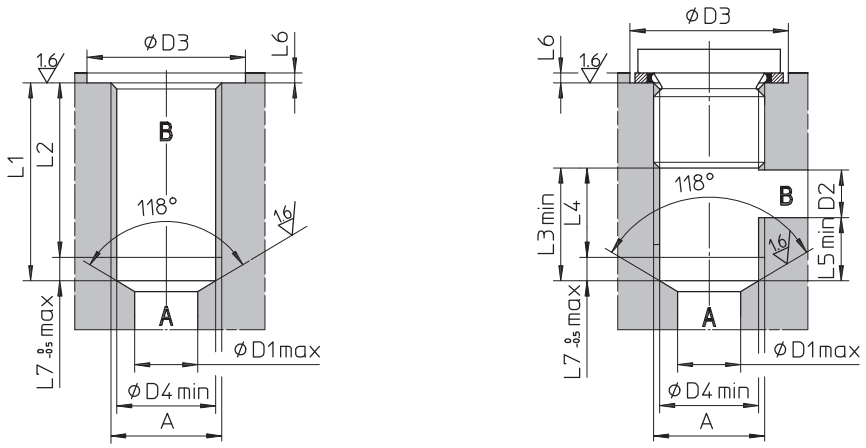
Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog
Flow direction	As shown in the symbol at section 2
Rated flow	See diagrams Q/Δp at section 4

Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 FLOW VERSUS PRESSURE DROP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

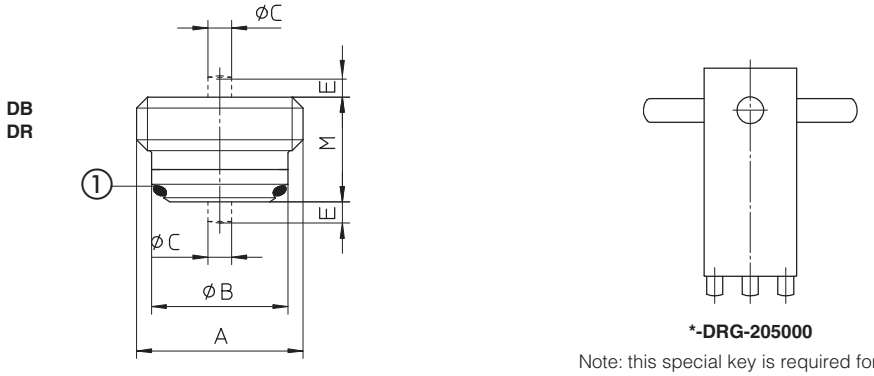


5 RECESS DIMENSIONS [mm]



	A	D1	D2	D3	D4	L1	L2	L3	L4	L5	L6	L7
DB-5/G DR-5/G	G 1/4"	8	6	22	11,6	22	19	14	11	8	1,5	3
DB-10/G DR-10/G	G 3/8"	9	8	26	15	24	21	17	14	9	1,5	3
DB-15/G DR-15/G	G 1/2"	12	12	30	18,75	28	24,5	22	18,5	10	1,5	3,5

6 VALVE DIMENSIONS [mm]



***-DRG-205000**

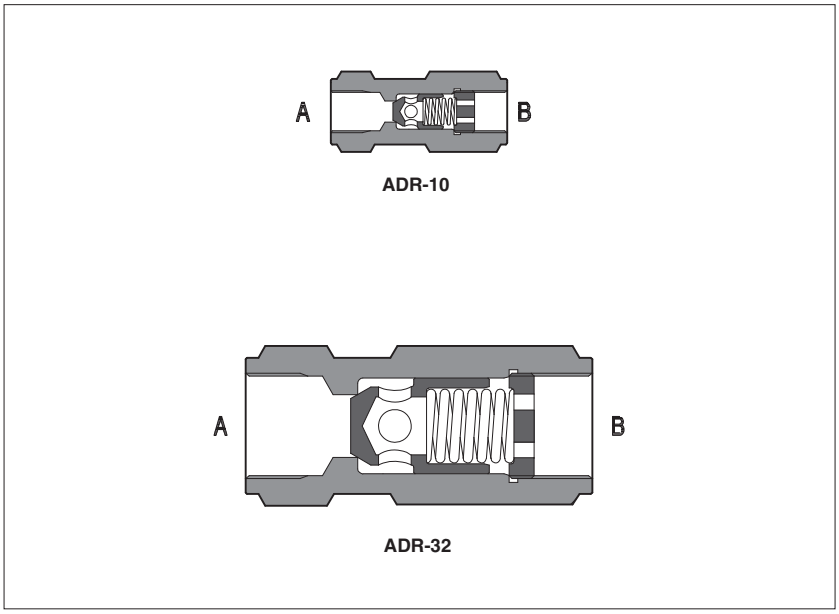
Note: this special key is required for assembling the valve in the cavity

	A	B	C	E	M	①	Mass (Kg)
DB-5/G	G 1/4"	11,5	2,1	1,5	10,3	OR-9x1/70	0,060
DR-5/G			2,4		9		
DB-10/G	G 3/8"	15	2,8	2	11,3	OR-11x1,5/70	0,012
DR-10/G			3,3	2,5	11,4		
DB-15/G	G 1/2"	18,5	3,2	2,5	12,9	OR-14x1,5/70	0,020
DR-15/G			4	2,5	13,6		

	A	KEY	Tightening torque (Nm)
DB-5/G	G 1/4"	CH 7 ⬡	15
DR-5/G		5-DRG-205000	
DB-10/G	G 3/8"	CH 6 ⬡	20
DR-10/G		10-DRG-205000	
DB-15/G	G 1/2"	CH 8 ⬡	40
DR-15/G		15-DRG-205000	

Check valves type ADR

in-line mounting - from G 1/4" to G 1 1/4" threaded ports



ADR are direct operated check valves for in-line mounting available with port size from 1/4" to 1¼" GAS.

Cartridge designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

Flow up to **500 l/min**
Pressure up to **400 bar**

1 MODEL CODE

ADR	-	10	/	4		**
Check valve in-line mounting		Size/threated connections: **06** = G 1/4" **10** = G 3/8" **15** = G 1/2" **20** = G 3/4" **25** = G 1" **32** = G 1 1/4"		Cracking pressure: - = 0,5 bar **/2** = 2 bar **/4** = 4 bar **/8** = 8 bar		Series number

2 HYDRAULIC CHARACTERISTICS

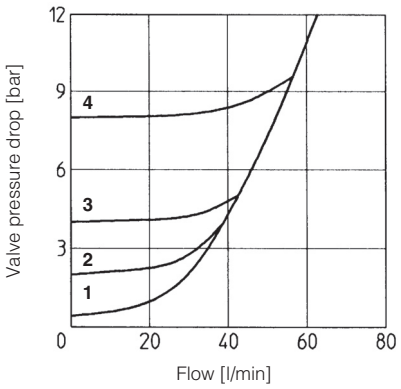
Hydraulic symbol		A B					
Valve model		**ADR-06**	**ADR-10**	**ADR-15**	**ADR-20**	**ADR-25**	**ADR-32**
Max recommended flow	[l/min]	40	80	150	300	360	500
Max pressure	[bar]	400		350			

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Fluid	Hydraulic oil as per DIN 51524 ... 535;
Fluid temperature	≤ 80°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog
Flow direction	As shown in the symbol at section 2
Rated flow	See diagrams Q/Δp at section 4

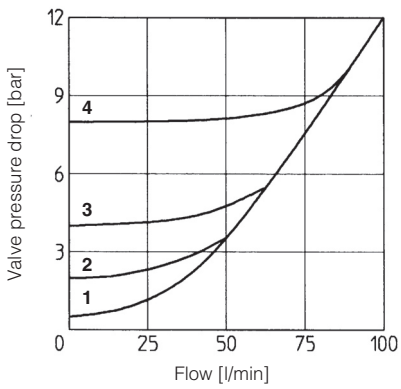
4 FLOW VERSUS PRESSURE DROP DIAGRAMS Based on based on mineral oil ISO VG 46 at 50°C

ADR-06



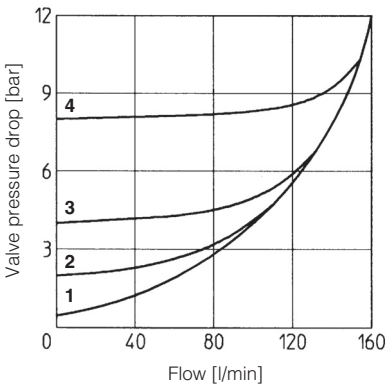
1 = ADR-06
2 = ADR-06/2
3 = ADR-06/4
4 = ADR-06/8

ADR-10



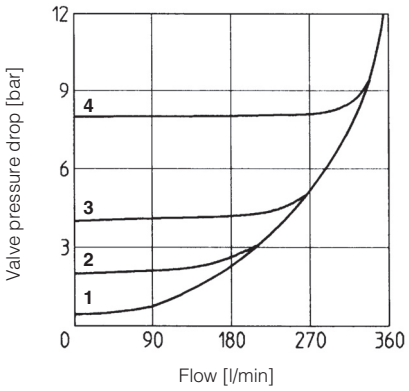
1 = ADR-10
2 = ADR-10/2
3 = ADR-10/4
4 = ADR-10/8

ADR-15



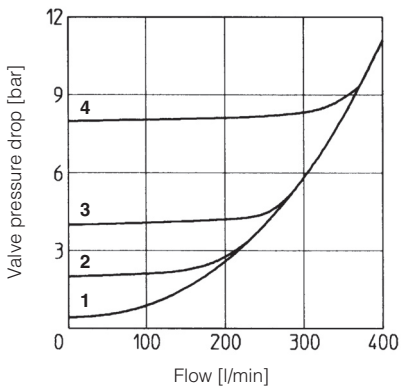
1 = ADR-15
2 = ADR-15/2
3 = ADR-15/4
4 = ADR-15/8

ADR-20



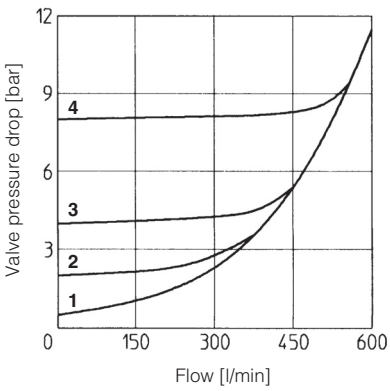
1 = ADR-20
2 = ADR-20/2
3 = ADR-20/4
4 = ADR-20/8

ADR-25



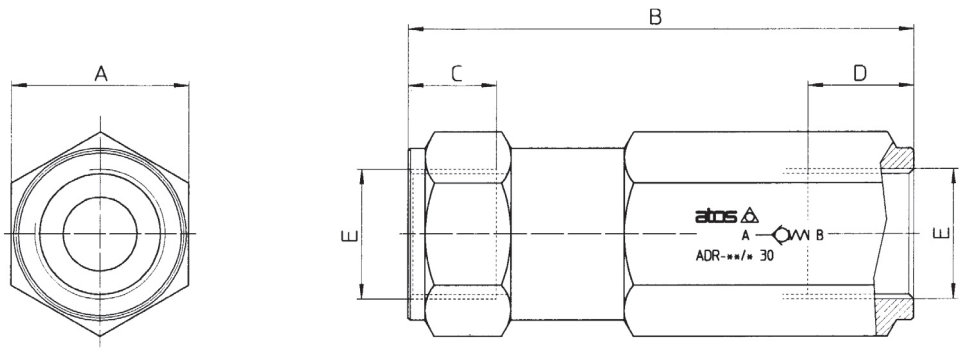
1 = ADR-25
2 = ADR-25/2
3 = ADR-25/4
4 = ADR-25/8

ADR-32



1 = ADR-32
2 = ADR-32/2
3 = ADR-32/4
4 = ADR-32/8

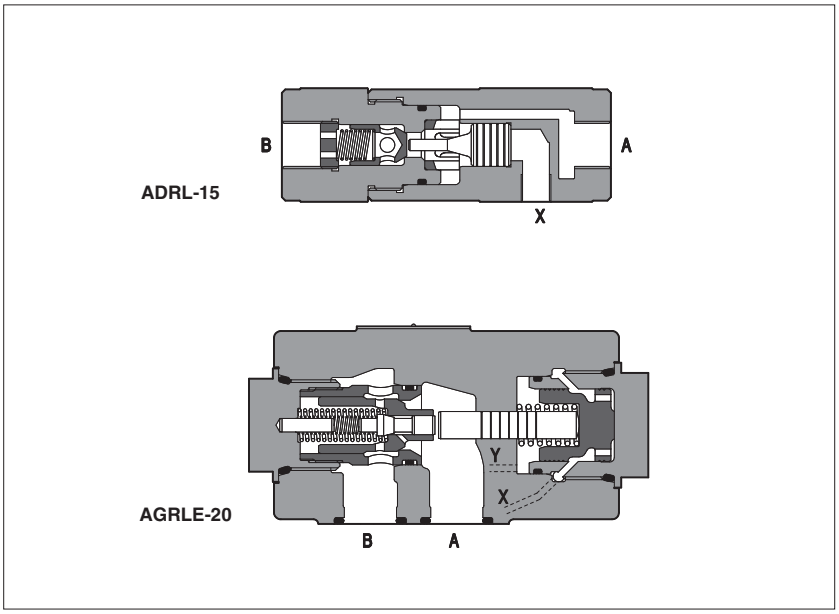
5 DIMENSIONS [mm]



Model	A	B	C	D	E	Mass [kg]
ADR - 06	22	67	12	13	G 1/4"	0,2
ADR - 10	27	70	12	13	G 3/8"	0,4
ADR - 15	32	82,5	14	17	G 1/2"	0,6
ADR - 20	36	102,5	16	21,5	G 3/4"	0,9
ADR - 25	46	120	18	24,5	G 1"	2,1
ADR - 32	55	137,5	20	23	G 1 1/4"	2,5

Pilot operated check valves type ADRL, AGRL, AGRLE

in-line mounting, port size from G 3/8" to G 1 1/4"
subplate mounting, ISO 5781 size 10, 20 and 32



ADRL are pilot operated (port X) check valves for in-line mounting available with port size from 3/8" GAS to 1 1/4" GAS.
Flow up to 300 l/min.
Pressure up to 400 bar.

AGRL and **AGRLE** are pilot operated (port X) check valves for subplate mounting available with mounting surface ISO 5781 size 10, 20 and 32.
Flow up to 500 l/min.
Max pressure: 315 bar.

AGRLE versions have an external drain (port Y) of the pilot chamber to permit a correct use of pilot operated check valve in systems where valve must open in presence of pressure at port A: infact pressure at port A, on regular pilot operated check valves, may affect the check opening by acting against the pilot device.

Valves designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE

AGRL	E	-	10	/	*	**	/	*

ADRL = pilot operated check valve in-line mounting
AGRL = pilot operated check valve subplate mounting

Only for AGRL:
- = without external drain
E = with external drain

Threaded connections for ADRL:
10 = G 3/8"
15 = G 1/2"
20 = G 3/4"
32 = G 1 1/4"

Size for AGRL and AGRLE:
10 **20** **32**

Cracking pressure

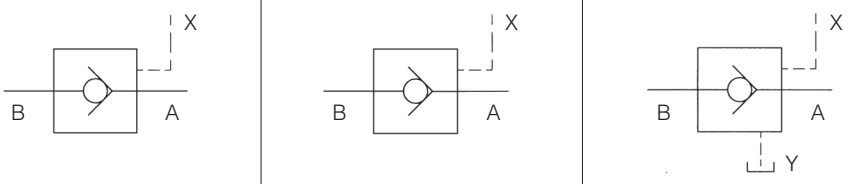
for ADRL	for AGRL
- = 0,5 bar	**-** = 0,5 bar
2 = 2 bar	
4 = 4 bar	
8 = 8 bar	

Series number

Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbols



Model	ADRL-10	ADRL-15	ADRL-20	ADRL-32	AGRL-10	AGRL-20	AGRL-32	AGRLE-10	AGRLE-20	AGRLE-32
Piloting ratio (1)	2,8	2,7	2,5	2,3	13,6	14,0	14,4	13,6	14,0	14,4
Max recommended flow [l/min]	30	60	100	300	160	300	500	160	300	500
Max pressure [bar]	400	350			315					

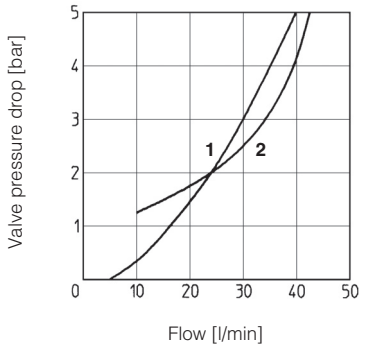
(1) Applying the pilot pressure through the pilot port X, the pilot spool opens the check valve, allowing free flow B→A.
The minimum pilot pressure for correct operation depends on the pilot ratio indicated in the table and on the pressure closing the check. i.e.: the pilot pressure for ADRL-20 is the pressure on the check divided by 2,5. The valves AGRL-* and AGRLE-*, are equipped with a decompression system.

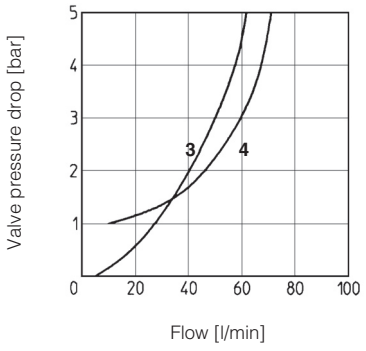
3 **MAIN CHARACTERISTICS, SEALS AND FLUIDS** - for other fluids not included in below table, consult our technical office

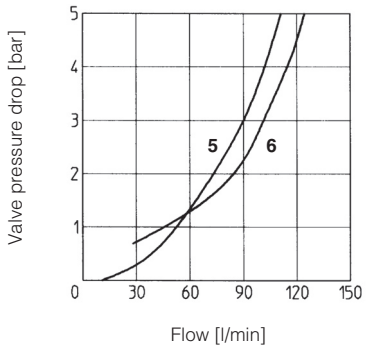
Assembly position	Any position. For AGRLE valves, the drain port Y has to be connected directly to the tank without counter pressure		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

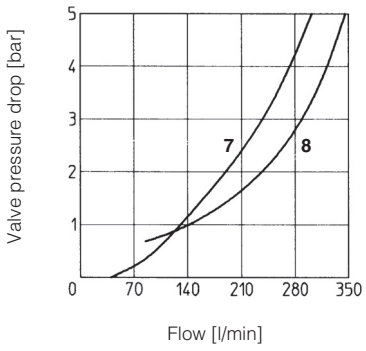
4 **FLOW VERSUS PRESSURE DROP DIAGRAMS FOR ADRL** based on mineral oil ISO VG 46 at 50°C

1 = **ADRL-10** B→A
2 = **ADRL-10** A→B
3 = **ADRL-15** B→A
4 = **ADRL-15** A→B
5 = **ADRL-20** B→A
6 = **ADRL-20** A→B
7 = **ADRL-32** B→A
8 = **ADRL-32** A→B



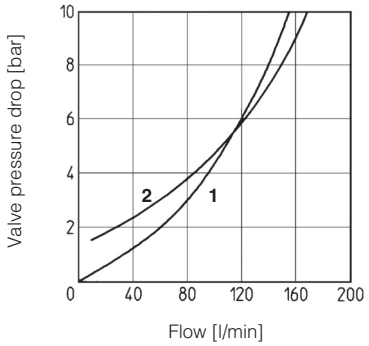


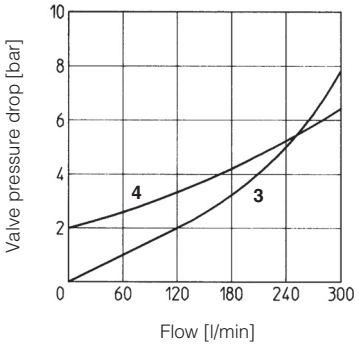


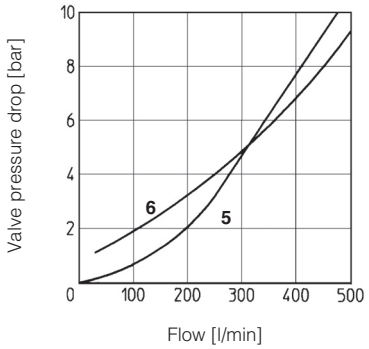


5 FLOW VERSUS PRESSURE DROP DIAGRAMS FOR AGRL AND AGRLE based on mineral oil ISO VG 46 at 50°C

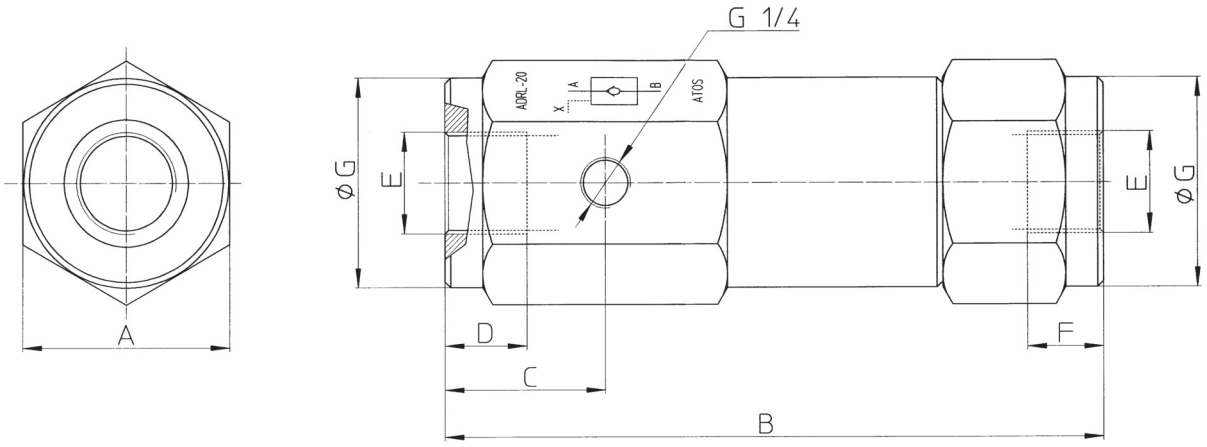
1 = **AGRL-10, AGRLE-10** B→A
2 = **AGRL-10, AGRLE-10** A→B
3 = **AGRL-20, AGRLE-20** B→A
4 = **AGRL-20, AGRLE-20** A→B
5 = **AGRL-32, AGRLE-32** B→A
6 = **AGRL-32, AGRLE-32** A→B







6 DIMENSIONS FOR ADRL VALVES [mm]

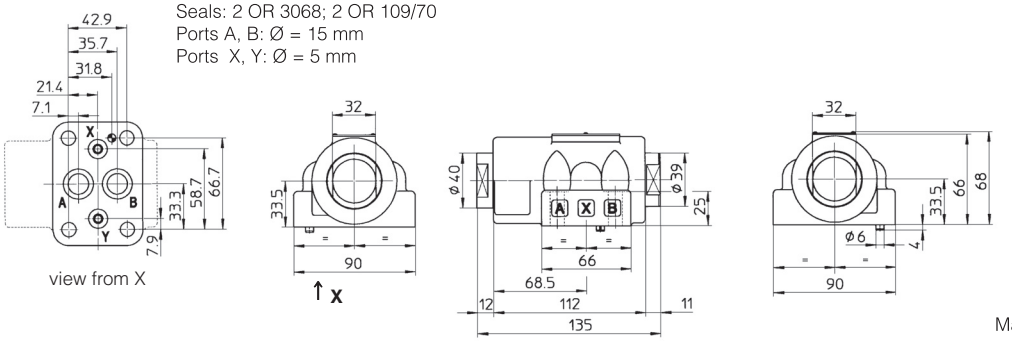


Model	A	B	C	D	E	F	ØG	Mass [Kg]
ADRL-10	41	120	30	14	G 3/8"	12	40	1
ADRL-15	50	145	33	16	G 1/2"	16	49	2
ADRL-20	55	175	42,5	18,5	G 3/4"	19	54,5	2,5
ADRL-32	90	245	53	23,5	G 1 1/4"	25	87,5	7

7 DIMENSIONS FOR AGRL AND AGRLE VALVES [mm]

AGRL-10
AGRLE-10

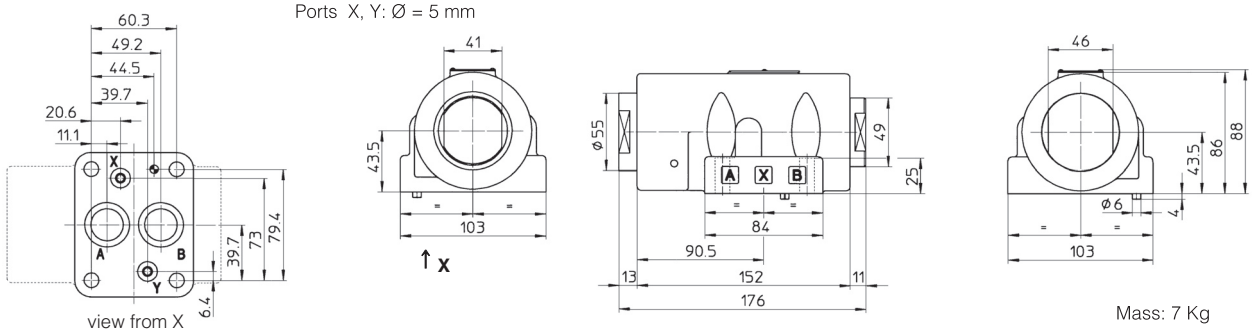
ISO 5781: 2000
Mounting surface: 5781-06-07-0-00
Fastening bolts: 4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 3068; 2 OR 109/70
Ports A, B: Ø = 15 mm
Ports X, Y: Ø = 5 mm



Mass: 4 Kg

AGRL-20
AGRLE-20

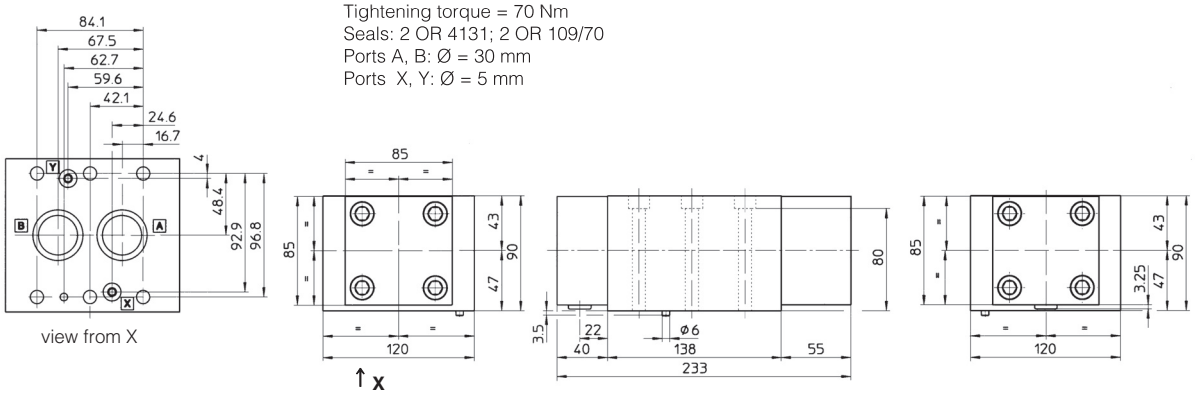
ISO 5781: 2000
Mounting surface: 5781-08-10-0-00
Fastening bolts: 4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 4100; 2 OR 109/70
Ports A, B: Ø = 23 mm
Ports X, Y: Ø = 5 mm



Mass: 7 Kg

AGRL-32
AGRLE-32

ISO 5781: 2000
Mounting surface: 5781-10-13-0-00
Fastening bolts: 6 socket head screws M10x100 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 4131; 2 OR 109/70
Ports A, B: Ø = 30 mm
Ports X, Y: Ø = 5 mm



Mass: 14,8 Kg

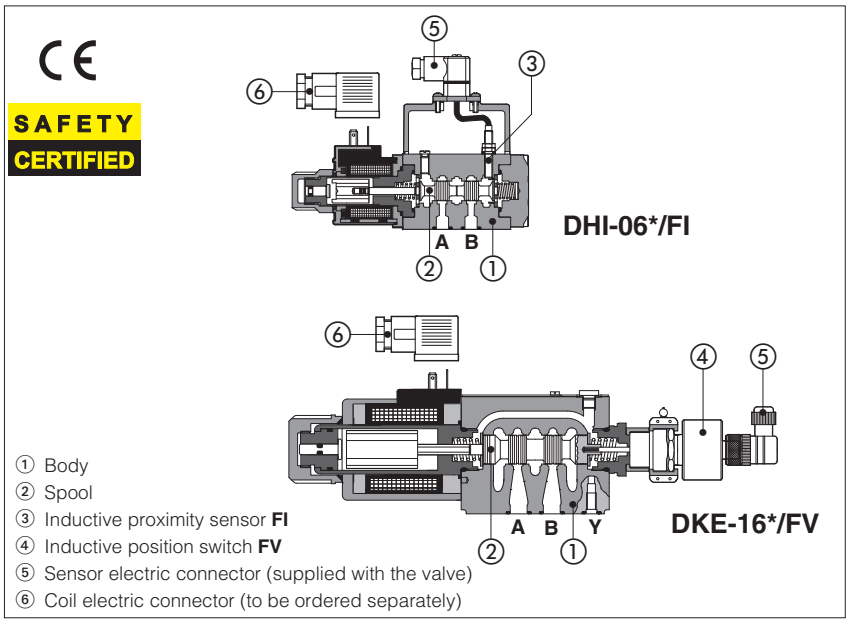
8 MOUNTING SUBPLATES FOR AGRL AND AGRLE VALVES

Valve	Subplate model	Port location	GAS ports				Ø Counterbore [mm]				Mass [kg]
			A	B	X	Y	A	B	X	Y	
AGRL-10, AGRLE-10	BA-305	Ports A, B, X, Y underneath;	1/2"	1/2"	1/4"	1/4"	30	30	21,5	21,5	1
AGRL-20, AGRLE-20	BA-505		1"	1"	1/4"	1/4"	46	46	21,5	21,5	2
AGRL-32, AGRLE-32	BA-705 A		1 1/2"	1 1/2"	1/4"	1/4"	63,5	63,5	21,5	21,5	7,5

The subplates are supplied with fastening bolts. For further details see table K280.

Safety directional valves with spool position monitoring

On-off, direct operated, conforming to Machine Directive 2006/42/EC - certified by



① Body
② Spool
③ Inductive proximity sensor **FI**
④ Inductive position switch **FV**
⑤ Sensor electric connector (supplied with the valve)
⑥ Coil electric connector (to be ordered separately)

Direct operated safety directional valves with spool position monitoring, **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/EC.

DHI, size 06, for AC and DC supply, with cURus certified solenoids

DHE, size 06, high performances, for AC and DC supply with cURus certified solenoids

DKE, size 10, for AC and DC supply with cURus certified solenoids

The valves are equipped with **FI** inductive proximity sensor or **FV** inductive position switch for the spool position monitoring, see section [1] and [11] for sensors availability and technical characteristics.

Certification
The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting surface: **ISO 4401**, size **06** and **10**
Max flow: **DHI 60 l/min**
DHE 80 l/min
DKE 150 l/min
Max pressure: **350 bar**

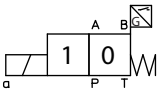
[1] RANGE OF VALVE'S MODELS

Valve code	Size	Description	DC solenoids		AC solenoids	
			Sensor type			
			/FI	/FV	/FI	/FV
DHI-06	06	direct operated solenoid valves, on-off, single solenoid	•	•	•	•
DHI-07	06	direct operated solenoid valves, on-off, double solenoid	•		•	
DHE-06	06	direct operated solenoid valves, on-off, single solenoid	•	•	•	•
DHE-07	06	direct operated solenoid valves, on-off, double solenoid	•	•	•	
DKE-16	10	direct operated solenoid valves, on-off, single solenoid	•	•	•	•
DKE-17	10	direct operated solenoid valves, on-off, double solenoid	•	•	•	

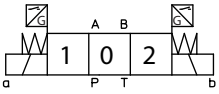
Notes:
FI = inductive proximity sensor, type NO (normally open) or NC (normally closed)
FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector
See section [11] for sensor's characteristics

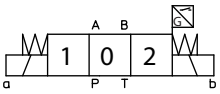
1.1 FI sensor & FV switch configurations

Single solenoid valves size 06 & 10 are provided with n°1 FI sensor or n° 1 FV switch for the spool position monitoring

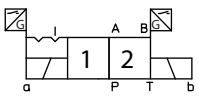


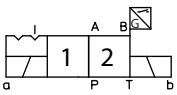
Double solenoid valves size 06 & 10 are provided with n° 2 FI sensors or n° 1 FV switch for the spool position monitoring



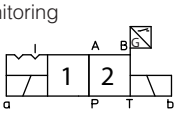


Double solenoid valves size 06 with detent are provided with n°2 FI sensors or n° 1 FV switch for the spool position monitoring





Double solenoid valves size 10 with detent are provided with n° 1 FI sensor or n° 1 FV switch for the spool position monitoring



For model code of DHI and DHE safety valves, see section [2]
For model code of DKE safety valves, see section [4]

2 MODEL CODE OF DHI AND DHE

DHI	-	0	63	1/2	/	A	/	FV	*	-	X	24DC	**	/	*

Directional control valve size 06
DHI = max flow 60 l/min
DHE = max flow 80 l/min

Size ISO 4401
0 = size 06

Valve configuration, see section 3
61 = single solenoid, central plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, external plus central position, spring offset
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent

Spool type, see section 3

Options, see section 8

Electrical signal - only for **FI** version (1):
/NC = electric contact is closed when the valve is de-energized
/NO = electric contact is open when the valve is de-energized

Spool position monitor:
FI = inductive proximity switch
FV = inductive position switch (double contact)

Voltage code, see section 9

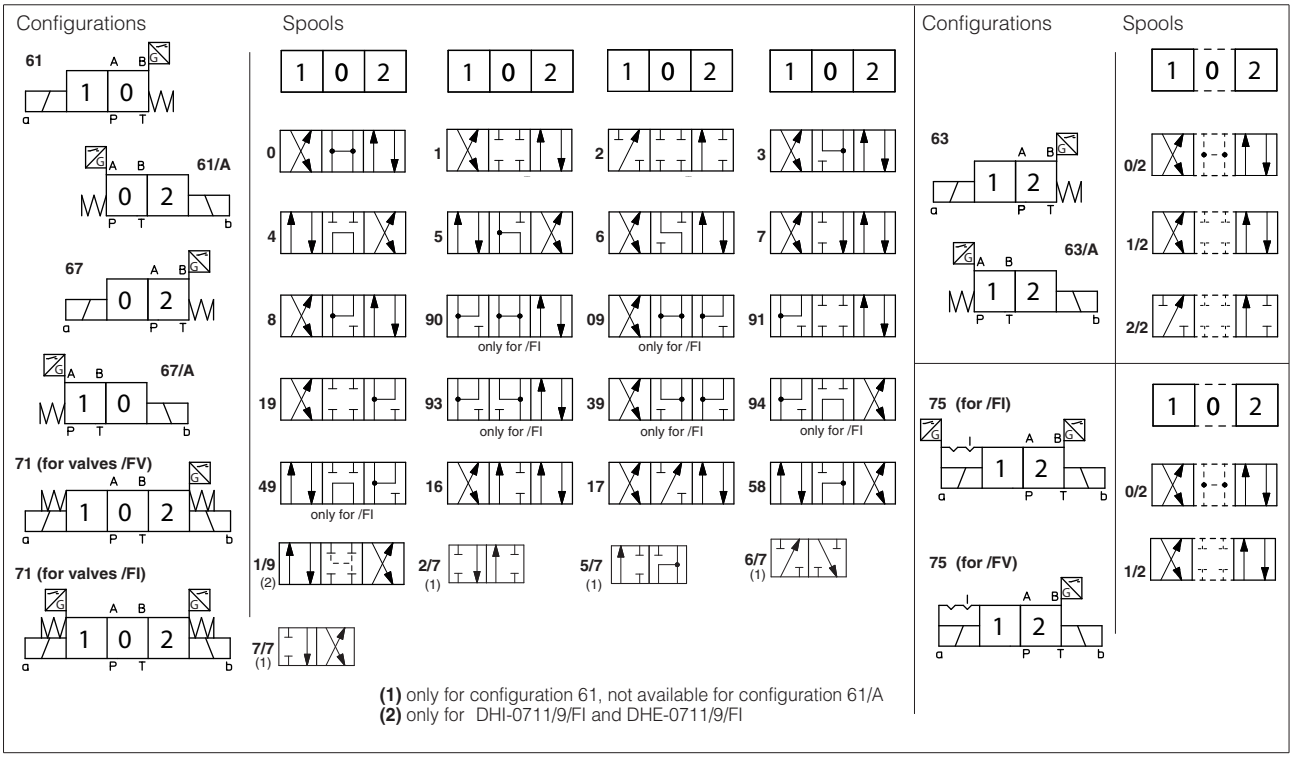
X = without connector, see section 10 for available connectors, to be ordered separately

Series number

Seals material see sect. 6,7
- = NBR
PE = FKM

(1) the **FV** inductive position switch provides both NC and NO contacts

3 CONFIGURATIONS AND SPOOLS FOR DHI AND DHE (representation according to ISO 1219-1)



(1) only for configuration 61, not available for configuration 61/A
(2) only for DHI-0711/9/FI and DHE-0711/9/FI

3.2 Special shaped spools for DHI and DHE

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4**, **5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1**.
  They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 1/2, 3, 8** are available as **1P, 1/2P, 3P, 8P** to limit valve internal leakages.
- Other types of spools can be supplied on request.

3.1 Standard spool availability for DHI and DHE - spools not listed in the table are available for all valves models

Valve type	standard spool						
	09	90	39	93	49	94	1/9
DHI/FI	•	•	•	•	•	•	•
DHI/FV							
DHE/FI	•	•	•	•	•	•	•
DHE/FV							

4 MODEL CODE OF DKE

DKE	- 1	63	1/2	/ A	/ FV	* - X	24DC	** /	*

Directional control valve size 10

Size ISO 4401
1 = size 10

Valve configuration, see section 5
61 = single solenoid, central plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, external plus central position, spring offset
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent

Spool type, see section 5

Options, see section 8

Electrical signal - only for **FI** version (1):
/NC = electric contact is closed when the valve is de-energized
/NO = electric contact is open when the valve is de-energized

X = without connector, see section 10 for available connectors, to be ordered separately

Voltage code, see section 9

Series number

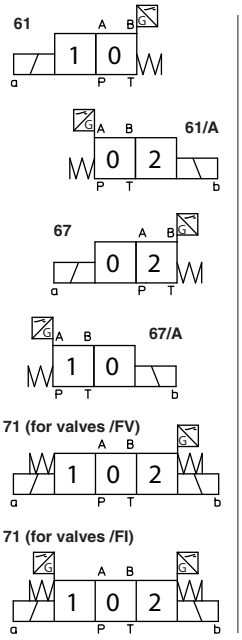
Seals material see sect. 6,7
- = NBR
PE = FKM

Spool position monitor:
FI = inductive proximity switch
FV = inductive position switch (double contact)

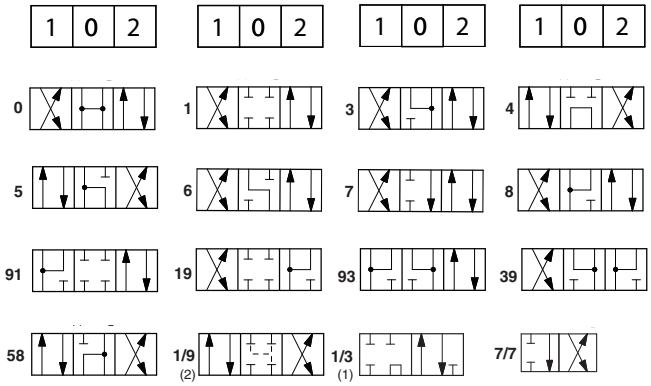
DKE/FI and /FV are always provided with Y drain port
(1) the **FV** inductive position switch provides both NC and NO contacts

5 CONFIGURATIONS AND SPOOLS FOR DKE (representation according to ISO 1219-1)

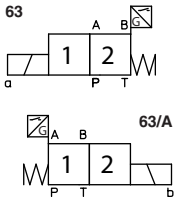
Configurations

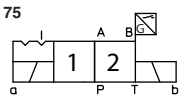


Spools

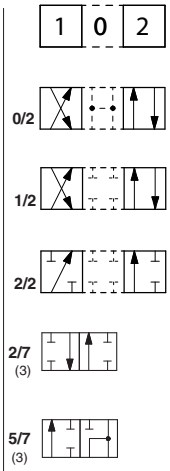


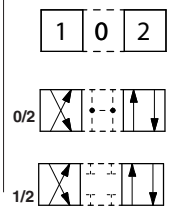
Configurations





Spools





(1) only for DKE-1611/3/*DC
(2) only for DKE-1711/9/FI
(3) only for configuration 63, not available for configuration 63/A

5.1 Special shaped spools for DKE

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1** is also available as **1/1**, properly shaped to reduce the water-hammer shocks during the switching.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- other types of spools can be supplied on request.

6 MAIN CHARACTERISTICS

Assembly position / location		Any position
Subplate surface finishing		Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849		150 years, for further details see technical table P007
Compliance		CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components **(1)** -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature		**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Flow direction		As shown in the symbols of table 3 and 5
Operating pressure	**DHI**	P, A, B = **350 bar** T = **100 bar** (version /FI); **120 bar** (version /FV)
	DHE	P, A, B = **350 bar** T = **100 bar** (version /FI); **210 bar** (DC solenoid - version /FV); **160 bar** (AC solenoid - version /FV)
	DKE	P, A, B = **350 bar** T = (with Y port not connected to tank) **100 bar** (version /FI); **210 bar** (DC solenoid - version /FV); **120 bar** (AC solenoid - version /FV) T = (with Y port drained to tank) **250 bar**
Rated flow		see diagrams Q/Δp at section 14
Maximum flow	**DHI**	**60 l/min** see section 15
	DHE	**80 l/min** see section 15
	DKE	**150 l/min** see section 15

(1) The type-examination certificate can be download from www.atos.com

6.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils (all versions) and AC coils (only DHI) **F** (155°C) for AC coils (DHE, DKE) Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 9
Supply voltage tolerance	± 10%
Certification	**cURus** North American standard

7 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

8 OPTIONS

A = Single solenoid valves: solenoid mounted at side of port B. In standard versions the solenoid is mounted at side of port A.
Double solenoid valves DHE/FV(DC), DKE/FV(DC): FV inductive position switch mounted at side of port A. In standard versions the position switch is mounted at side of port B.

WARNING: the manual operation is not permitted for safety valves, than the valve is provided with solenoid blind rings to prevent the access to the manual override. The manual override protected by rubber cup (option /WP) is not available

WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury
Safety valves must be installed and commissioned only by qualified personnel
Safety valves must not be disassembled
The inductive proximity FI or the inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers
Valve's components cannot be interchanged
The valves must operate without switching shocks and spool vibrations

9 ELECTRIC FEATURES

9.1 COILS FOR DHI AND DHE VALVES

Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)**		Code of spare coil		
				DHI	**DHE**	**DHI**	Colour of coil label **DHI**	**DHE**
DHI DHE	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC							
	48/50 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	48/60 AC							
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	120/60 AC							
	230/50 AC	**230RC**				COU-230RC	blue	COE-230RC
	230/60 AC							

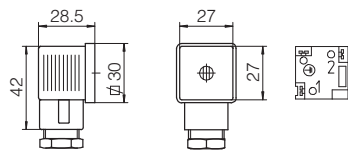
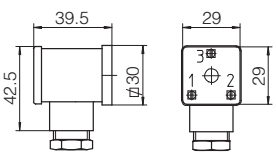
(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DHI) and 58 VA (DHE)
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(4) Only for DHI
(5) Only for DHE

9.2 COILS FOR DKE VALVE

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil
12 DC	**12 DC**	666 or 667	36 W	CAE-12DC
14 DC	**14 DC**			CAE-14DC
24 DC	**24 DC**			CAE-24DC
28 DC	**28 DC**			CAE-28DC
110 DC	**110 DC**			CAE-110DC
125 DC	**125 DC**			CAE-125 DC
220 DC	**220 DC**			CAE-220DC
110/50/60 AC	**110/50/60 AC**		100 VA (3)	CAE-110/50/60AC (1)
230/50/60 AC	**230/50/60 AC**			CAE-230/50/60AC (1)
115/60 AC	**115/60 AC**		130 VA (3)	CAE-115/60AC
230/60 AC	**230/60 AC**			CAE-230/60AC
110/50/60 AC	**110 DC**	669	36 W	CAE-110DC
230/50/60 AC	**220 DC**			CAE-220DC

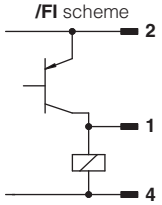
(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 90 VA
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

10 COILS ELECTRIC CONNECTORS - according to din 43650 (to be ordered separately)

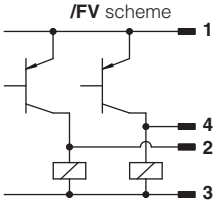
666, 667 (for AC or DC supply)	**669** (for AC supply)	**CONNECTOR WIRING**	
		**666, 667** 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	**669** 1,2= Supply voltage VAC 3 = Coil ground
		SUPPLY VOLTAGES	
		666	**667** / **669**
		All voltages	24 AC or DC 110 AC or DC 220 AC or DC 110/50 AC 110/60 AC 230/50 AC 230/60 AC

11 TECHNICAL CHARACTERISTICS OF INDUCTIVE PROXIMITY AND POSITION SWITCHES

Type of switch		**/FI** proximity sensor	**/FI** scheme	**/FV** position switch	**/FV** scheme
Supply voltage	[V]	10÷30		20÷32	
Ripple max	[%]	≤ 20		≤ 10	
Max current	[mA]	200		400	
Max peak pressure	[bar]	100		400	
Mechanical life		virtually infinite		virtually infinite	
Switch logic		PNP		PNP	



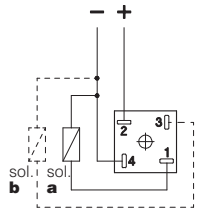
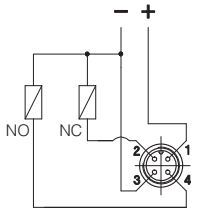
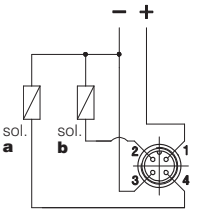
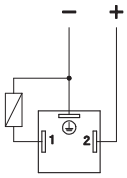
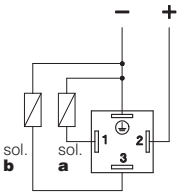
1 output signal
2 supply +24 VDC
4 GND



1 supply +24 VDC
2 output signal

3 GND
4 output signal

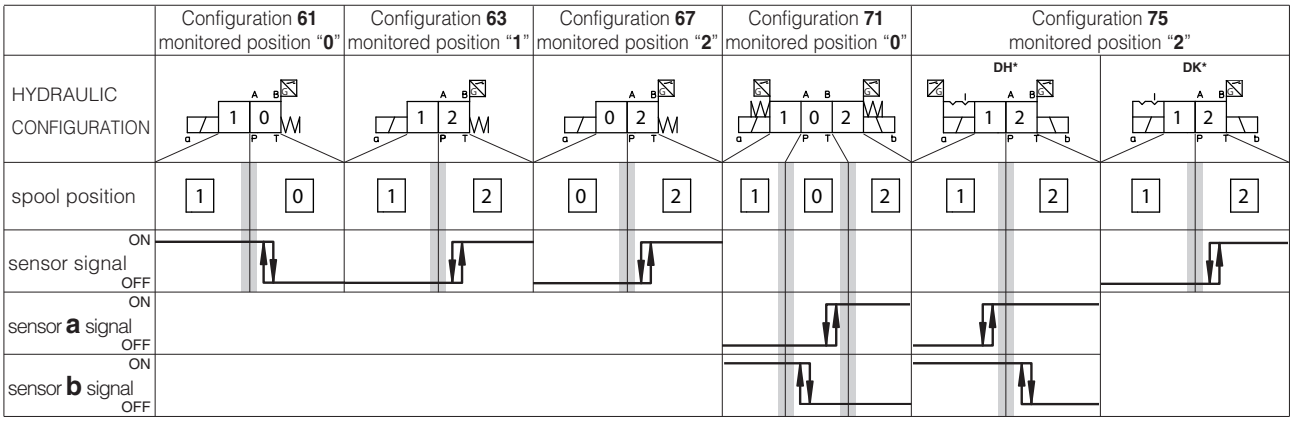
12 CONNECTING SCHEMES OF INDUCTIVE PROXIMITY AND POSITION SWITCHES - FI and FV sensor's connector are always supplied with the valve

DH*/FI single solenoid / double solenoid (dotted line)	**/FV (all valves)** single solenoid	**/FV (all valves)** double solenoid	**DKE/FI** single solenoid	**DKE/FI** double solenoid
Connector type **345** IP65	Connector type **ZBE-06** IP65	Connector type **ZBE-06** IP65	Connector type **666** IP65	Connector type **664** IP65
				
1 =output signal 2 =supply +24 VDC 3 = output signal for double solenoid 4 = GND	1 = supply +24 VDC 2 = output signal NC 3 = GND 4 = output signal NO	1 = supply +24 VDC 2 = output signal sol.**b** 3 = GND 4 = output signal sol.**a**	1 = output signal S 2 = supply +24 VDC ⏚ = GND	1 = output signal sol.**a** 2 = supply +24 VDC 3 = output signal sol.**b** ⏚ = GND

NOTE: the /FI proximity and /FV position switch are not provided with a protective earth connection

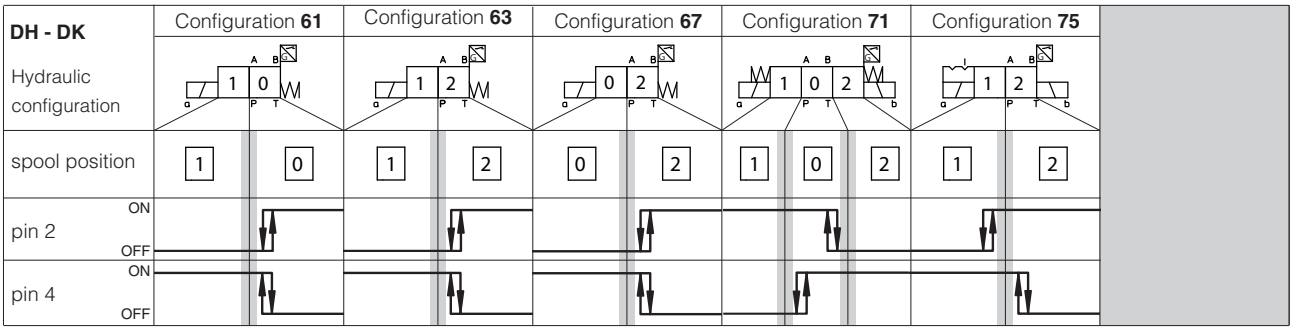
13 STATUS OF OUTPUT SIGNAL

13.1 Signal status for FI versions



Diagrams show the behaviour of the output signal for inductive switches type **FI/NO**.
For inductive switches type **FI/NC** the behaviour is opposite (high level signal instead of low level signal and viceversa)

13.2 Signal status for FV versions



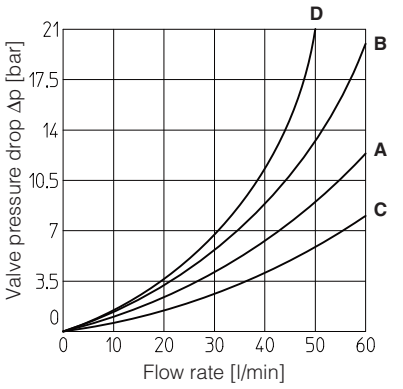
Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

14 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

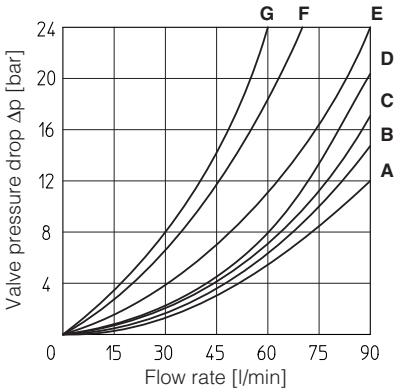
DHI

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1	C	C	C	C	
0/2, 1, 1/1, 1/2, 1/9	A	A	A	A	
2, 3, 3/1	A	A	C	C	
2/2, 4, 4/8, 5, 5/1, 58, 58/1, 94	D	D	D	D	A
6, 7, 16, 17	A	A	C	A	
8	C	C	B	B	
09, 19, 90, 91	B	B	A	A	
39, 93	D	D	D	D	



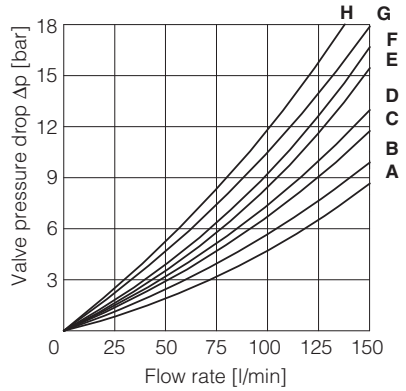
DHE

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1	A	A	C	C	D
1, 1/1, 1/9	D	C	C	C	
3, 3/1	D	D	A	A	
4, 4/8, 5, 5/1, 49, 58, 58/1, 94	F	F	G	C	E
1/2, 0/2	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8	A	A	E	E	
2	D	D			
2/2	F	F			
09, 19, 90, 91	E	E	D	D	
39, 93	F	F	G	G	



DKE

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T	B→A
0, 0/1, 0/2, 2/2	A	A	B	B		
1, 1/1, 1/9, 6, 8	A	A	D	C		
3, 3/1, 7	A	A	C	D		
4	B	B	B	B	F	
5, 58	A	B	C	C	G	
1/2	B	C	C	B		
19, 91	E	E	G	G		H
39, 93	F	F	G	G		H



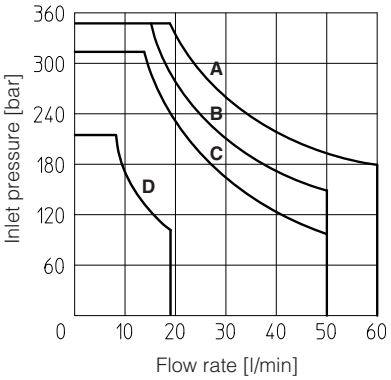
15 **OPERATING LIMITS** based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

DHI

Curve	Spool type
A	0, 1,1/2, 8
B	0/1, 0/2, 1/1, 1/9, 3, 3/1
C	4, 4/8, 5, 5/1, 6, 7, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	2, 2/2

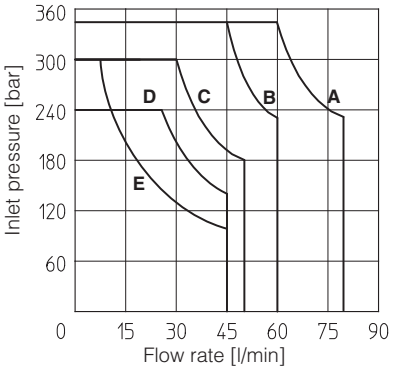
DHI



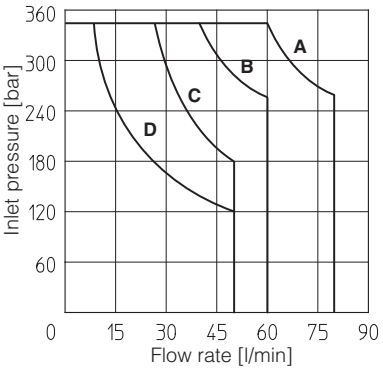
DHE

Curve	Spool type	
	AC	**DC**
A	1,1/2, 8	0, 0/1, 1, 1/2, 3, 8
B	0, 0/1, 0/2, 1/1, 1/9, 3	0/2, 1/1, 6, 7, 1/9, 19
C	3, 3/1, 6, 7	3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	4, 4/8, 5, 5/1, 16, 17, 19, 39, 58, 58/1, 09, 90, 91, 93, 94	2, 2/2
E	2, 2/2	-

DHE - AC



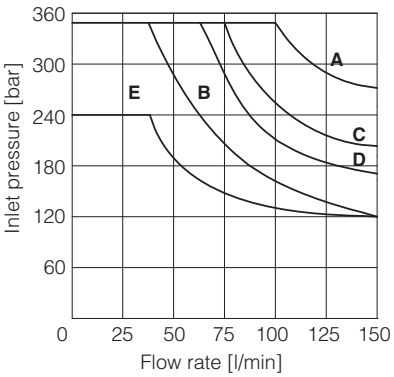
DHE - DC



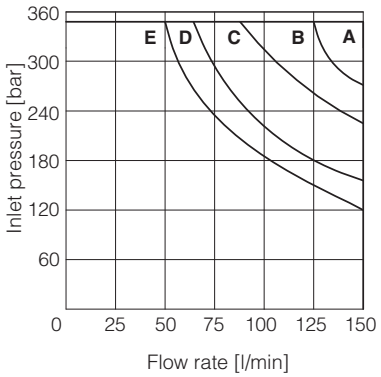
DKE

Curve	Spool type	
	AC	**DC**
A	0/1	0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8
B	4, 5, 19, 91	6, 7
C	0, 1/1, 3, 3/1	19, 91
D	1, 1/2, 0/2	4, 5
E	6, 7, 8, 2/2	2/2

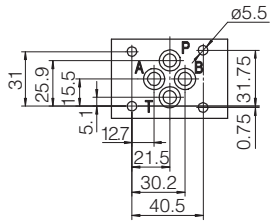
DKE - AC



DKE - DC



16 DIMENSIONS FOR DHI AND DHE SOLENOID SAFETY VALVES [mm]

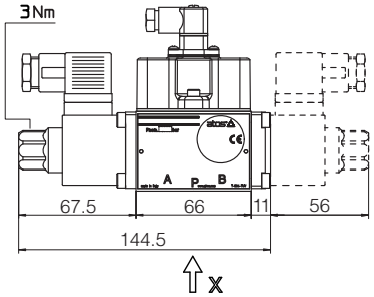


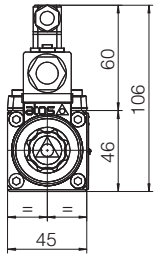
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws: M5x50 class 12.9 (DHI)
M5x30 class 12.9 (DHE)
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

option /A
Single solenoid valves: solenoid mounted at side of port B.
Double solenoid valves DHE/FV(DC): FV inductive position switch mounted at side of port A

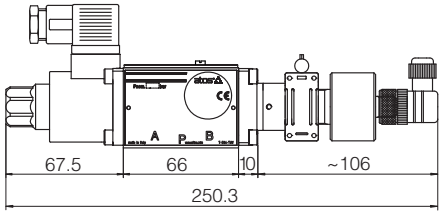
DHI-06*/FI (DC, AC)
DHI-07*/FI (DC, AC) dotted line

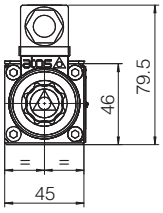




Mass:
kg 1,6 (one solenoid)
kg 1,9 (two solenoids)

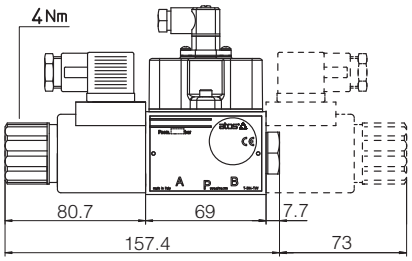
DHI-06*/FV (DC, AC)

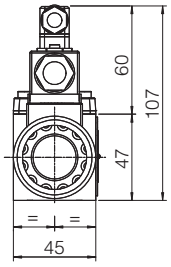




Mass: kg 1,7

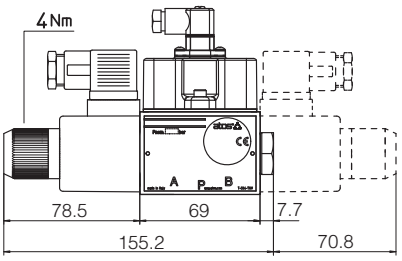
DHE-06*/FI (DC)
DHE-07*/FI (DC) dotted line

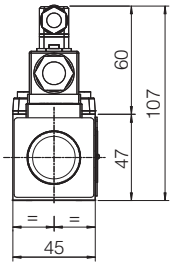




Mass:
kg 1,85 (one solenoid)
kg 2,1 (two solenoids)

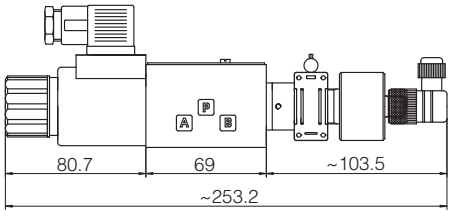
DHE-06*/FI (AC)
DHE-07*/FI (AC) dotted line





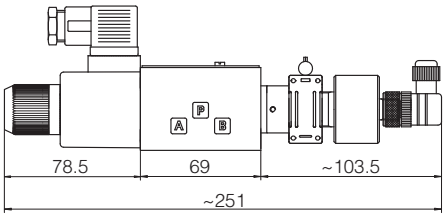
Mass:
kg 1,85 (one solenoid)
kg 2,1 (two solenoids)

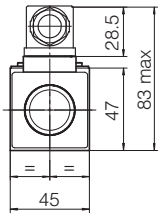
DHE-06*/FV (DC)



Mass: kg 1,95

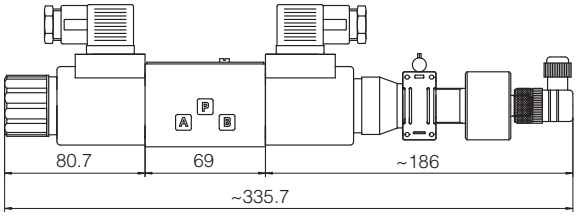
DHE-06*/FV (AC)

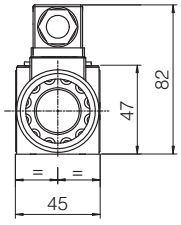




Mass: kg 1,8

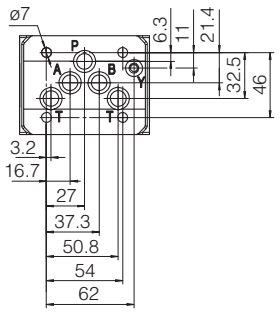
DHE-07*/FV (DC)





Mass: kg 2,2

17 DIMENSIONS OF DKE SOLENOID SAFETY VALVES [mm]

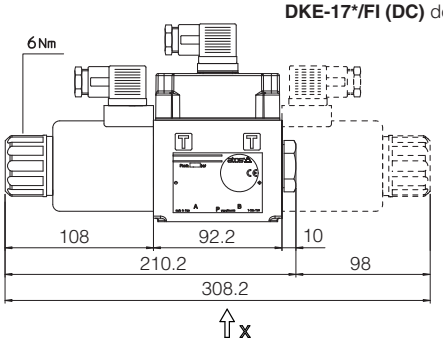


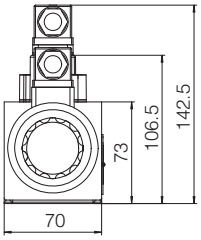
ISO 4401: 2005
Mounting surface:
4401-05-05-0-05
(without port X)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050. 1 OR 108
Ports P,A,B,T: Ø = 11.5 mm (max)
Ports Y: Ø = 5 mm

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
Y = DRAIN PORT

option /A
Single solenoid valves: solenoid mounted at side of port B.
Double solenoid valves DKE/FV(DC): FV inductive position switch mounted at side of port A

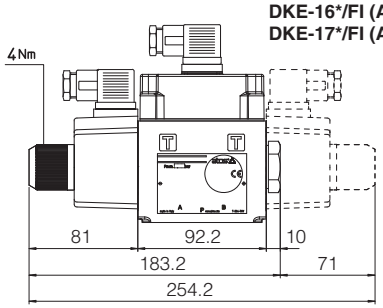
DKE-16*/FI (DC)
DKE-17*/FI (DC) dotted line

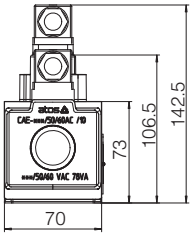




Mass:
kg 4,4 (one solenoid)
kg 5,8 (two solenoids)

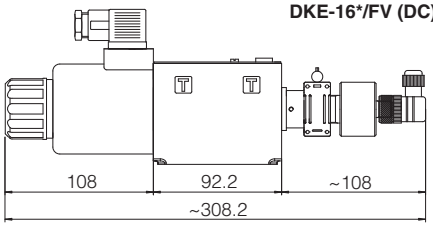
DKE-16*/FI (AC)
DKE-17*/FI (AC) dotted line





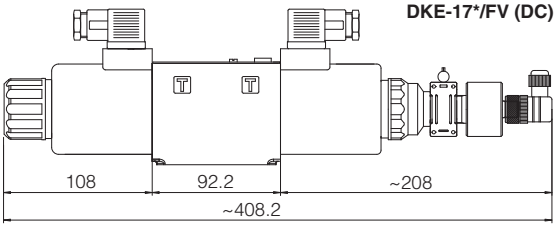
Mass:
kg 3,7 (one solenoid)
kg 4,4 (two solenoids)

DKE-16*/FV (DC)



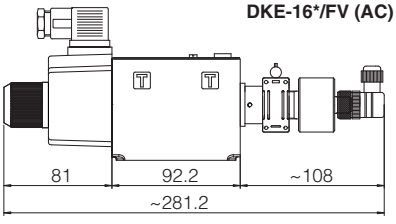
Mass: kg 4,4

DKE-17*/FV (DC)



Mass: kg 5,9

DKE-16*/FV (AC)

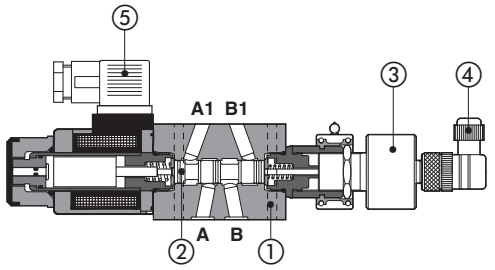


Mass: kg 3,8

Safety modular valves with spool position monitoring

On-off, direct, conforming to Machine Directive 2006/42/EC - certified by

SAFETY CERTIFIED



HF-0611/FV

① Body
② Spool
③ Inductive position switch **FV**
④ Sensor electric connector (supplied with the valve)
⑤ Coil electric connector (to be ordered separately)

HF are spool type, direct operated solenoid valves in modular execution, normally used for safety functions to shut-off or to by-pass the hydraulic user lines.
They are provided with **FV** inductive position switch for spool position monitoring, **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/EC.

The modular execution permits to make compact functional circuits, by the stack mounting with other modular valves and solenoid valves size 06.

Applications
Syncro press brakes, vertical presses, plastic injection, ceramic presses.

Certification
The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting Surface: **ISO 4401 size 06**
Max flow: **60 l/min**
Max pressure: **350 bar**

1 MODEL CODE

HF-0	61	1	/	A	/	FV	-	E	X	24DC	**	/*

HF-0: Modular directional valve size 06

61: **Valve configuration**, see section 2
61 = single solenoid, central plus external position, spring centered
67 = single solenoid, central plus external position, spring offset

1: **Spool type**: **1**, **3**, **4** see section 2

A: **Options**:
A = solenoid mounted at side of port B
B = orientation of coil and proximity connectors rotated of 180°

FV: **Optional spool position monitor**:
FV = inductive position switch (only for HF-0611, HF-0614, HF-0673)

E: **E** = solenoid OE for AC and DC supply

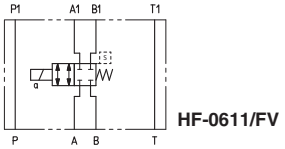
X: **X** = without connector
See section 6 for available connectors, to be ordered separately

24DC: **Voltage code**, see section 7

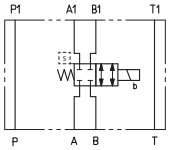
******: Series number

/*: Seals material, see section 4:
- = NBR
PE = FKM

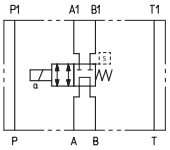
2 CONFIGURATION



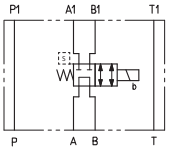
HF-0611/FV



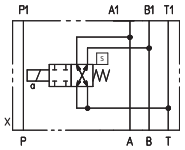
HF-0611/AFV



HF-0614/FV



HF-0614/AFV



HF-0673/FV

3 MAIN CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Compliance	CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components **(1)** -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Flow direction	As shown in the symbols of table 2
Operating pressure	Ports P,A,B: **350** bar; Port T: **210** bar (DC solenoid); **160** bar (AC solenoid)
Maximum flow	**60 l/min**

(1) The type-examination certificate can be download from www.atos.com

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils **F** (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with mating connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 7
Supply voltage tolerance	± 10%
Certification	**cURus** North American standard

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

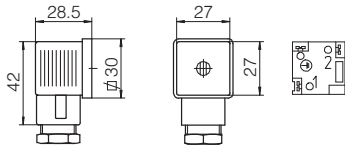
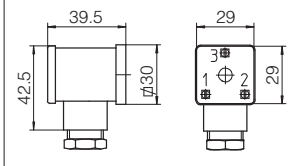
5 OPTIONS

A = Solenoid mounted at side of port B. In standard versions, solenoid is mounted at side of port A.

B = Orientation of coil and proximity connectors rotated of 180°

the manual operation is not permitted for safety valves, than they are provided with solenoid blind rings to prevent the access to the manual override.

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666, 667 (for AC or DC supply)	**669** (for AC supply)	**CONNECTOR WIRING**	
		**666, 667** 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	**669** 1,2 = Supply voltage VAC 3 = Coil ground
		SUPPLY VOLTAGES	
666	**667**	**669**	
All voltages	24 AC or DC 110 AC or DC 220 AC or DC	110/50 AC 110/60 AC 230/50 AC 230/60 AC	

Note: for electronic connectors type **E-SD**, see tab. K500

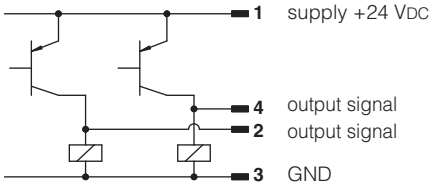
7 ELECTRIC FEATURES

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil
12 DC	**12 DC**	666 or 667	30 W	COE-12DC
14 DC	**14 DC**			COE-14DC
24 DC	**24 DC**			COE-24DC
28 DC	**28 DC**			COE-28DC
48 DC	**48 DC**			COE-48DC
110 DC	**110 DC**			COE-110DC
125 DC	**125 DC**			COE-125DC
220 DC	**220 DC**			COE-220DC
110/50 AC	**110/50/60 AC**		58 VA (3)	COE-110/50/60AC (1)
230/50 AC	**230/50/60 AC**			COE-230/50/60AC (1)
115/60 AC	**115/60 AC**		80 VA (3)	COE-115/60AC
230/60 AC	**230/60 AC**			COE-230/60AC
110/50 AC - 120/60 AC	**110 RC**	669	30 W	COE-110RC
230/50 AC - 230/60 AC	**230 RC**			COE-230RC

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.
(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

8 TECHNICAL CHARACTERISTICS OF FV INDUCTIVE POSITION SWITCH

Type of switch		contactless inductive position switch with integrated amplifier
Supply voltage	[V]	20÷32
Ripple max	[%]	≤ 10
Max current	[mA]	400
Reaction time	[ms]	15
Max peak pressure	[bar]	400
Mechanical life		virtually infinite
Switch logic		PNP

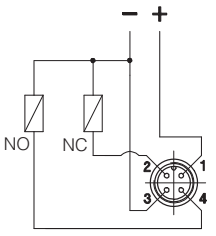


9 CONNECTING SCHEME OF FV INDUCTIVE POSITION SWITCH

single solenoid

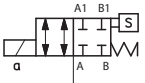
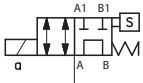
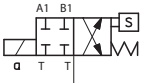
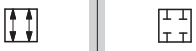
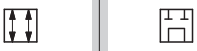
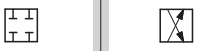
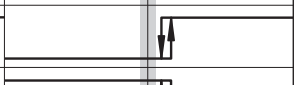
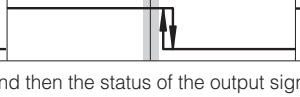
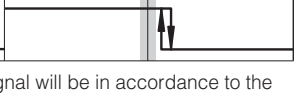
Connector type **ZBE-06**
(supplied with the valve)

1 = supply +24 VDC
2 = output signal NC
3 = GND
4 = output signal NO



Note: the /FV position switch is not provided with a protective earth connection

10 STATUS OF OUTPUT SIGNAL FOR MODULAR VALVES WITH /FV INDUCTIVE POSITION SWITCH

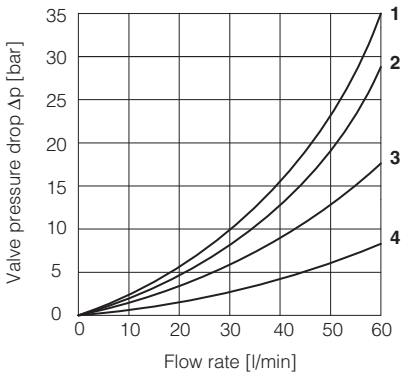
Hydraulic configuration	Configuration **611**	Configuration **614**	Configuration **673**
			
spool position			
pin 2 ON / OFF			
pin 4 ON / OFF			

Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

11 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

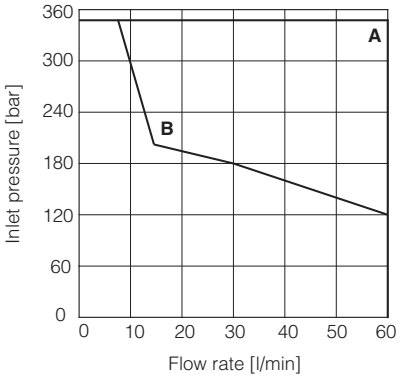
Flow direction / Valve type	A→A1	B→B1	A→B	A1→T	B1→T
HF-0611	1	2			
HF-0614	1	2	3		
HF-0673	3	3		4	4



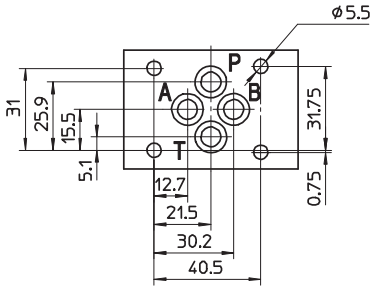
12 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%)

Valve type	Curve
HF-0611	**A**
HF-0614, HF-0673	**B**

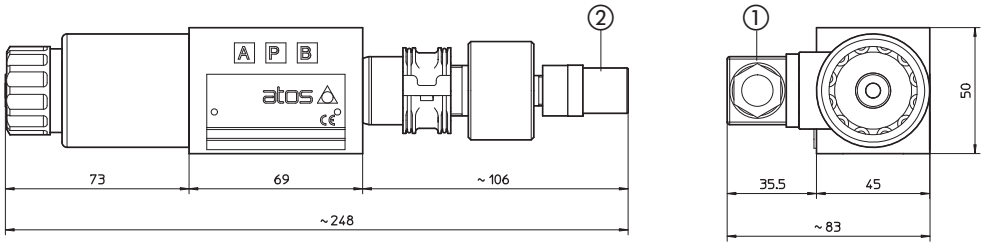


13 DIMENSIONS [mm]



ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Seals: 4 OR 108
Ports P, A, B, T: Ø = 7.5 mm (max).

HF-0611/FV
HF-0614/FV
HF-0673/FV



① = Power supply connector code 666, 667 or 669, to be ordered separately

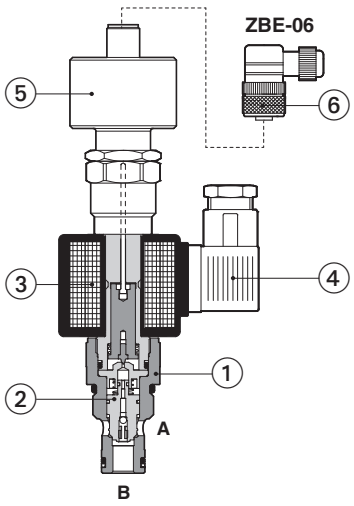
② = Inductive position switch connector code ZBE-06, supplied with the valve

Safety cartridge valves with poppet position monitoring

screw-in, 2-way, poppet type, leak free, conforming to Machine Directive 2006/42/CE - certified by

CE

SAFETY CERTIFIED



1. cartridge body
2. poppet
3. coil
4. coil connectors
5. inductive position switch
6. sensor connector (to be ordered separately)

JO-DL-4-2/FV-X 24DC

JO-DL are leak free, poppet type solenoid cartridges in screw-in execution normally used to cut off the hydraulic power supply line. They are available in normally closed NC configuration.

They are provided with /**FV** inductive position switch (double contact NC/NO) ⑤ wich supplies the output electrical on-off signal indicating the poppet ② position (open/closed), and therefore they can be used as safety valves for emergency conditions.

They are **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/CE.

Certification
The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Max flow: **300 l/min**
Max pressure: **350 bar**

1 MODEL CODE

JO	-	D	L	-	4	-	2	/	FV	-	X	24 DC	**	/	*

Cartridge valve screw-in type UNF

D = Directional control

L = Poppet type

Size:
4 = 3/4"-16UNF-2A
6 = 7/8"-14UNF-2A
10 = 1 5/16"-12UNF-2A

2 = Two-way

Version:
FV = normally closed in rest position, with inductive position switch (double contact)

X = Without connector, see section 5 for available connector

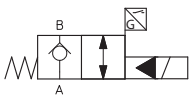
Voltage code:
12DC = 12 VDC
24DC = 24 VDC

Series number

Seals material, see section 4:
- = NBR
PE = FKM

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol



Model			JO-DL-4-2/FV	JO-DL-6-2/FV	JO-DL-10-2/FV
Operating pressure		[bar]	Ports A and B **350**		
Max flow		[l/min]	40	75	300
Response time:	energizing	[ms]	35	30	35
	de-energizing	[ms]	50	60	70
Internal leakage			less than 5 drops/min (≤ 0,36 cm³/min) max at 350 bar		

3 GENERAL CHARACTERISTICS

Installation position	Any position
Cavity	JO-DL-4 = SAE-08-2N; JO-DL-6 = SAE-10-2N; JO-DL-10 = SAE-16-2N
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Compliance	CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components **(1)** -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC.
Ambient temperature	**Standard** execution = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C

(1) The type-examination certificate can be download from www.atos.com

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μm (β10 ≥75 recommended)		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

5 ELECTRIC CHARACTERISTICS

Relative duty factor	100%	
Supply voltage	See model code at section 1	
Supply voltage tolerance	±10%	
Max power	19 Watt	
Power connector	666 (plastic - black); 3 pins, cable clamp PG11, cable max ø 11 mm	**to be ordered separately**
Type of connector for /FV version	Type ZBE-06 (plastic); 4 pins, cable clamp PG9, cable max ø 8 mm	
Connectors features	666: DIN 43650 - ISO 4400; IP65 (DIN 40050); VDE 0110C	
	ZBE-06: M12 - IEC60947-5-2; IP67 (DIN 40050)	

6 INSTALLATION NOTES

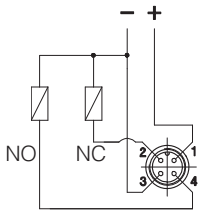
1) The assembling of cartridges inside manifolds must be done tightening the valve exagonal ring (for tightening torque, see section 10).
   Excessive values can cause anomalous deformation and poppet sticking.
   For the /FV versions avoid to tighten through the position sensor.
2) The CE certification is valid only with shielded electric cables and connector. Consult also tab. P004.
   These safety valves must be supplied only and always as one complete component, proximity sensor is factory adjusted.
   The supply of subcomponents invalidates the certification.

7 TECHNICAL CHARACTERISTICS AND CONNECTING SCHEME OF INDUCTIVE POSITION SWITCH /FV

Type of switch		position switch **/FV**
Supply voltage	[V]	20÷32
Ripple max	[%]	≤ 10
Max current	[mA]	400
Max peak pressure	[bar]	400
Mechanical life		virtually infinite
Switch logic		PNP

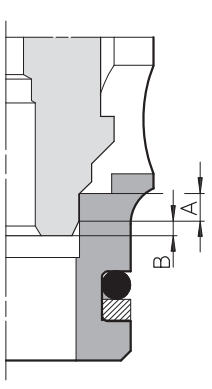
Note: the /FV position switch are not provided with a protective earth connection

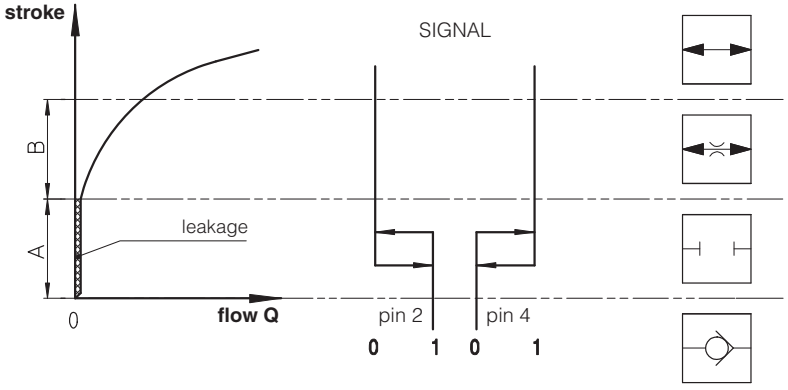
Connector type **ZBE-06**



1 = supply +24 VDC
2 = output signal NC
3 = GND
4 = output signal NO

8 SIGNAL STATUS - VERSIONS /FV





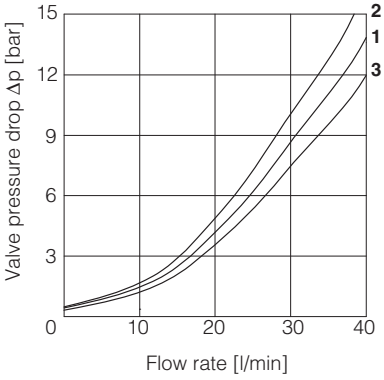
A: overlapping stroke
B: damping stroke

According the criteria of safety specifications, the poppet position signal must change its status inside the overlapping stroke (before the effective valve opening).

9 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

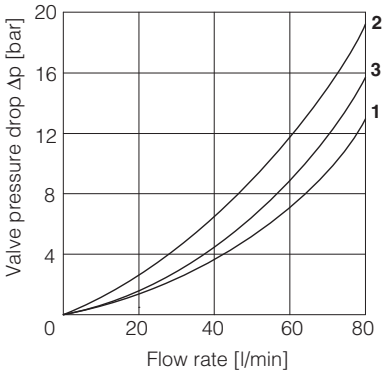
9.1 JO-DL-4

Valve pressure drop - FV version
1= A → B energized
2= B → A de-energized
3= B → A energized



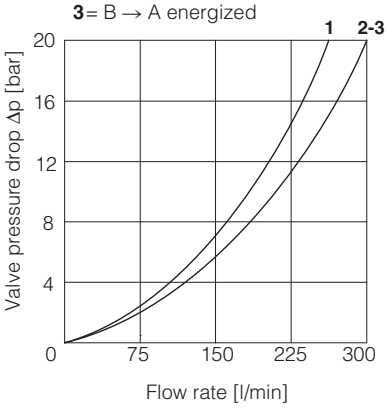
9.2 JO-DL-6

Valve pressure drop - FV version
1= A → B energized
2= B → A de-energized
3= B → A energized



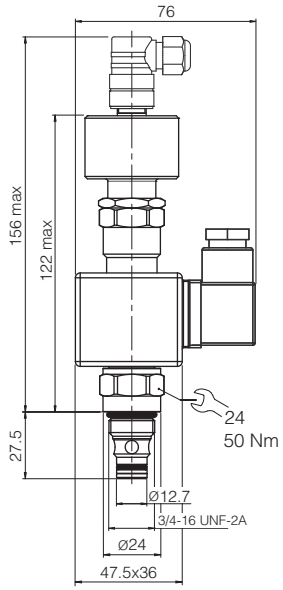
9.3 JO-DL-10

Valve pressure drop - FV version
1= A → B energized
2= B → A de-energized
3= B → A energized

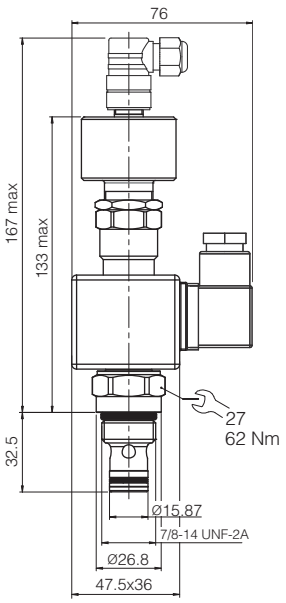


10 DIMENSIONS [mm]

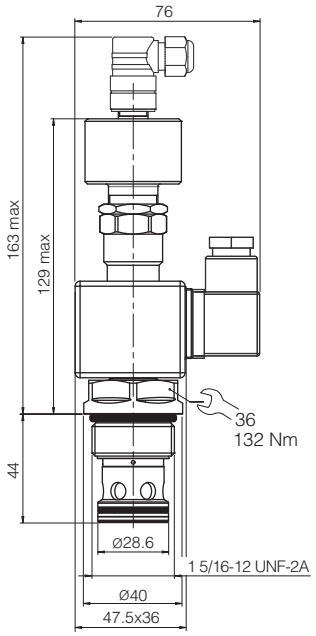
JO-DL-4-2-2/N*/FV
Mass 0.5 Kg



JO-DL-6-2/N*/FV
Mass 0.5 Kg

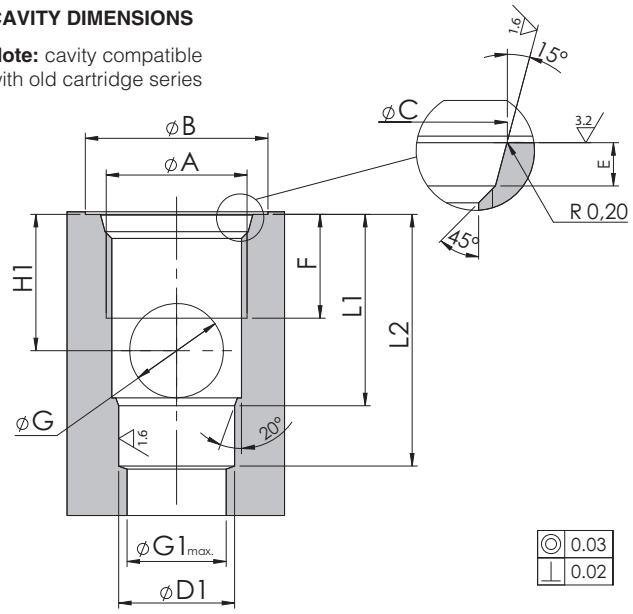


JO-DL-10-2/N*/FV
Mass 0.7 Kg



CAVITY DIMENSIONS

Note: cavity compatible with old cartridge series



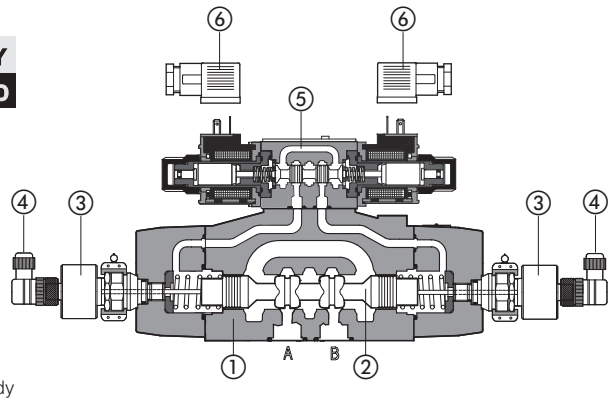
	SAE-08-2N	SAE-10-2N	SAE-16-2N
A	3/4-16 UNF	7/8-14 UNF	1 5/16-12 UNF
B	26	30	42
C	$20.6\ ^{+0,1}_{0}$	$23.9\ ^{+0,1}_{0}$	$35.5\ ^{+0,1}_{0}$
D1	$12.7\ ^{+0,05}_{0}$	$15.87\ ^{+0,05}_{0}$	$28.60\ ^{+0,05}_{0}$
E	$2.6\ ^{+0,3}_{0}$	$2.6\ ^{+0,3}_{0}$	$3.3\ ^{+0,3}_{0}$
F	13	15	20
G	9	12	19
G1	12	15	24
H1	14	18	25
L1	20.5	25.5	36
L2	29	34.5	49

Safety directional valves with spool position monitoring

On-off, pilot operated, conforming to Machine Directive 2006/42/EC - certified by

CE

SAFETY CERTIFIED



① Main body
② Main spool
③ Inductive position switch **FV**
④ Sensor electric connector (supplied with the valve)
⑤ Pilot solenoid valve
⑥ Coil electric connector (to be ordered separately)

DPHI-271*/FV

Pilot operated safety directional valves with main spool position monitoring, **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/EC.
Two models are available depending to the pilot valve execution:

DPHI for AC and DC supply, solenoid pilot valve ⑤ type DHI, with cURus certified solenoids, see tech. table E010
DPHE high performances, for AC and DC supply, solenoid pilot valve ⑤ type DHE with cURus certified solenoids, see tech. table E015

The valves are equipped with **FV** inductive position switch for the main spool position monitoring, see section 9 for sensor's technical characteristics.

Certification
The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting surface: **ISO 4401, size 10, 16, 25**
Max flow: **160, 300, 700 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPH	I	-	2	71	1	/	A	/	FV	X	24DC	**	/	*

DPH — Pilot operated directional control valve

Solenoid pilot valve:
I = DHI for AC and DC supply with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

Valve size, ISO 4401:
1 = 10 **2** = 16 **4** = 25

Valve configuration, see section 2:
61 = single solenoid, center plus external position, spring centered
63 = single solenoid, 2 external positions, spring offset
67 = single solenoid, center plus external position, spring offset
71 = double solenoid, 3 positions, spring centered
75 = double solenoid, 2 external positions, with detent

Spool type, see section 2

Hydraulic options, see section 5
A, **D**, **E**, **R**
Optional devices for main spool switching control, see section 6
H, **H9**, **L9**

Spool position monitor
FV = inductive position switch (double contact)

X = without connector, see section 8 for available connectors, to be ordered separately

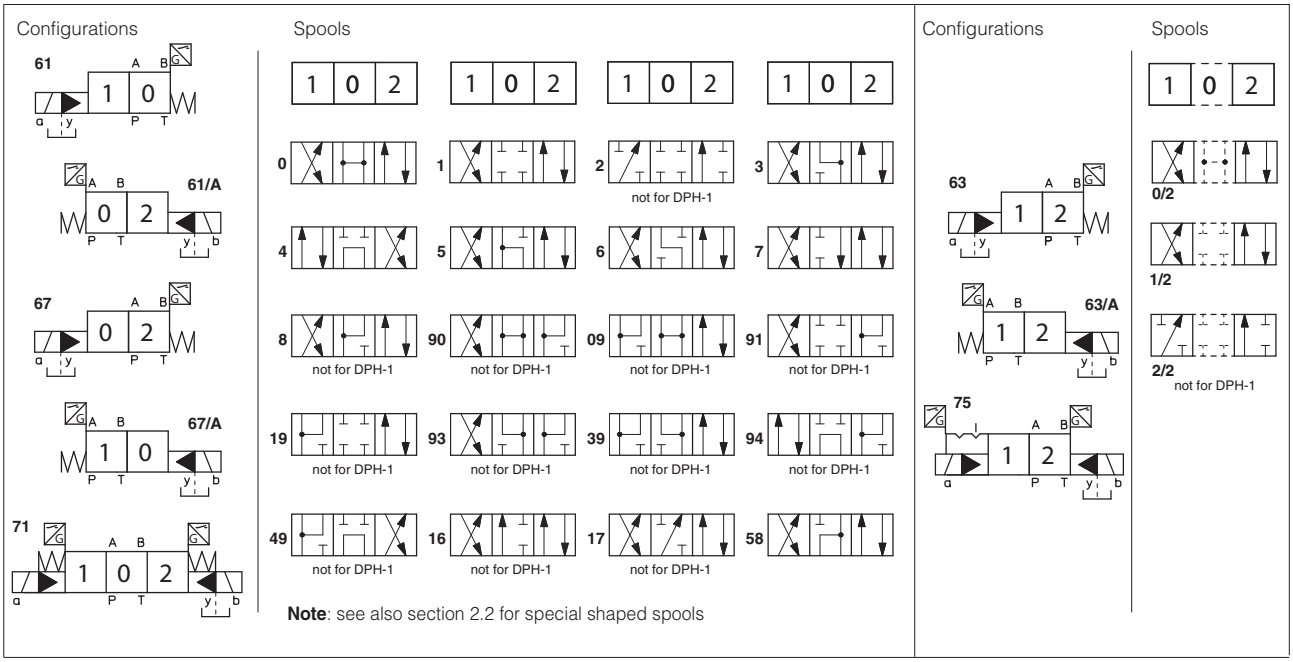
Voltage code, see section 7

Series number

Seals material see sect. 3,4
- = NBR
PE = FKM

Notes:
FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector
The FV inductive position switch is directly connected to the valve main spool
In pilot operated valves only the main spool position is monitored; the pilot solenoid valve is not monitored

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



2.1 Standard spools availability

- DPH*-1 are available only with spools **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- DPH*-2 and DPH*-4 are available with all spools shown in the above table

2.2 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5, 58, 6** and **7** are also available as **1/1, 4/8, 5/1, 58/1, 6/1** and **7/1** that are properly shaped to reduce water-hammer shocks during the switching.

2.3 Special spool availability

Valve size	special shaped spool							
	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPH*-1	•	•		•				
DPH*-2, DPH*-4	•	•	•	•	•	•	•	•

3 MAIN CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Compliance	CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components **(1)** -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Flow direction	As shown in the symbols of table 2
Operating pressure	P, A, B, X = **350 bar** (for pilot pressure see also option /L9 at section 6) T = **250 bar** for external drain (standard) T with internal drain (option /D) = **120 bar** DPHI; **210 bar** DPHE (DC); **160 bar** DPHE (AC) Y = 0 bar Minimum pilot pressure for correct operation is **8 bar**
Maximum flow	DPH*-1: **160 l/min;** DPH*-2: **300 l/min;** DPH*-4: **700 l/min** (see Q/Δp diagrams at section 12 and operating limits at section 13)

(1) The type-examination certificate can be download from www.atos.com

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils (all versions) and AC coils (only DPHI) **F** (155°C) for AC coils (only DPHE) Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features [7]
Supply voltage tolerance	± 10%
Certification	**cURus** North American standard

[4] SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

[5] HYDRAULIC OPTIONS

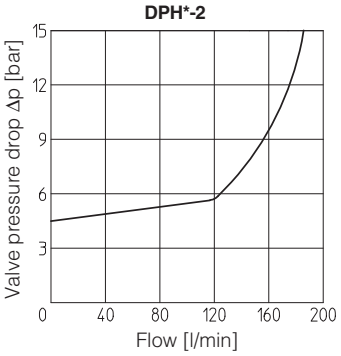
5.1 option /A = Solenoid mounted at side of port A of main body (only for single solenoid valves)
In standard version the solenoid is mounted at side of port B
For sensor position, see sect [16]

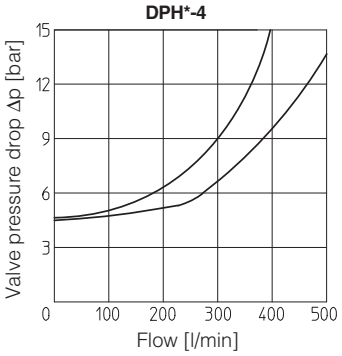
5.2 option /D = Internal drain (standard configuration is external drain)

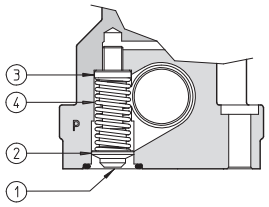
5.3 option /E = External pilot pressure (standard configuration is internal pilot pressure)

5.4 option /R = Pilot pressure generator (4 bar on port P - not for DPH*-1)
The device **/R** generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0, 0/1, 4, 4/8, 5, 58, 09, 90, 94, 49.**
The device **/R** has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.

Pressure drop through the pilot pressure generator /R







① Flapper-guide ③ Spring stop-washer
② Flapper ④ Spring

Ordering code of spare pilot pressure generator

R/DP	-	*
Pilot pressure generator		Size: **2** for DP-2 **4** for DP-4

WARNING: the manual operation is not permitted for safety valves, than the valve is provided with solenoid blind rings to prevent the access to the manual override. The manual override protected by rubber cup (option /WP) is not available

WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury
Safety valves must be installed and commissioned only by qualified personnel
Safety valves must not be disassembled
The inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers
Valve's components cannot be interchanged
The valves must operate without switching shocks and spool vibrations

6 DEVICES FOR MAIN SPOOL SWITCHING CONTROL

Following options are suggested to reduce the hydraulic shocks at the valve operation

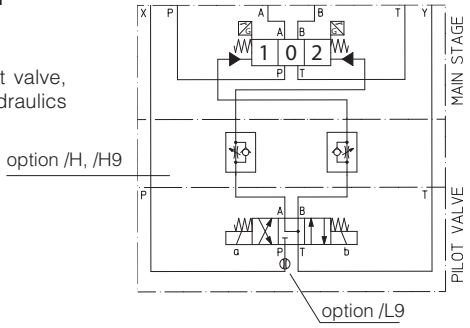
6.1 option /H = Adjustable chokes (meter-out to the pilot chambers of the main valve)

6.2 option /H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve)

6.3 option /L9 = Only for DP-2 and DP-4: plug with calibrated restictor in P port of pilot valve, suggested in case of pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

Plug code:
PLUG-12A ø1,2 mm for DP-2
PLUG-15A ø1,5 mm for DP-4

FUNCTIONAL SCHEME (config. 71)
example of switching control options



7 ELECTRIC FEATURES

Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)**		Code of spare coil		
				DPHI	**DPHE**	**DPHI**	Colour of coil label **DPHI**	**DPHE**
DPHI DPHE	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC							
	48/50 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	48/60 AC							
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	120/60 AC							
	230/50 AC	**230RC**				COU-230RC	blue	COE-230RC
	230/60 AC							

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DPHI) and 58 VA (DPHE)

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

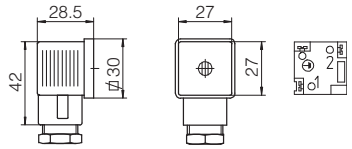
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

(4) Only for DPHI

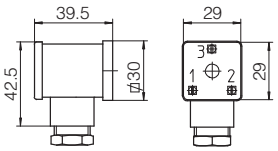
(5) Only for DPHE

8 COILS ELECTRIC CONNECTORS according to din 43650 (to be ordered separately)

666, 667 (for AC or DC supply)



669 (for AC supply)



CONNECTOR WIRING

666, 667
1 = Positive ⊕
2 = Negative ⊖
⏚ = Coil ground

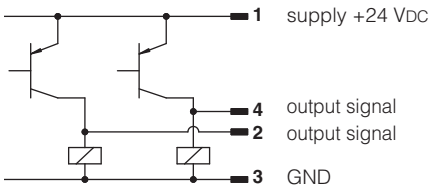
669
1,2= Supply voltage VAC
3 = Coil ground

SUPPLY VOLTAGES

666	**667**	**669**
All voltages	24 AC or DC 110 AC or DC 220 AC or DC	110/50 AC 110/60 AC 230/50 AC 230/60 AC

9 TECHNICAL CHARACTERISTICS OF FV INDUCTIVE POSITION SWITCH

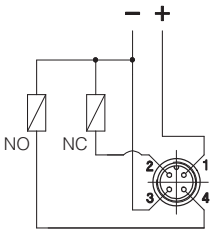
Type of switch		contactless inductive position switch with integrated amplifier
Supply voltage	[V]	20÷32
Ripple max	[%]	≤ 10
Max current	[mA]	400
Reaction time	[ms]	15
Max peak pressure	[bar]	400
Mechanical life		virtually infinite
Switch logic		PNP



10 CONNECTING SCHEME OF FV INDUCTIVE POSITION SWITCH

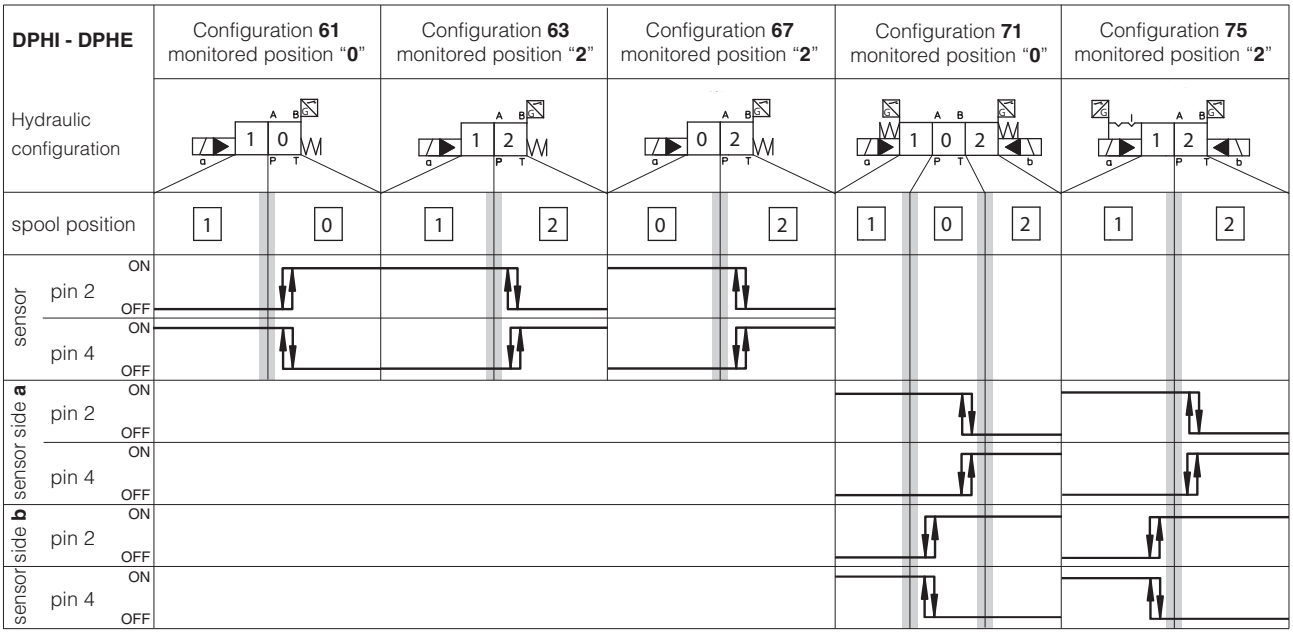
Connector type **ZBE-06** (supplied with the valve)

1 = supply +24 VDC
2 = output signal NC
3 = GND
4 = output signal NO



Note: the /FV position switch is not provided with a protective earth connection

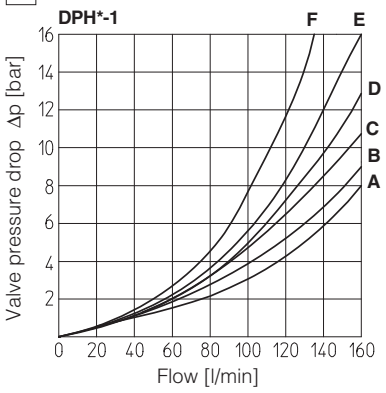
11 STATUS OF OUTPUT SIGNAL

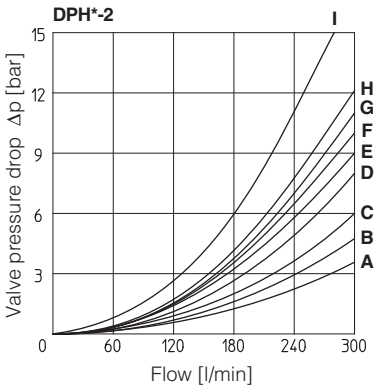


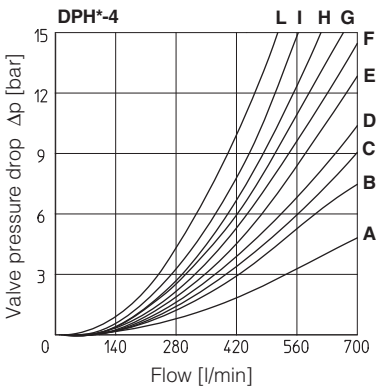
Note:
FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

12 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C







DPH*-1

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	C	-
0	D	E	C	C	E
1	A	B	D	C	-
3, 6, 7	A	B	C	C	-
4, 4/8	B	C	D	D	-
5, 58	A	E	C	C	F

DPH*-2

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0/2, 1, 3, 6, 7, 8	A	A	D	A	-
1/1, 1/2, 7/1	B	B	D	E	-
0	A	A	D	E	C
0/1	A	A	D	-	-
2	A	A	-	-	-
2/2	B	B	-	-	-
3/1	A	A	D	D	-
4	C	C	H	I	F
4/8	C	C	G	I	F
5	A	B	F	H	G
5/1	A	B	D	F	-
6/1	B	B	C	E	-
09	A	-	-	G	-
16	A	C	D	F	-
17	C	A	E	F	-
19	C	-	-	G	-
39	C	-	-	H	-
49	-	D	-	-	-
58	B	A	F	H	H
58/1	B	A	D	F	-
90	A	A	E	-	D
91	C	C	E	-	-
93	-	C	D	-	-
94	D	-	-	-	-

DPH*-4

Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
1	B	B	B	D	-
1/1	D	E	E	F	-
1/2	E	D	B	C	-
0	D	C	D	E	F
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-
0/2	D	D	D	E	-
2	B	B	-	-	-
2/2	E	D	-	-	-
3	B	B	D	F	-
4	C	C	H	L	L
5	A	D	D	D	H
6/1	D	E	D	F	-
7/1	D	E	F	F	-
8	D	D	E	F	-
09	D	-	-	F	F
16	C	D	E	F	-
17	E	D	E	F	-
19	F	-	-	E	-
39	G	F	-	F	-
58	E	A	B	F	H
58/1	E	D	D	F	-
90	D	D	D	-	F
91	F	F	D		
93	-	G	D	-	-

13 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPH*-1

Spool	Inlet pressure [bar]			
	70	160	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7	160	160	160	145
4, 4/8	160	160	135	100
5, 58	160	160	145	110
0/1, 0/2, 1/2	160	160	145	135

DPH*-2

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7, 8	300	300	300	300
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1, 0/2, 1/2	300	250	210	180
16, 17, 56, *9, 9*	300	300	270	200

DPH*-4

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 6, 7, 8	700	700	700	600
2, 4, 4/8	500	500	450	400
5, 0/1, 0/2, 1/2	600	520	400	300
0, 3	700	700	600	540
16, 17, 58, *9, 9*	500	500	500	450

14 SWITCHING TIMES (average values in m sec)

TEST CONDITIONS:
- Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;
- 2 bar of counter pressure on port T;
- mineral oil: ISO VG 46 at 50°C

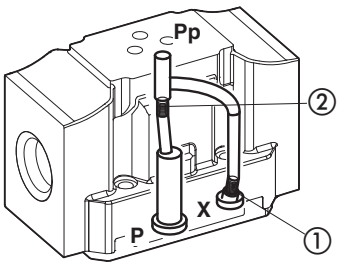
Piloting pressure		70 bar		140 bar		250 bar	
Valve model		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
DPH*-1	Switch ON	35÷50	50÷75	30÷40	45÷65	20÷30	35÷50
	Switch OFF	50÷80					
DPH*-2	Switch ON	40÷55	55÷80	30÷45	50÷70	20÷35	40÷55
	Switch OFF	60÷95					
DPH*-4	Switch ON	60÷95	80÷115	45÷75	60÷95	30÷50	45÷65
	Switch OFF	80÷130					

15 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

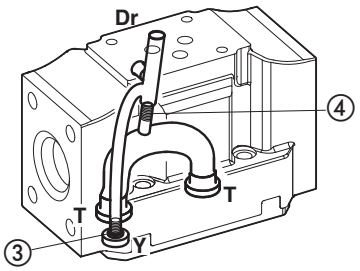
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPH*-1

Pilot channels



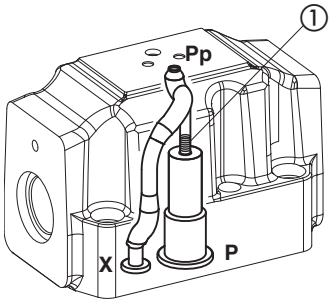
Drain channels



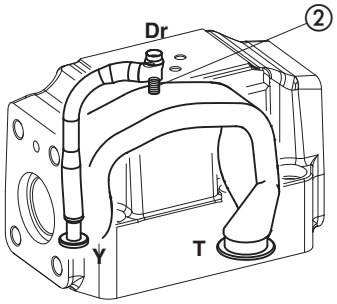
Internal piloting: blinded plug SP-X300F ① in X;
plug SP-X310F ② in Pp;
External piloting: blinded plug SP-X300F ② in Pp;
plug SP-X310F ① in X;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPH*-2

Pilot channels

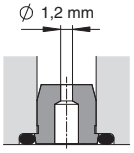


Drain channels



Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

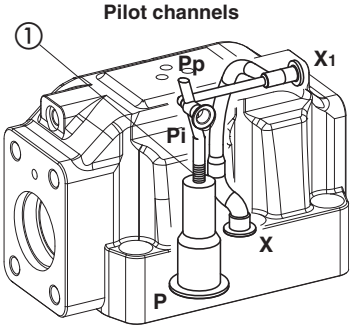
Option L9
This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve



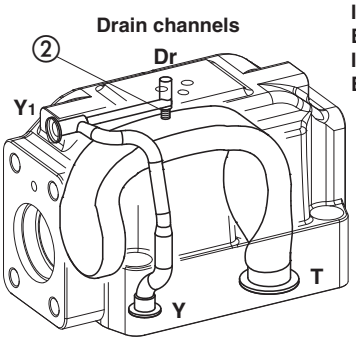
PLUG-12A

DPH*-4

Pilot channels

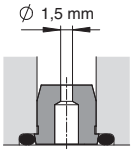


Drain channels



Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

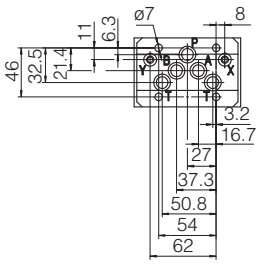
Option L9
This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve



PLUG-15A

DPH*-1/FV

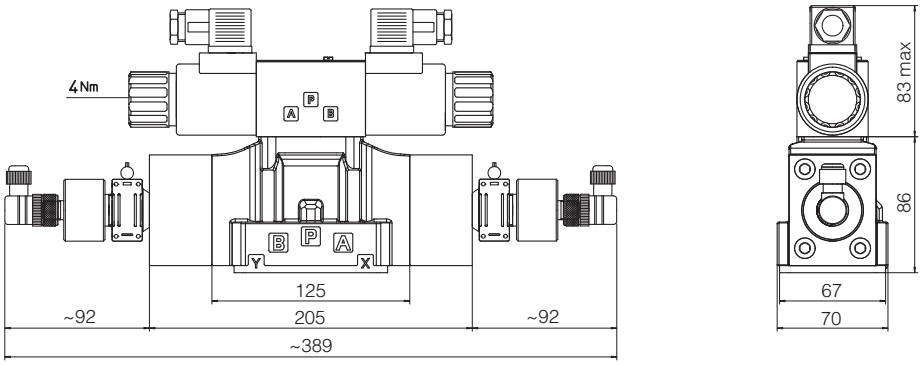
ISO 4401: 2005
Mounting surface:
4401-05-05-0-05
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050, 2 OR 108
Ports P,A,B,T: Ø = 11 mm (max)
Ports X, Y: Ø = 5 mm



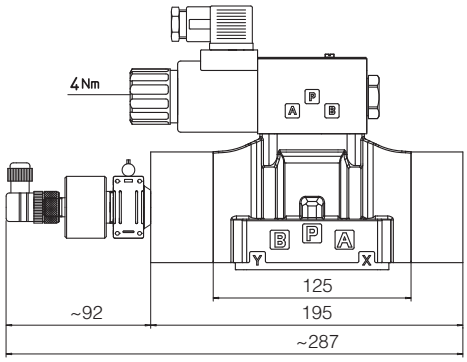
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

Mass (Kg)	
DPHI-16	7,1
DPHI-17	7,7
DPHE-16	7,2
DPHE-17	7,9
Option H, H9	+1,0

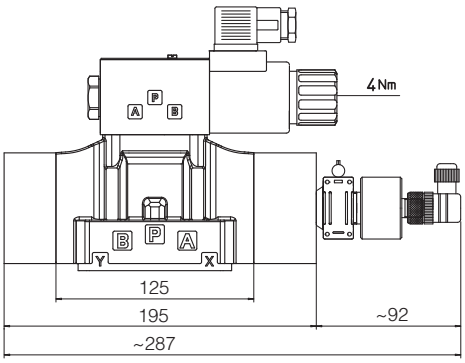
DPH*-171*
DPH*-175*



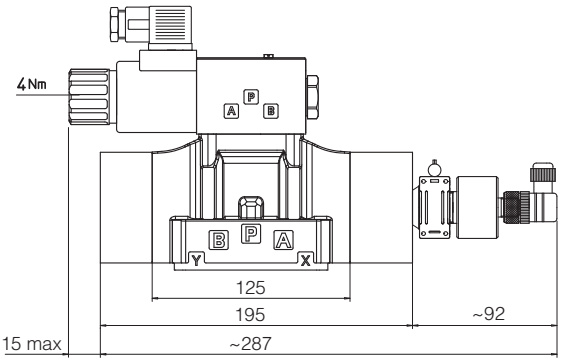
DPH*-161*



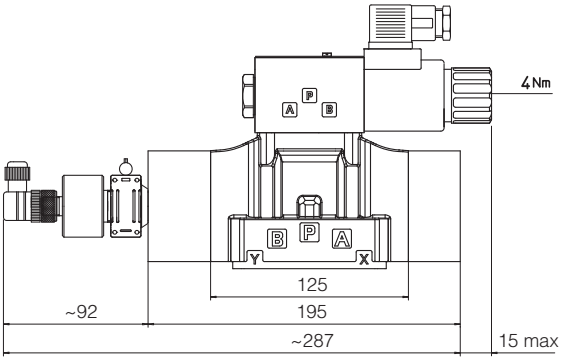
DPH*-161*/A



DPH*-163*
DPH*-167*



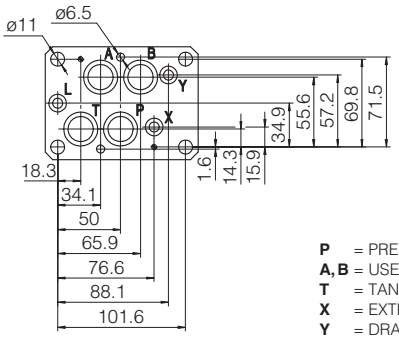
DPH*-163*/A
DPH*-167*/A



DPH*-2*/FV

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05

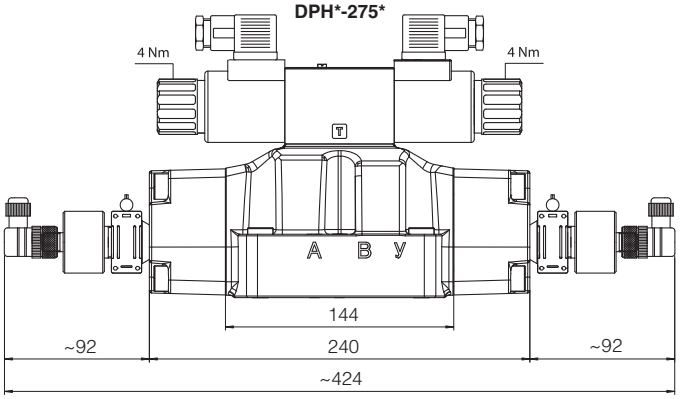
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 130, 2 OR 2043

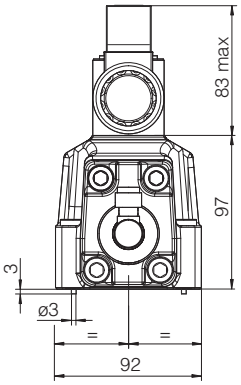


Mass (Kg)	
DPHI-26	10,1
DPHI-27	10,7
DPHE-26	10,2
DPHE-27	10,9
Option H, H9	+1,0

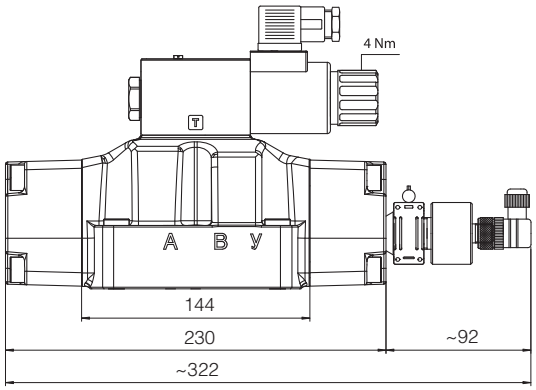
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

DPH*-271*
DPH*-275*

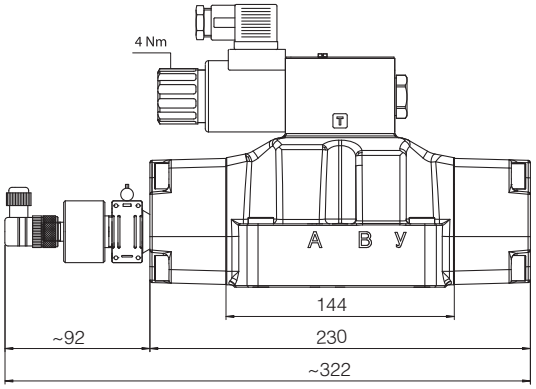




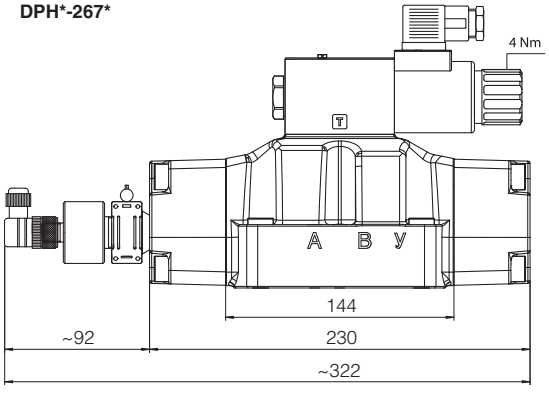
DPH*-261*



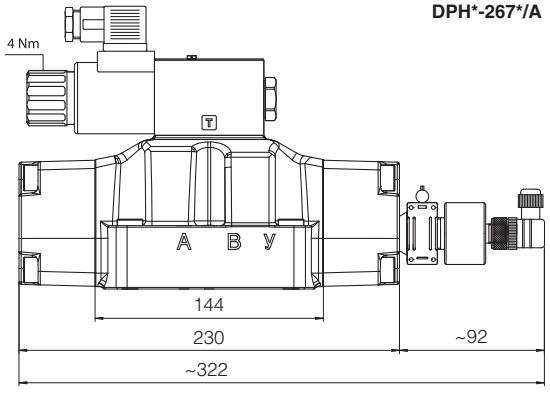
DPH*-261*/A



DPH*-263*
DPH*-267*



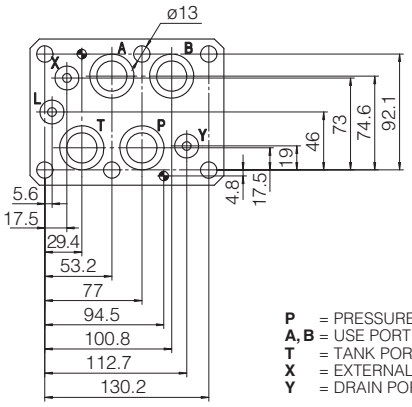
DPH*-263*/A
DPH*-267*/A



DPH*-4*/FV

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05

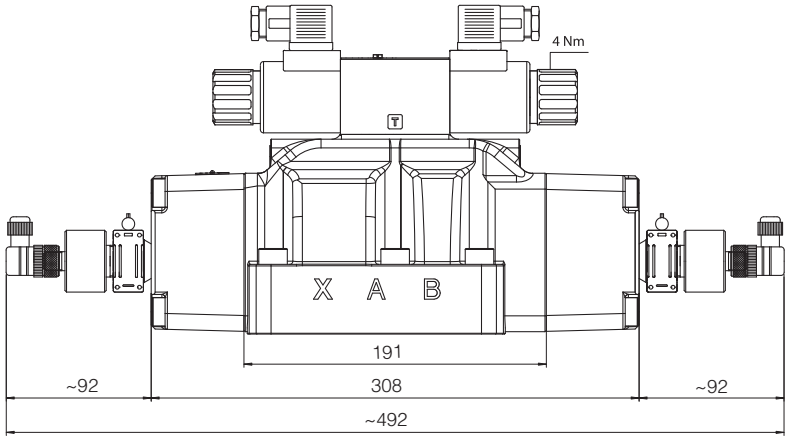
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 4112, 2 OR 3056

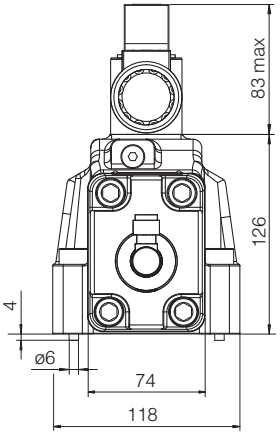


Mass (Kg)	
DPHI-46	17,6
DPHI-47	18,2
DPHE-46	17,7
DPHE-47	18,4
Option H, H9	+1,0

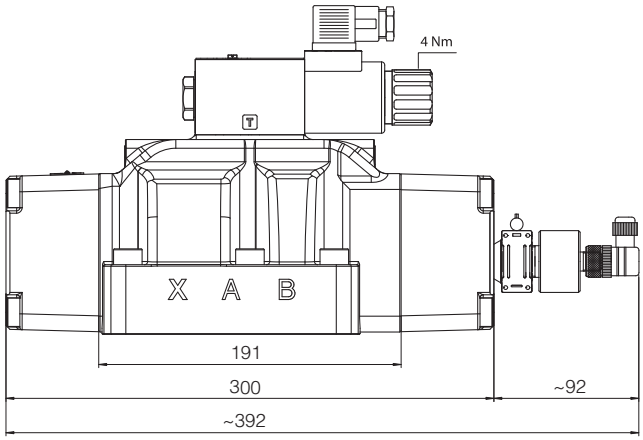
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

DPH*-471*
DPH*-475*

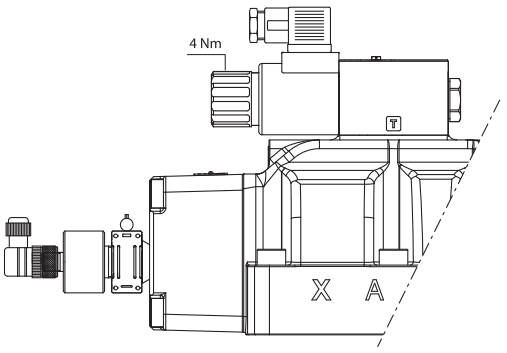




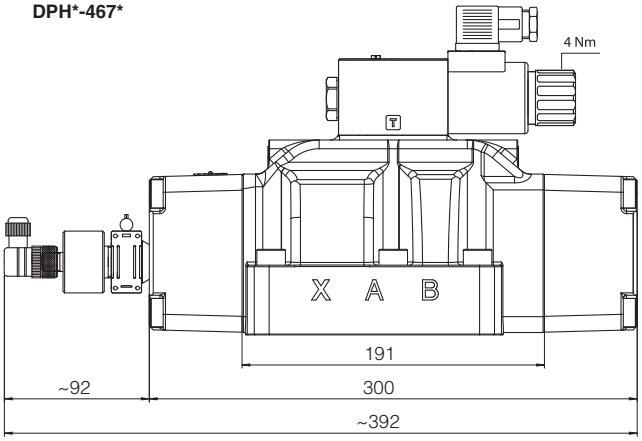
DPH*-461*



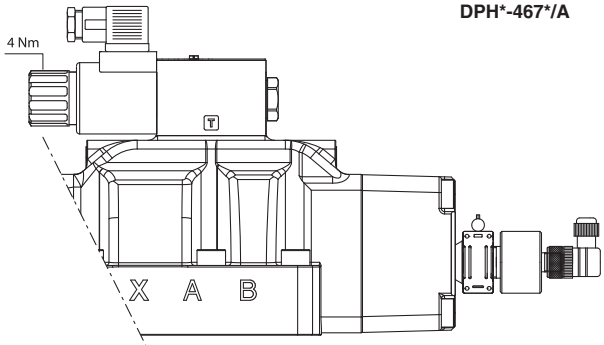
DPH*-461*/A



DPH*-463*
DPH*-467*

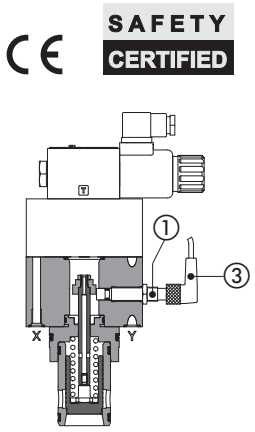


DPH*-463*/A
DPH*-467*/A

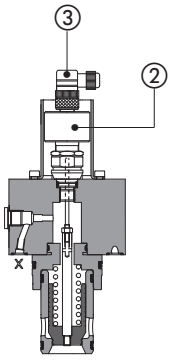


Safety cartridge valves with poppet position monitoring

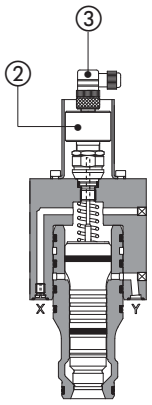
ISO standard, on-off, poppet type, conforming to Machine Directive 2006/42/EC - certified by TÜV



LIFI-3242*/NC



LIDA-3243*/FV



LIDAS-3243*/FV

① Inductive proximity sensor **FI**
② Inductive position switch **FV**
③ Sensor electric connector (supplied with the valve)

Safety cartridge valves with poppet position monitoring, **CE** marked and certified by **TÜV,** in accordance with safety requirements of Machine Directive 2006/42/EC.

LIFI: intermediate safety element with **FI** inductive proximity sensor, to be coupled with functional covers

LIDA: safety valve with integral cover design and with **FV** inductive position switch, available with optional solenoid pilot valve (LIDAH)

LIDAS: active pilot operated safety valve with **FV** inductive position switch, available with optional solenoid pilot valve (LIDASH), see section 12 for sensors technical characteristics.

These valves are normally used to cut off the hydraulic power line in case of emergency condition, thus avoiding dangerous movements of the machines actuators.

Certification
The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting surface & cavity:
ISO 7368 size **16** to **50**
Max flow: **1800 l/min** at Δp = 5 bar
Max pressure: up to **420 bar**

1 RANGE OF VALVE'S MODELS

Valve code	Size	Description	DC solenoids		AC solenoids	
			Sensor type			
			/FI	/FV	/FI	/FV
LIFI	16÷50	intermediate elements with cartridge, to be coupled with a functional cover	•		•	
LIDA(H)	16÷50	cartridges valve		•		•
LIDAS(H)	16÷50	active cartridges valve		•		•

Notes: **FI** = inductive proximity sensor, type NO (normally open or NC (normally closed)
FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector

See section 12 for sensor's characteristics

2 MODEL CODE OF LIFI INTERMEDIATE SAFETY ELEMENT - to be coupled with covers in section 3

LIF	I	-	25	42	1	/	NC	**	/	*

LIF: Intermediate saferty element and cartridge according to ISO 7368

Poppet position monitor:
I = inductive proximity switch

Size ISO 7368
16; 25; 32; 40; 50
Other dimensions available on request

Type of poppet, see sect. 9 for Q/Δp diagrams
42 = with damping nose, area ratio 1:1,1
43 = with damping nose, area ratio 1:1,6

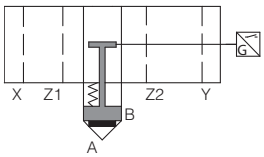
/NC = closed contact with poppet in resting position

Spring cracking pressure:
1 = 0,3 bar for poppet 42; 0,6 bar for poppet 43
2 = 1,5 bar for poppet 42
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FKM

2.1 Hydraulic symbols of LIFI



Note: in LIFI safety valves the cartridge and the intermediate element with poppet position sensor cannot be separated

3 MODEL CODE OF FUNCTIONAL COVERS TO BE COUPLED WITH LIFI SAFETY VALVES

LID	A	-	2	/	*	F	-	I	X	24DC	**	/	*	/	*

LID
Cover according to ISO 7368

Cover type, see section 3.1 for hydraulic configuration:
A = direct pilot
B = with shuttle valve for pilot selection;
EW* = with solenoid valve for pilot selection
BH** = as EW* but with shuttle valve for pilot selection;

Size ISO 7368
1 = 16; **2** = 25; **3** = 32; **4** = 40; **5**= 50;

Options:
B = cartridge piloted via port B of solenoid valve (only for LIDEW* and LIDBH**)
E = with external attachment X (1/4" GAS) and underneath port X plugged

F = prearranged for coupling with LIFI cover

Type of pilot solenoid valve only for LIDBH** and LIDEW*:
I = DHI Pmax **350 bar**
E = DHE Pmax **350 bar**
EP = DHEP Pmax **420 bar**

Only for LIDEW* and LIDBH**:
X = without connector, to be order separately see section 11

Voltage code only for LIDEW* and LIDBH**: see section 10

Series number

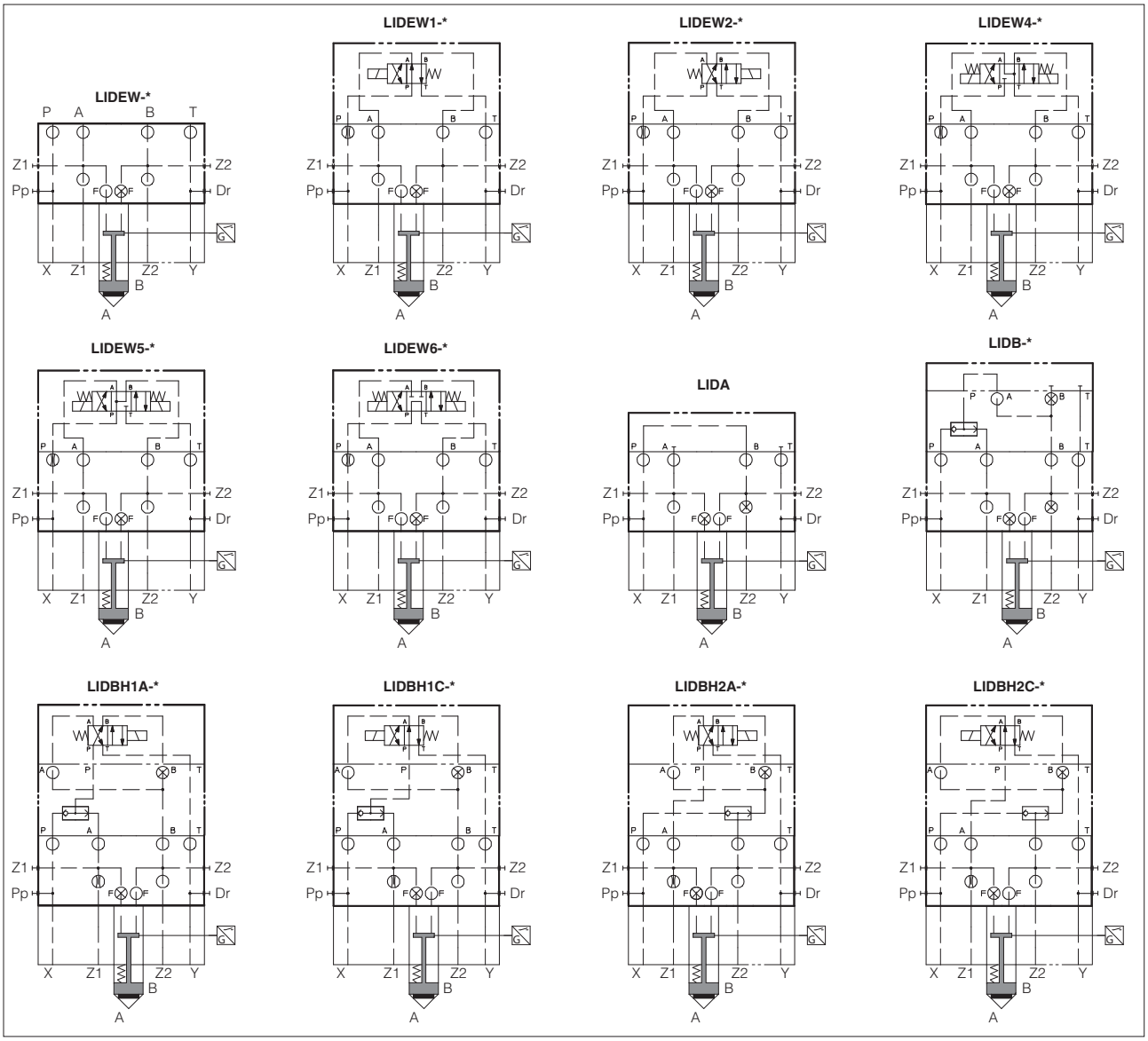
Seals material:
omit for NBR (mineral oil & water glycol)
PE = FKM

Optional different setting of calibrated plugs in the pilot channels (see tech. tables H030, H040)

For valve type LIDB, LIDEW (in the configuration with external pilot line) Atos can supply leak free poppet type directional pilot valves type DLEH-3*. Consult our technical office for detailed information.

3.1 HYDRAULIC SYMBOLS OF FUNCTIONAL COVERS

the following symbols show the functional covers coupled with intermediate safety element type LIFI



4 MODEL CODE OF LIDA SAFETY VALVES (integral design cover)

LIDA	H	-	25	43	3	/	FV	-	I	X	24DC	**	/	*

Safety cartridge valve according to ISO 7368

optional pilot valve:
- = omit if not required
H = with NG 6 pilot valve

Size ISO 7368:
16; **25**; **32**; **40**; **50**

poppet type:
43 = with damping nose area ratio 1:1,6

spring cracking pressure:
1 = 0,6 bar **3** = 3 bar **6** = 5,5 bar

Poppet position monitor:
FV = inductive position switch (double contact)

Pilot solenoid valve only for LIDAH
I = DHI Pmax **350 bar**
E = DHE Pmax **350 bar**
EP = DHEP Pmax **420 bar**

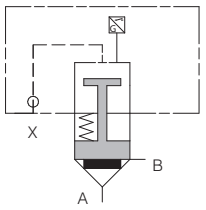
Only for LIDAH
X = without connector, to be order separately see section 11

Only for LIDAH
Voltage code, see section 10

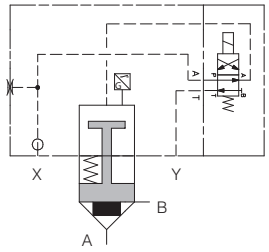
Series number

Seals material: omit for NBR (mineral oil & water glycol)
PE = FKM

4.1 HYDRAULIC SYMBOLS OF LIDA /FV



LIDA-43/FV**



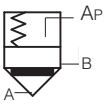
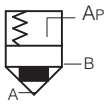
LIDAH-43/FV**

5 MAIN CHARACTERISTICS OF LIFI AND LIDA(H)/FV

Assembly position / location		Any position
Subplate surface finishing		Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849		75 years, for further details see technical table P007
Compliance		CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components **(1)** -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature		**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Flow direction		A→B or B→A
Operating pressure	**LIFI**	A, B, X, Z1, Z2 = **420 bar**
	LIDA/FV	A, B, X = **420 bar**;
	LIDAH/FV	A, B, X = LIDAH-I = **350 bar**; LIDAH-E = **350 bar**; LIDAH-EP = **420 bar**
		Y = LIDAH-I = **120 bar**; LIDAH-E, -EP (DC) = **210 bar**; LIDAH-E, -EP (AC) = **160 bar**

(1) The type-examination certificate can be download from www.atos.com

5.1 poppet characteristics of LIFI and LIDA(H)/FV

Poppet type		**42** (only LIFI)	**43**
Functional sketch (Hydraulic symbol)			
Operating pressure		**420 bar**	
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 15	Size **16**	140	120
	25	300	280
	32	550	440
	40	1150	860
	50	1800	1370
Area ratio A:Ap		**1:1,1**	**1:2** for size 16, 25 **1:1,6** for size 32, 40,50

6 MODEL CODE OF LIDAS ACTIVE SAFETY PILOT OPERATED VALVES

LIDAS	H	-	40	43	3	/	FV	-	I	X	24DC	**	/	*

Active safety cartridges, according to ISO 7368

Optional pilot valve:
- = without pilot solenoid valve
H = with pilot solenoid valve

Size ISO 7368:
16; **25**; **32**; **40**; **50**

Poppet type:
43 = with damping nose

Spring cracking pressure
3 = 3 bar

Poppet position monitor:
FV = inductive position switch (double contact)

Pilot solenoid valve only for LIDASH
I = DHI Pmax **350 bar**
E = DHE Pmax **350 bar**
EP = DHEP Pmax **420 bar**

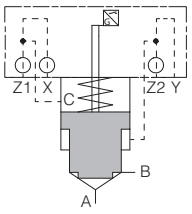
Only for LIDASH
X = without connector, to be order separately see section [11]

Only for LIDASH voltage code, see section [10]

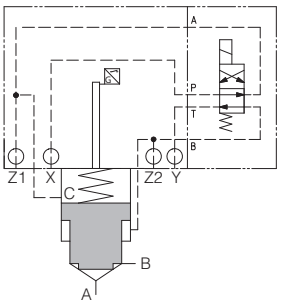
Series number

Seals material: omit for NBR (mineral oil & water glycol)
PE = FKM

6.1 HYDRAULIC SYMBOLS OF LIDAS



LIDAS/FV



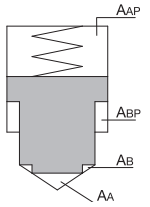
LIDASH-*/FV

7 MAIN CHARACTERISTICS OF LIDAS/FV

Assembly position / location		Any position				
Subplate surface finishing		Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)				
MTTFd values according to EN ISO 13849		150 years, for further details see technical table P007				
Compliance		CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components **(1)** -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006				
Ambient temperature		**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C				
Flow direction		A→B or B→A				
Operating pressure	**LIDAS/FV**	A, B, X, Z1, Z2 = **420 bar**				
	LIDASH/FV	A, B, X, Z1, Z2 = LIDASH-I **350** bar; LIDASH-E **350** bar; LIDASH-EP **420** bar Y = LIDASH-I **120** bar; LIDASH-E, -EP (DC) = **210** bar; LIDASH-E, -EP (AC) = **160** bar;				
Size		**16**	**25**	**32**	**40**	**50**
Maximum flow at Δp = 5 bar [l/min]		200	360	550	1100	1800
Poppet characteristics [cm²]						
A_A		1,43	3,46	5,30	8,04	13,85
A_B (% of A_A)		58,6	41,7	51,5	56,3	41,7
A_{BP} (% of A_A)		107,0	90,5	85,2	87,9	97,8
A_{AP} (% of A_A)		265,6	232,2	236,7	244,1	239,2
A_A / (A_A + A_B) poppet ratio		0,6				
A_{AP} / (A_A + A_B) piloting ratio		1,6				

(1) The type-examination certificate can be download from www.atos.com

7.1 Poppet areas of LIDAS/FV



Poppet areas

AA = main flow (side A)
AB = main flow (side B)
AAP = piloting area (close)
ABP = piloting area (open)

Thanks to the areas ratio $A_{AP}/(A_A+A_B)$, the valve closing is always ensured with a piloting pressure (X port) equal to the line pressure (A or B line).

8 COILS CHARACTERISTICS

Insulation class	Pilot valve **E**, **EP: H** (180°C) for DC coils **F** (155°C) for AC coils Pilot valve **I: H** (180°C) for DC or AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 10
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

9 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

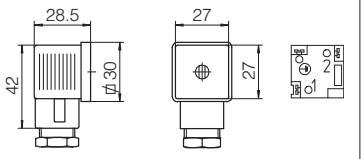
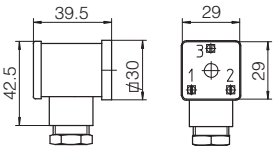
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

10 ELECTRIC FEATURES - coils for pilot solenoid valves

Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)**		Code of spare coil		
				DHI	**DHEP**	**DHI**	Colour of coil label **DHI**	**DHE, DHEP**
DHI DHE DHEP	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC							
	48/50 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	48/60 AC							
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	120/60 AC							
	230/50 AC	**230RC**				COU-230RC	blue	COE-230RC
	230/60 AC							

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DHI) and 58 VA (DHE and DHEP)
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(4) Only for pilot valve DHI
(5) Only for pilot valve DHE and DHEP

11 COILS ELECTRIC CONNECTORS FOR PILOT SOLENOID VALVES according to DIN 43650 (to be ordered separately)

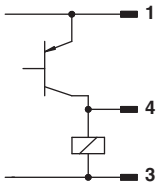
666, 667 (for AC or DC supply)	**669** (for AC supply)	**CONNECTOR WIRING**	
		**666, 667** 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	**669** 1,2= Supply voltage VAC 3 = Coil ground

SUPPLY VOLTAGES		
666	**667**	**669**
All voltages	24 AC or DC 110 AC or DC 220 AC or DC	110/50 AC 110/60 AC 230/50 AC 230/60 AC

12 TECHNICAL CHARACTERISTICS OF INDUCTIVE PROXIMITY AND POSITION SWITCHES

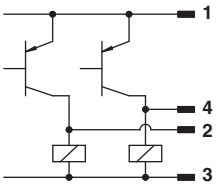
Valve type		**LIFI**	**LIDA*/FV, LIDAS*/FV**
Type of switch		**/FI** proximity sensor	**/FV** position switch
Supply voltage	[V]	10÷30	20÷32
Ripple max	[%]	≤ 20	≤ 10
Max current	[mA]	200	400
Max peak pressure	[bar]	500	400
Mechanical life		virtually infinite	virtually infinite
Switch logic		PNP	PNP

/FI scheme



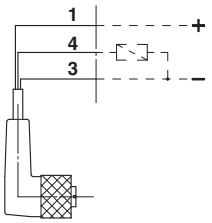
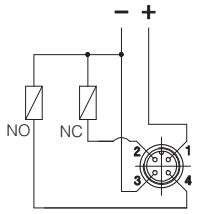
1 supply +24 VDC
3 GND
4 output signal

/FV scheme



1 supply +24 VDC
2 output signal
3 GND
4 output signal

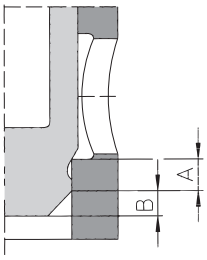
13 CONNECTING SCHEMES OF FI INDUCTIVE PROXIMITY AND FV POSITION SWITCHES

LIFI	**LIDA*/FV, LIDAS*/FV**
Connector type **BKS-B-20-4-03**	Connector type **ZBE-06** IP65
	
1 (brown) = supply +24 VDC 3 (blue) = GND 4 (black) = output signal CABLE LENGHT = 3 m	1 = supply +24 VDC 2 = output signal NC 3 = GND 4 = output signal NO

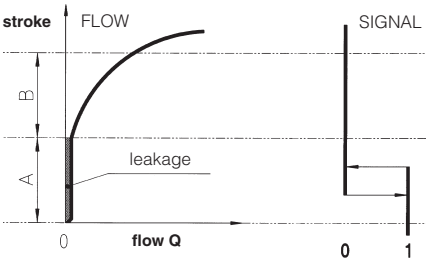
Notes:
- FI and FV sensor's connector are always supplied with the valve
- The /FI and /FV sensors are not provided with a protective earth connection

14 STATUS OF OUTPUT SIGNALS

A: overlapping stroke
B: damping stroke



According the criteria of safety specifications, the poppet position signal must change its status inside the overlapping stroke (before the effective valve opening).

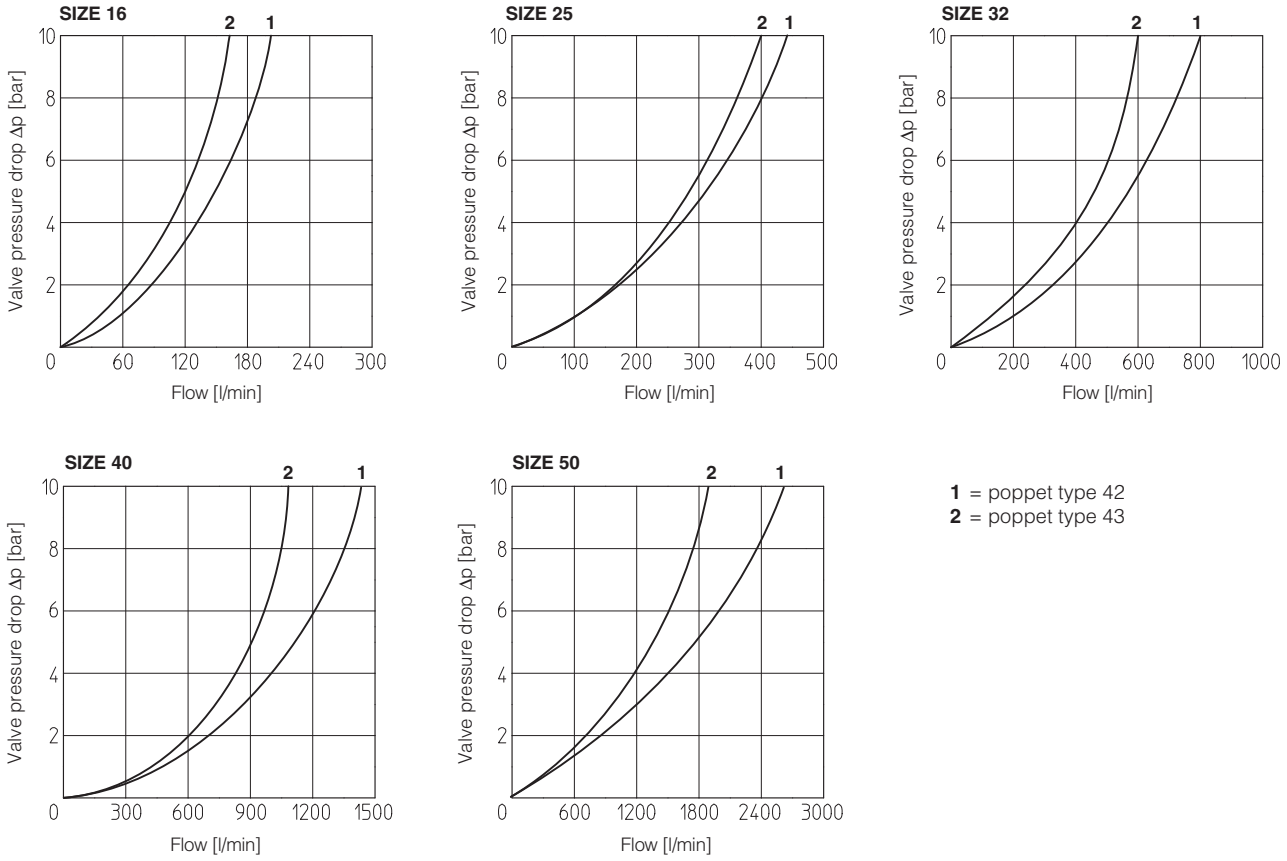


WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury

Safety valves must be installed and commissioned only by qualified personnel
Safety valves must not be disassembled
The inductive proximity FI or the inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers
Valve's components cannot be interchanged
The valves must operate without switching shocks and spool vibrations

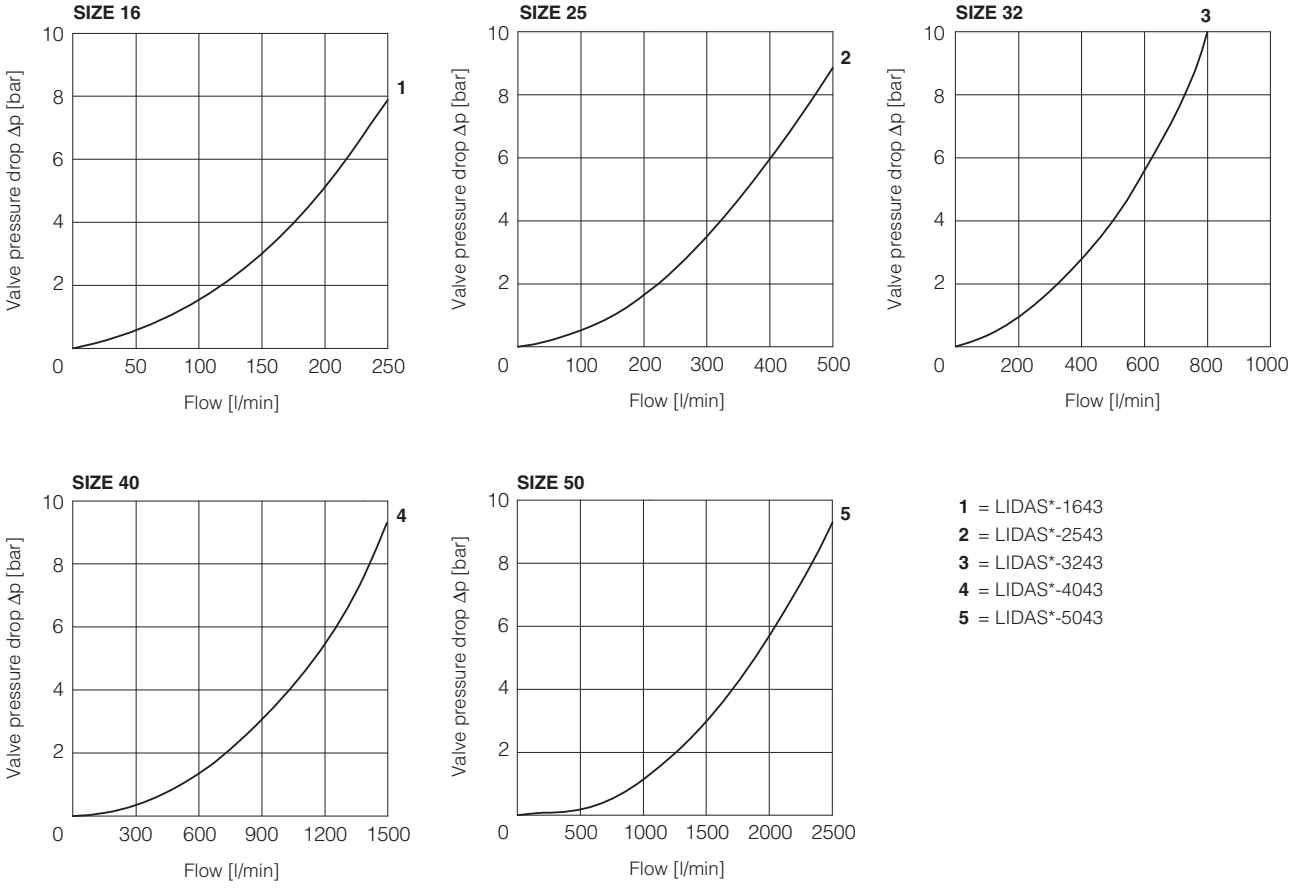
15 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50 °C

15.1 Q/Δp DIAGRAMS of LIFI and LIDA(H)/FV



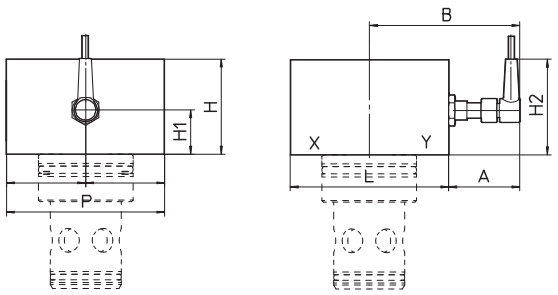
1 = poppet type 42
2 = poppet type 43

15.2 Q/Δp DIAGRAMS OF LIDAS/FV



1 = LIDAS*-1643
2 = LIDAS*-2543
3 = LIDAS*-3243
4 = LIDAS*-4043
5 = LIDAS*-5043

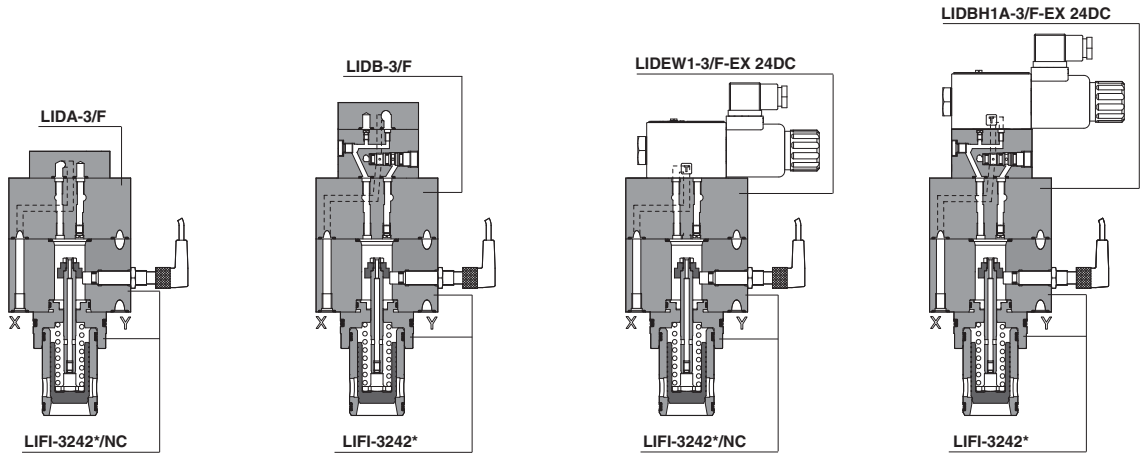
16 DIMENSIONS of LIFI SAFETY COVERS [mm]



	A	B	H	H1	H2	L	P
LIFI-16	54,5	94	50	25	56	72	65
LIFI-25	54,5	97	55	28	59	85	85
LIFI-32	47	97	60	28	59	100	100
LIFI-40	41	103,5	60	30	61	125	125
LIFI-50	44	114	70	30	61	140	140

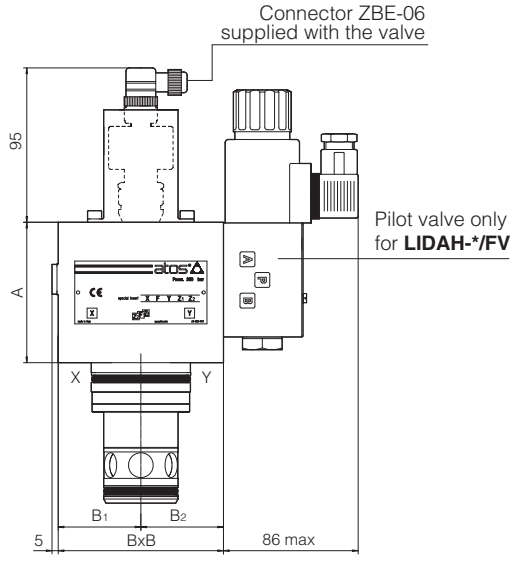
Note: for cover interface and cavity dimensions ISO 7368, see table P006

17 EXAMPLES OF LIFI COUPLED WITH OTHER COVERS (examples in size 32)

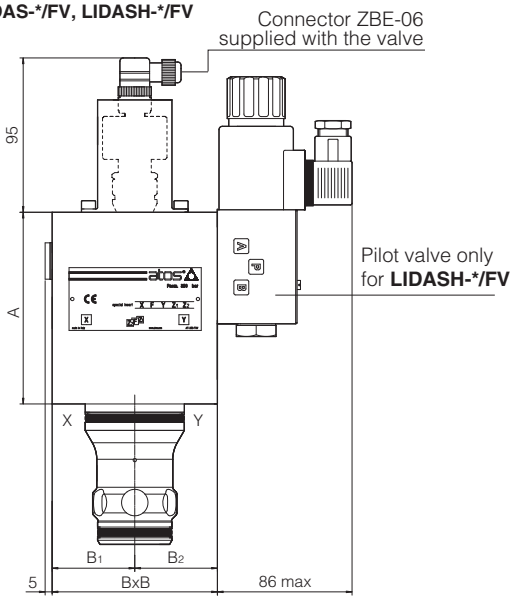


18 INSTALLATION DIMENSIONS of LIDA*/FV and LIDAS*/FV SAFETY CARTRIDGES [mm] (examples in size 32)

LIDA-*/FV, LIDAH-*/FV



LIDAS-*/FV, LIDASH-*/FV

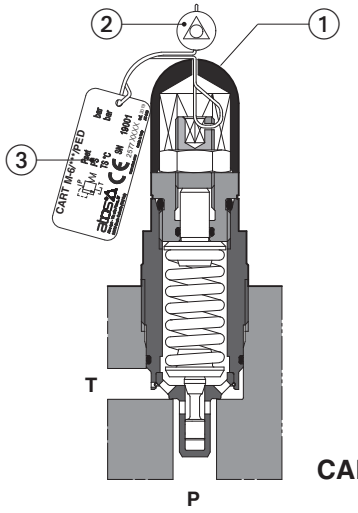


Note: for cover interface and cavity dimensions ISO 7368, see table P006

Size	LIDA				LIDAH				LIDAS				LIDASH				Seal		Fastening bolts			Tightening torque (Nm)
	A	B	B_1	B_2	A	B	B_1	B_2	A	B	B_1	B_2	A	B	B_1	B_2	LIDA	OTHER	LIDA	LIDAH	LIDAS, LIDASH	
16	50	65x85	40.5	39.5	85	65x80	40.5	39.5	85	65	39.5	39.5	95	65x72	32.5	39.5	1 OR 108	4 OR 108	4 M8x50	4 M8x70	4 M8x80	35
25	50	85	42.5	42.5	85	85	42.5	42.5	102	85	42.5	42.5	115	85	42.5	42.5	1 OR 108	4 OR 108	4 M12x55	4 M12x80	4 M12x95	125
32	65	100	50	50	85	100	50	50	104	100	50	50	116	100	50	50	1 OR 2043	4 OR 2043	4 M16x70	4 M16x70	4 M16x90	300
40	65	125	62.5	62.5	85	125	62.5	62.5	111	125	62.5	62.5	125	125	62.5	62.5	1 OR 3043	4 OR 3043	4 M20x80	4 M20x80	4 M20x70	600
50	65	140	70	70	85	140	70	70	50	140	70	70	135	140	70	70	1 OR 3043	4 OR 3043	4 M20x80	4 M20x80	4 M20x80	600

Safety pressure relief valves

direct, screw-in, conforming to PED Directive 2014/68/EU - certified by DEKRA



CART M-6/420/PED

① plastic cap
② lead sealing
③ nameplate with factory pressure setting

CART /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are factory set at the pressure level required by the costumer, see section 6.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

The screw-in execution is specifically designed to reduce the dimension of blocks and manifolds, without penalizing the functional characteristics.

Size: **G1/2" ÷ M35**
Max flow: **2,5 ÷ 150 l/min**
Max pressure: up to **420 bar**

1 MODEL CODE

CART	M-6	/	420	/	PED	/	280	*	/	*

CART
Safety pressure relief valves, screw-in

Size:
M-3 = G1/2 **(1)**
M-4 = M14x1
M-5 = M20x1,5
M-6 = M33x1,5 **(1)**
ARE-15 = M32x1,5
ARE-20 = M35x1,5 **(1)**

Max pressure (bar):
420 = for CART M-3, M-4, M-6, ARE-15
350 = for CART M-5
400 = for CART ARE-20

PED = EU Type examination to 2014/68/EU - certified by DEKRA

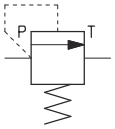
Factory pressure setting (bar):
to be defined by the customer
min step 1 bar (example **280** = 280 bar)
min pressure setting:
25 = for CART-M* and CART ARE-15
30 = for CART ARE-20

Series number

Seals material,
see section 5:
- = NBR
PE = FKM
BT = HNBR **(2)**:

(1) Available also in stainless steel execution, see technical table CWY010
(2) BT option is not available for **CART M5/PED** and **CART ARE-20/PED**

2 HYDRAULIC SYMBOL



CART* /PED

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Cavity	See section 9
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature range (not for CART M-5 and ARE-20)	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Ambient temperature range (only for CART M-5 and ARE-20)	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate **(1)** RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model	**CART M-3**	**CART M-4**	**CART M-5**	**CART M-6**	**CART ARE-15**	**CART ARE-20**
Max pressure [bar] on port P	420	420	350	420	420	400
Factory pressure setting range [bar]	25÷420	25÷420	25÷350	25÷420	25÷420	30÷400
Max pressure on port T [bar] **(1)**	50	50	50	50	50	50
Max flow [l/min] **(2)**	2,5	15	50	60	100	150

(1) The valves should be operated without counterpressure on T line, see note 2 at section 9
(2) Max flow without conterpressure on T line, see diagrams at section 9 for max ammissible flow

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

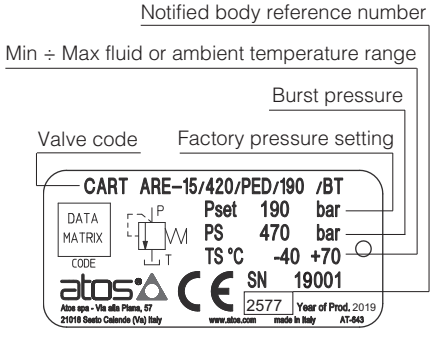
6 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 7

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
CART M-3	0.5
CART M-4	0.5
CART M-5	2
CART M-6	2
CART ARE-15	2
CART ARE-20	2

⚠ Any tampering of the lead sealing invalidates the certification

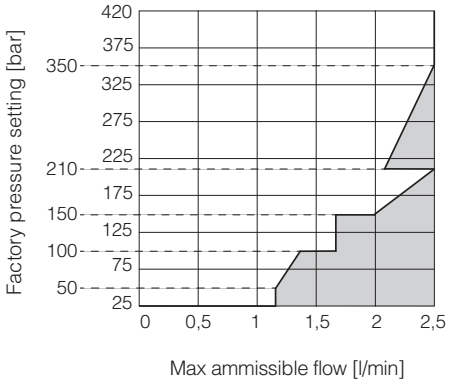
7 NAMEPLATE MARKING



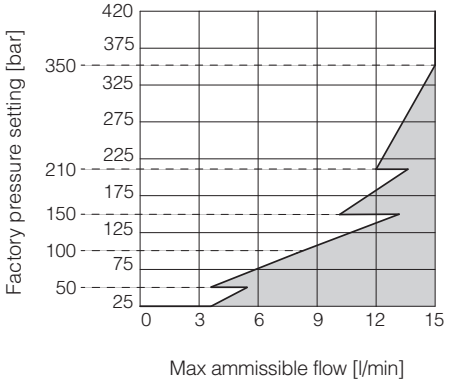
Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

8 **PERMITTED WORKING RANGE** (based on mineral oil ISO VG 46 at 50°C)

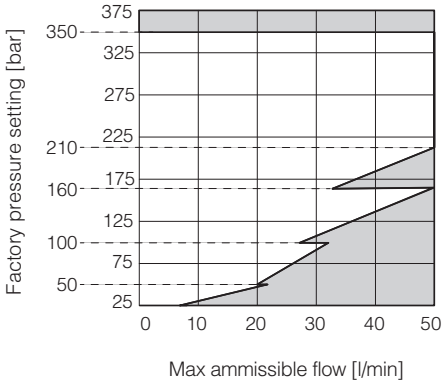
CART M-3 **/PED



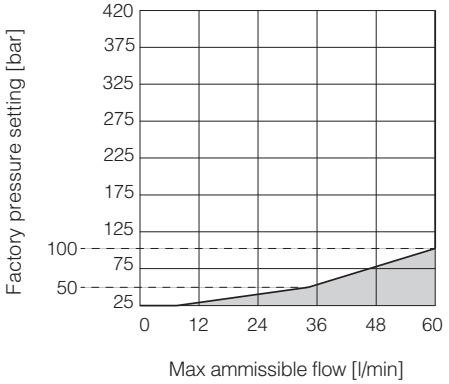
CART M-4 **/PED



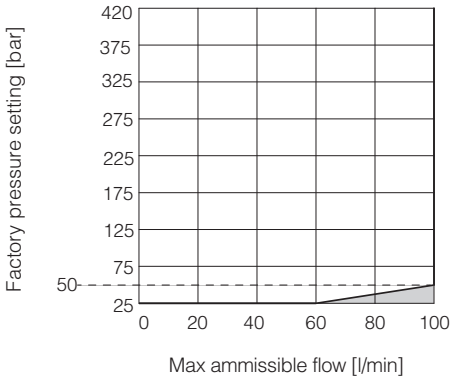
CART M-5 **/PED



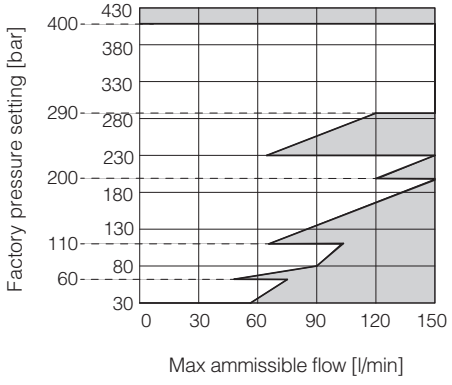
CART M-6 **/PED



CART ARE-15 **/PED



CART ARE-20 **/PED



Notes:

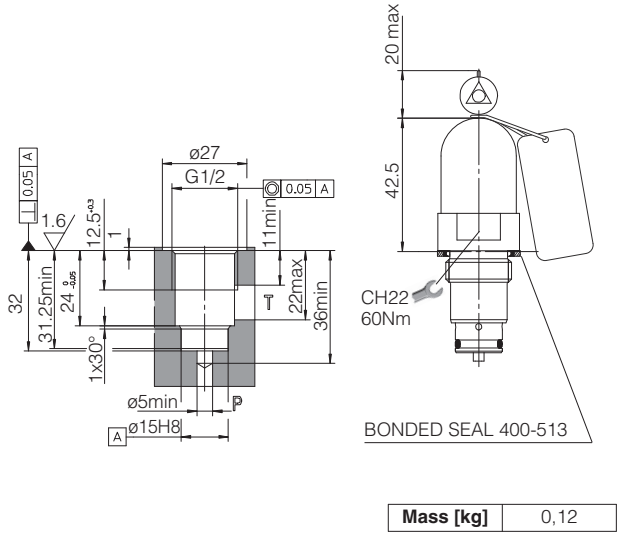
1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting.**
Pressure / flow values located in gray areas cannot be performed.

⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

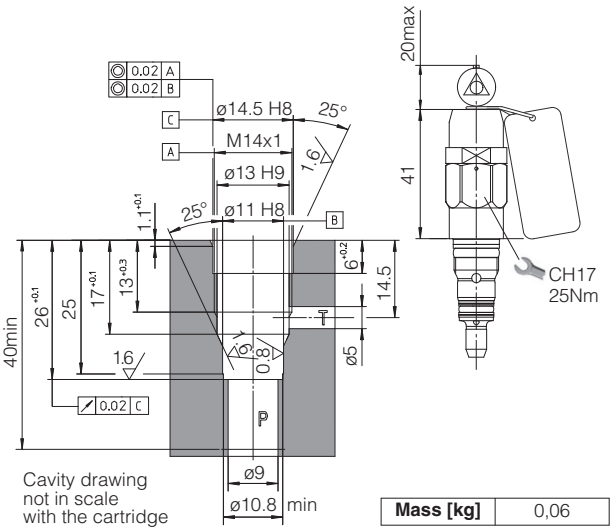
9 CAVITY AND INSTALLATION DIMENSIONS [mm]

CART M-3



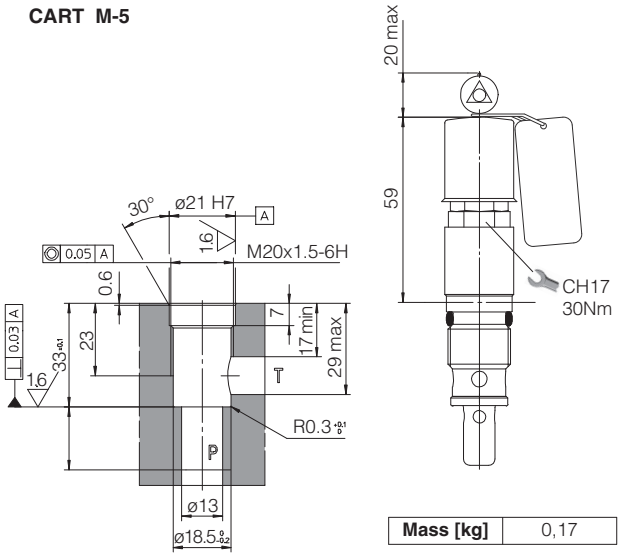
Mass [kg]	0,12

CART M-4



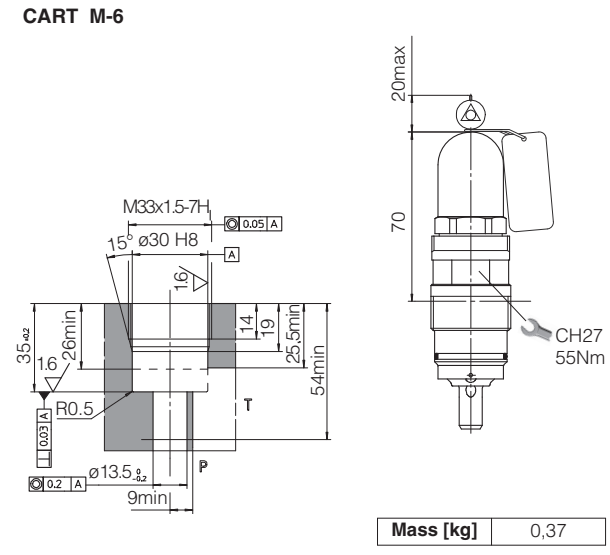
Mass [kg]	0,06

CART M-5



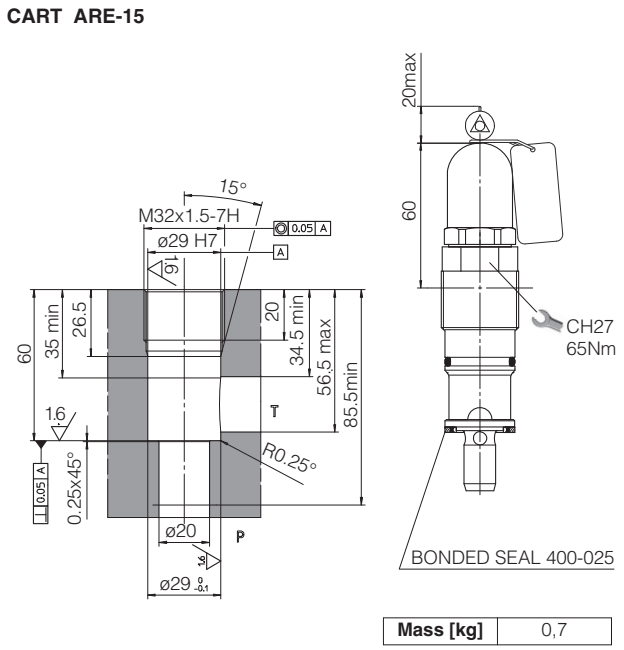
Mass [kg]	0,17

CART M-6



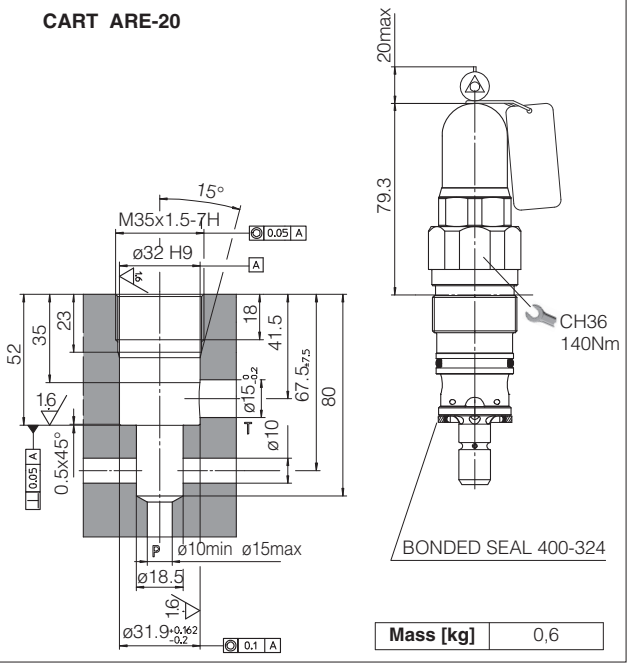
Mass [kg]	0,37

CART ARE-15



Mass [kg]	0,7

CART ARE-20



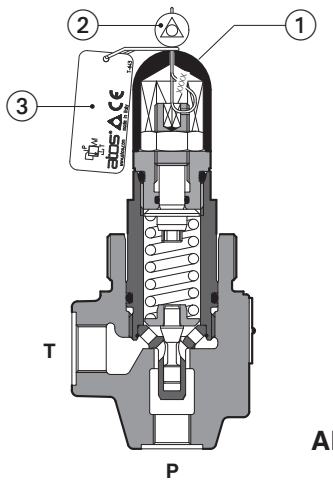
Mass [kg]	0,6

10 RELATED DOCUMENTATION

CY900	Operating and maintenance information for PED certified valves

Safety pressure relief valves

in line, direct, conforming to PED Directive 2014/68/EU - certified by DEKRA



ARE-06/420/PED

① plastic cap
② lead sealing
③ nameplate with factory pressure setting

ARE /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are provided with threaded ports for in-line mounting.

The valves are factory set at the pressure level required by the costumer, see section 6.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

ARE-06: Size: **G 3/8**"
Max flow: **60 l/min**
Max pressure: **420 bar**
ARE-15: Size: **G 1/2**"
Max flow: **100 l/min**
Max pressure: **420 bar**

1 MODEL CODE

ARE	-	06	/	420	/	PED	/	280	*	/	*

ARE: Safety pressure relief valves, in-line

Size:
06 = Port P G 3/8"
15 = Port P G 1/2"

Max pressure (bar):
420

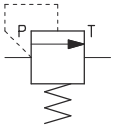
PED = EU Type examination to 2014/68/EU - certified by DEKRA

Factory pressure setting (bar):
to be defined by the customer
min step 1 bar (example **280** = 280 bar)
min pressure setting 25 bar

Series number

Seals material, see section 5:
- = NBR
PE = FKM
BT = HNBR:

2 HYDRAULIC SYMBOL



ARE-06* /PED

ARE-15* /PED

3 GENERAL CHARACTERISTICS

Assembly position	Any position
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate **(1)** RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model		**ARE-06**	**ARE-15**
Max pressure on port P	[bar]	420	420
Factory pressure setting range	[bar]	25÷420	25÷420
Max pressure on port T **(1)**	[bar]	50	50
Max flow **(2)**	[l/min]	60	100

(1) Ped valves should be operated without counterpressure on T line, see note 2 at section 8
(2) For PED valves see diagrams at section 8

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

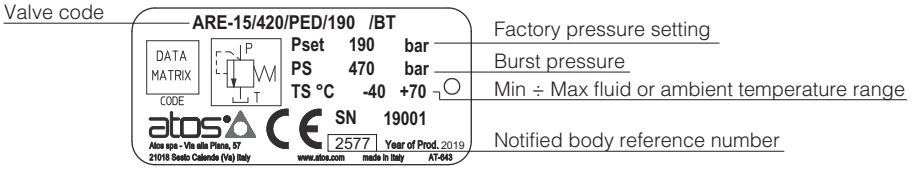
6 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 7

VALVE MODEL	**FLOW FOR FACTORY PRESSURE SETTING (l/min)**
ARE-06	2
ARE-15	2

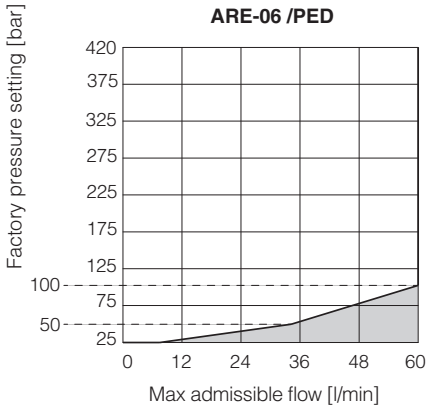
⚠ Any tampering of the lead sealing invalidates the certification

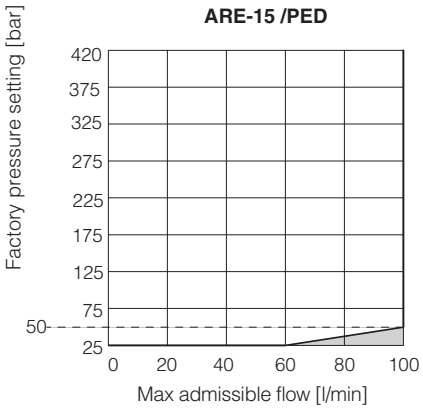
7 NAMEPLATE MARKING



Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

8 PERMITTED WORKING RANGE (based on mineral oil ISO VG 46 at 50°C)





Notes:

1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting.**
Pressure / flow values located in gray areas cannot be performed.

⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

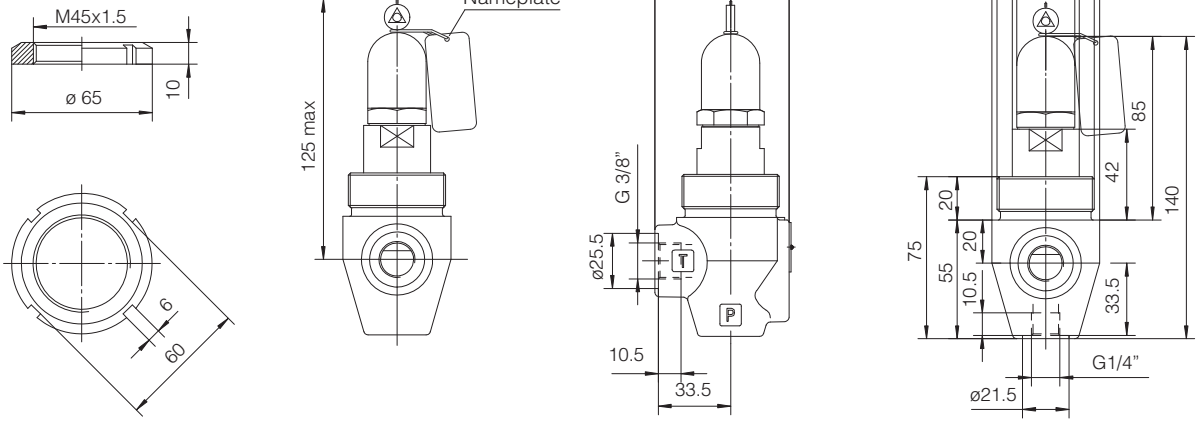
2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

9 INSTALLATION DIMENSIONS [mm]

ARE-06

P = INLET PORT G 3/8”
T = OUTLET PORT G 3/8”
Locking ring for fastening the valve.
Model code: SP-6-RE-310030

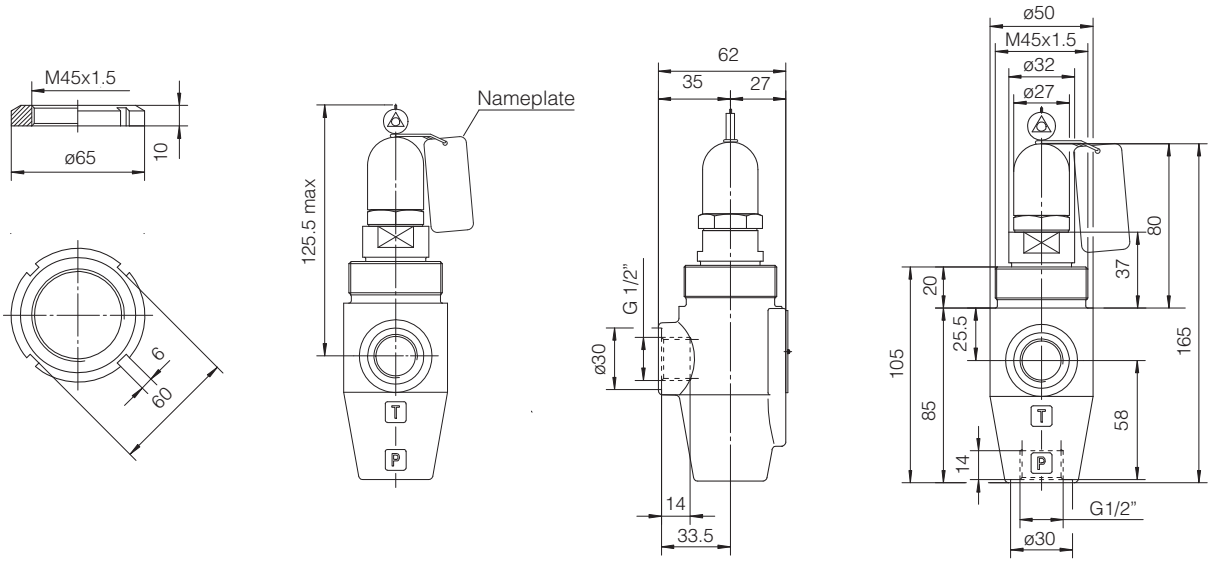
Mass [kg]	
ARE-06	1,0



ARE-15

P = INLET PORT G 1/2”
T = OUTLET PORT G 1/2”
Locking ring for fastening the valve.
Model code: SP-6-RE-310030

Mass [kg]	
ARE-15	1,3

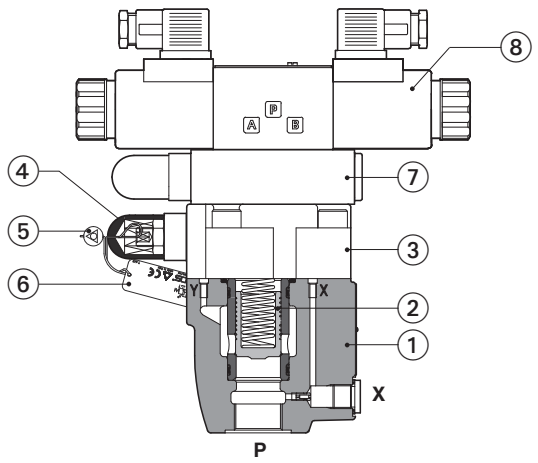


10 RELATED DOCUMENTATION

CY900	Operating and maintenance information for PED certified valves

Safety pressure relief valves

piloted, in-line, conforming to PED Directive 2014/68/EU - certified by DEKRA



① main body
② poppet
③ pilot stage
④ plastic cap
⑤ lead sealing
⑥ nameplate with factory pressure setting
⑦ second /third pressure setting
⑧ pilot solenoid valve for pressure selection

ARAM-20/20/*/PED

ARAM /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are factory set at the pressure level required by the costumer, see section [10].

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

ARAM can be equipped with a pilot solenoid valve for venting or for multiple pressure selection.

Size: **G 3/4"** and **G 1 1/4"**
Max flow: **350** and **500 l/min**
Max pressure: **350 bar**

[1] MODEL CODE

ARAM	-	20	/	20	/	350	/	210/100	/	E	/	PED	/	280	-	I	X	24DC	*	/	*

Piloted pressure relief valve, in-line

Valve size ISO 6264:
20 = port P - G 3/4"
32 = port P - G 1 1/4"

Configuration, see section [2] :
- = without pilot solenoid valve
10, 11:
with pilot solenoid valve for venting
20, 21, 22, 32:
with pilot solenoid valve for multiple pressure selection

Max pressure:
350 = 350 bar

Pressure range of second / third setting (1):
50 = 50 bar **100** = 100 bar
210 = 210 bar **350** = 350 bar

Options, see section [9] :
E **WP** **Y**

PED = EU Type examination to 2014/68/EU - certified by DEKRA

Factory pressure setting (bar):
to be defined by the customer min step 1 bar
(example **280** = 280 bar)
min pressure setting 30 bar

Pilot valve (1):
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(2)**:
Connectors to be ordered separately: see section [7]
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section [6] **(2)**:

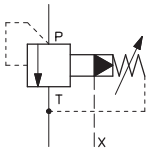
Series number

Seals material, see section [8] :
- = NBR
PE = FKM

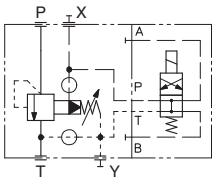
(1) Only for ARAM-* /20, /21, /22, /32
(2) Only for ARAM with pilot solenoid valve

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS

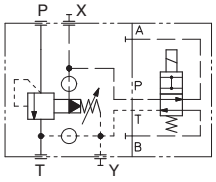
ARAM



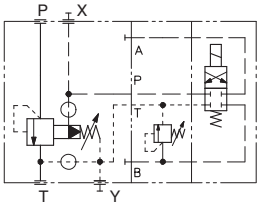
ARAM-/10**
one setting pressure + venting
with de-energized solenoid



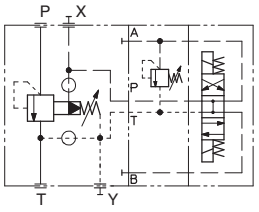
ARAM-/11**
one setting pressure + venting
with energized solenoid



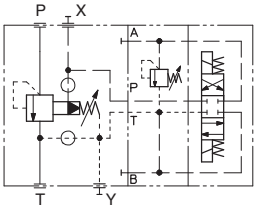
ARAM-/22**
two setting pressure
without venting



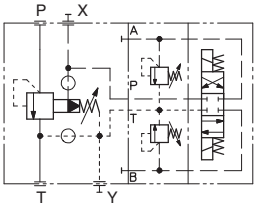
ARAM-/20**
two setting pressure + venting
with de-energized solenoid



ARAM-/21**
two setting pressure + venting
with energized solenoid



ARAM-/32**
three setting pressure
without venting



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +80°C
Surface protection	Zinc coating with black passivation -salt spray test (EN ISO9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate **(1)** RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model		**ARAM-10**	**ARAM-32**
Max pressure on ports P, X	[bar]	350	
Max pressure on ports T, Y **(1)**	[bar]	210 without pilot solenoid valve 120 with pilot solenoid valve -I 210 with pilot solenoid valve -E with DC solenoid 160 with pilot solenoid valve -E with AC solenoid	
Factory pressure setting range	[bar]	30÷350	
Max flow **(2)**	[l/min]	350	500

(1) The valves should be operated without counterpressure on T line, see note 2 at section 12
(2) Max flow without conterpressure on T line, see diagrams at section 12 for max ammissible flow

5 ELECTRICAL CHARACTERISTICS - for ARAM with pilot solenoid valve

Insulation class	DHI pilot	**H** (180°C)	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)	
Relative duty factor		100%	
Supply voltage and frequency		See coil voltage 6	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

6 **COIL VOLTAGE** - for ARAM with pilot solenoid valve

External supply nominal voltage ± 10% **(1)**	**Voltage code**	Type of connector	Power consumption **(3)** DHI	DHE	ARAM-*-I Code of spare coil	ARAM-*-I Colour of coil label	ARAM-*-E Code of spare coil
12 DC	**12 DC**	666 or 667	33 W	30 W	COU-12DC	green	COE-12DC
24 DC	**24 DC**				COU-24DC	red	COE-24DC
110 DC	**110 DC**				COU-110DC	black	COE-110DC
220 DC	**220 DC**				COU-220DC	black	COE-220DC
110/50 AC **(2)**	**110/50/60 AC**	666 or 667	60 VA	58 VA	COI-110/50/60AC	yellow	COE-110/50/60AC
115/60 AC	**115/60 AC (4)**		-	80 VA	-	-	COE-115/60AC
120/60 AC	**120/60 AC (5)**		60 VA	-	COI-120/60AC	white	-
230/50 AC **(2)**	**230/50/60 AC**		60 VA	58 VA	COI-230/50/60AC	light blue	COE-230/50/60AC
230/60 AC	**230/60 AC**		60 VA	80 VA	COI-230/60AC	silver	COE-230/60AC

(1) For other supply voltages see technical tables E010, E015
(2) Coil can be supplied also with 60 Hz: in this case the performances are reduced by 10 ÷ 15%
(3) Average values measured at nominal hydraulic condition and ambient temperature 20°C;
When AC solenoid is energized, the inrush current is approx 3 times the holding current
(4) Only for ARAM-*-E
(5) Only for ARAM-*-I

7 **ELECTRIC CONNECTORS ACCORDING TO DIN 43650** - for ARAM with pilot solenoid valve

The connectors must be ordered separately.

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tech table K800

8 **SEALS AND HYDRAULIC FLUIDS** - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

9 **OPTIONS**

E = external pilot
WP = prolunged manual override protected by rubber cap - only for ARAM with pilot solenoid valve
Y = external drain - only for ARAM with pilot solenoid valve

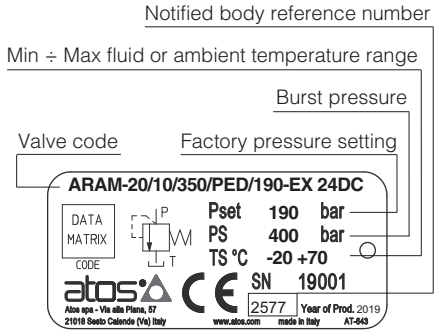
10 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 11 .

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
ARAM-10	25
ARAM-20	25

⚠ Any tampering of the lead sealing invalidates the certification

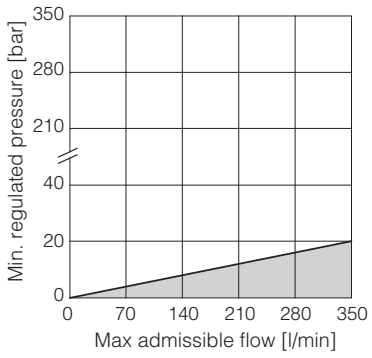
11 NAMEPLATE MARKING



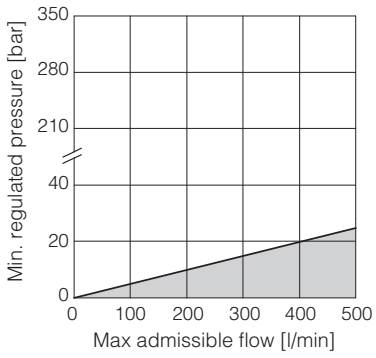
Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

12 PERMISSIBLE RANGE - based on mineral oil ISO VG 46 at 50°C

ARAM-20 /PED



ARAM-32 /PED



Notes:

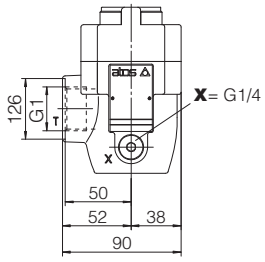
1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting.**
Pressure / flow values located in gray areas cannot be performed.

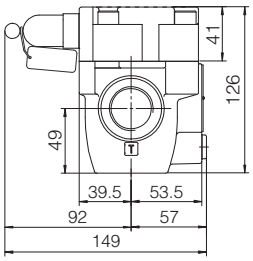
⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

13 INSTALLATION DIMENSIONS [mm]

ARAM-20

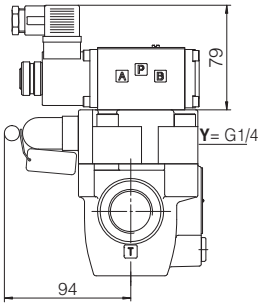




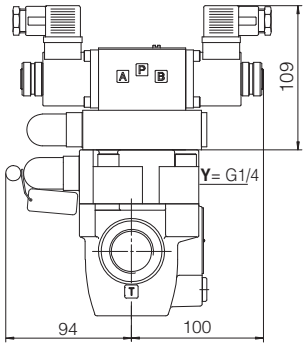
X = port connection for external pilot
Y = port connection for external drain

	Mass [kg]
ARAM-20	3,9

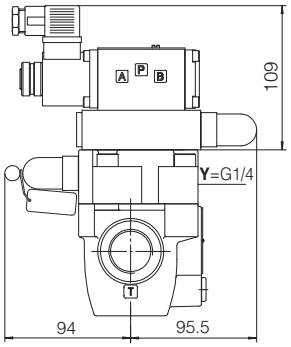
	Mass [kg]	
	with option IX	with option EX
ARAM-20/10	5,4	5,7
ARAM-20/11		
ARAM-20/20	7,1	7,7
ARAM-20/21		
ARAM-20/22	6,8	7,2
ARAM-20/32	7,4	8,0



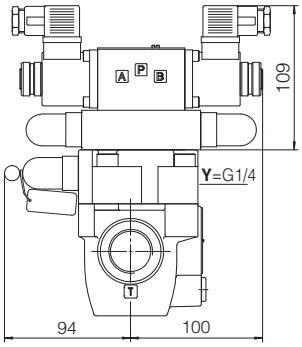
ARAM-20/10/-IX**
ARAM-20/11/-IX**



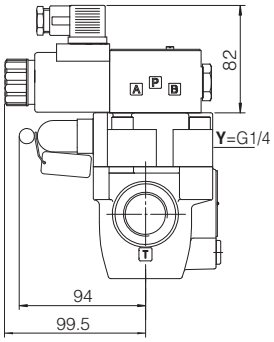
ARAM-20/20/-IX**
ARAM-20/21/-IX**



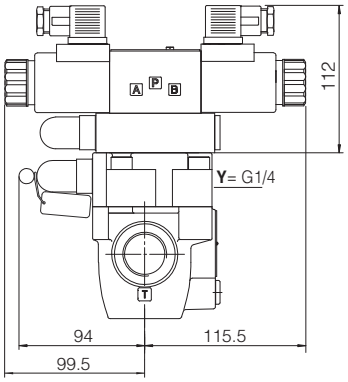
ARAM-20/22/-IX**



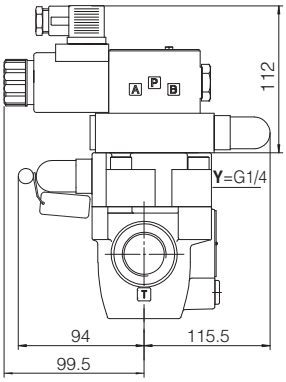
ARAM-20/32/-IX**



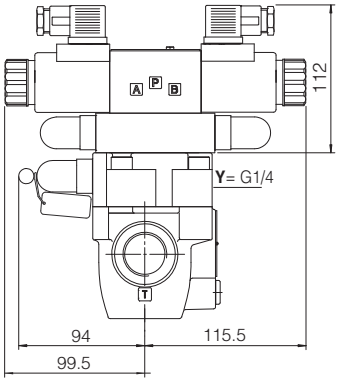
ARAM-20/10/-EX**
ARAM-20/11/-EX**



ARAM-20/20/-EX**
ARAM-20/21/-EX**



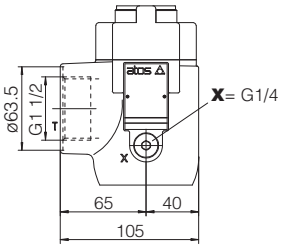
ARAM-20/22/-EX**

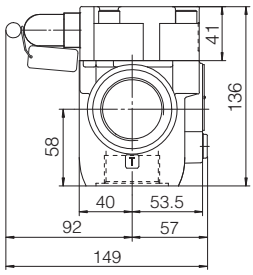


ARAM-20/32/-EX**

Overall dimensions refer to valves with connectors type 666

ARAM-32

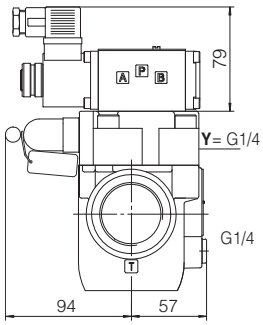




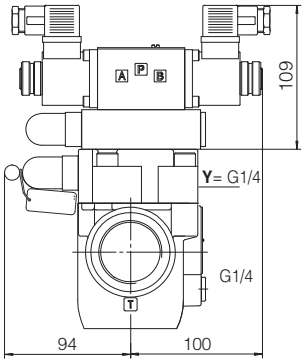
	Mass [kg]
ARAM-32	4,7

	Mass [kg]	
	with option IX	with option EX
ARAM-32/10	6,2	6,5
ARAM-32/11		
ARAM-32/20	7,9	8,5
ARAM-32/21		
ARAM-32/22	7,6	7,9
ARAM-32/32	8,8	8,2

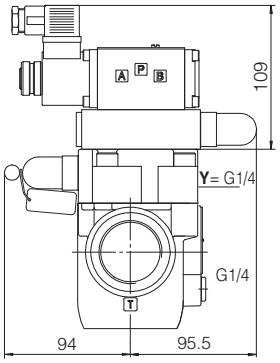
X = port connection for external pilot
Y = port connection for external drain



ARAM-32/10/-IX**
ARAM-32/11/-IX**



ARAM-32/20/-IX**
ARAM-32/21/-IX**



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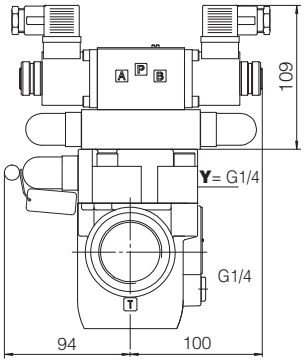
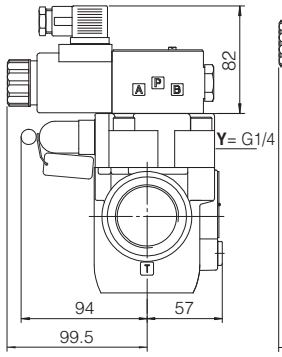
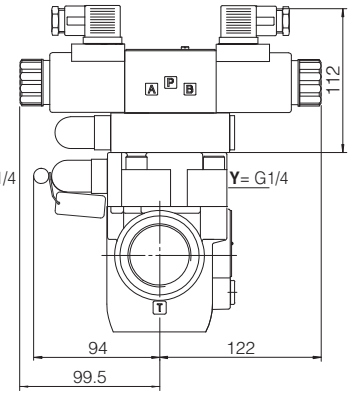


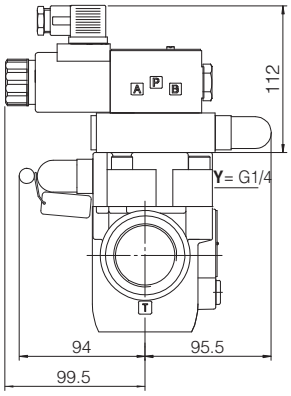
ARAM-32/32/-IX**



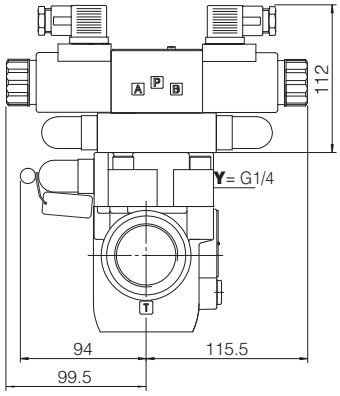
ARAM-32/10/-EX**
ARAM-32/11/-EX**



ARAM-32/20/-EX**
ARAM-32/21/-EX**



ARAM-32/22/-EX**



ARAM-32/32/-EX**

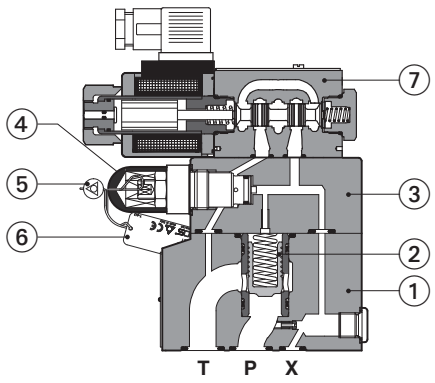
Overall dimensions refer to valves with connectors type 666

14 RELATED DOCUMENTATION

CY900	Operating and maintenance information for PED certified valves

Safety pressure relief valves

piloted, subplate, conforming to PED Directive 2014/68/EU - certified by DEKRA



AGAM-10/11/*/PED

① main body
② poppet
③ pilot stage
④ plastic cap
⑤ lead sealing
⑥ nameplate with factory pressure setting
⑦ pilot solenoid valve for pressure selection

AGAM /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are factory set at the pressure level required by the costumer, see section 10.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

AGAM can be equipped with a pilot solenoid valve for venting or for different pressure selection.

Size: **10, 20** and **32** - ISO 6264
Max flow: **200, 400** and **600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGAM	-	20	/	20	/	350	/	210/100	/	E	/	PED	/	280	-	I	X	24DC	*	/	*

Piloted pressure relief valve, subplate

Valve size ISO 6264:
10 20 32

Configuration, see section 2 :
- = without pilot solenoid valve
10, 11:
with pilot solenoid valve for venting
20, 21, 22, 32:
with pilot solenoid valve for multiple pressure selection

Max pressure:
350 = 350 bar

Pressure range of second / third setting (1):
50 = 50 bar **100** = 100 bar
210 = 210 bar **350** = 350 bar

Options, see section 9 :
E WP Y

PED = EU Type examination to 2014/68/EU - certified by DEKRA

Factory pressure setting (bar):
to be defined by the customer min step 1 bar
(example **280** = 280 bar)
min pressure setting 30 bar

Pilot valve (2):
I = DHI for AC and DC supply, with **cURus** certified solenoids
E = DHE for AC and DC supply, high performances with **cURus** certified solenoids

X = without connector **(2)**:
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for -I)
-00-AC = AC solenoid valve without coils (for -E)
-00-DC = DC solenoid valve without coils (for -E)

Voltage code, see section 6 **(2)**:

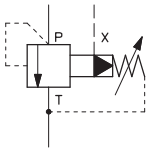
Series number

Seals material, see section 8:
- = NBR
PE = FKM

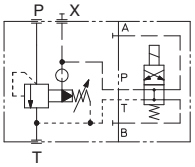
(1) Only for AGAM-* /20, /21, /22, /32
(2) Only for AGAM with pilot solenoid valve

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS

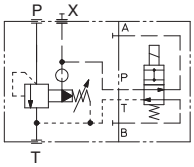
AGAM



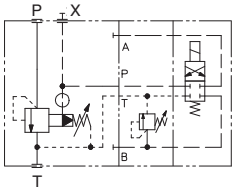
AGAM-/10**
one setting pressure + venting
with de-energized solenoid



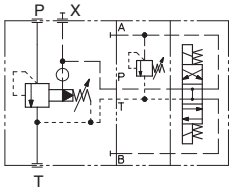
AGAM-/11**
one setting pressure + venting
with energized solenoid



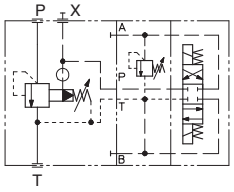
AGAM-/22**
two setting pressure
without venting



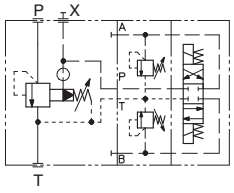
AGAM-/20**
two setting pressure + venting
with de-energized solenoid



AGAM-/21**
two setting pressure + venting
with energized solenoid



AGAM-/32**
three setting pressure
without venting



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C
Surface protection	Zinc coating with black passivation -salt spray test (EN ISO9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate **(1)** RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model	**AGAM-10**	**AGAM-20**	**AGAM-32**
Max pressure on ports P, X [bar]	350		
Max pressure on ports T, Y **(1)** [bar]	210 without pilot solenoid valve 120 with pilot solenoid valve -I 210 with pilot solenoid valve -E with DC solenoid 160 with pilot solenoid valve -E with AC solenoid		
Factory pressure setting range [bar]	30÷350		
Max flow **(2)** [l/min]	200	400	400

(1) The valves should be operated without counterpressure on T line, see note 2 at section 12
(2) Max flow without conterpressure on T line, see diagrams at section 12 for max ammissible flow

5 ELECTRICAL CHARACTERISTICS - for AGAM with pilot solenoid valve

Insulation class	DHI pilot	**H** (180°C)	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	**H** (180°C) for DC coils **F** (155°C) for AC coils	
Protection degree to DIN EN 60529		**IP 65** (with connectors 666, 667, 669 or E-SD correctly assembled)	
Relative duty factor		100%	
Supply voltage and frequency		See coil voltage 6	
Supply voltage tolerance		± 10%	
Certification		**cURus** North American standard	

6 COIL VOLTAGE - for AGAM with pilot solenoid valve

External supply nominal voltage ± 10% **(1)**	**Voltage code**	Type of connector	Power consumption **(3)** DHI	DHE	AGAM-*-I Code of spare coil	Colour of coil label	AGAM-*-E Code of spare coil
12 DC	**12 DC**	666 or 667	33 W	30 W	COU-12DC	green	COE-12DC
24 DC	**24 DC**				COU-24DC	red	COE-24DC
110 DC	**110 DC**				COU-110DC	black	COE-110DC
220 DC	**220 DC**				COU-220DC	black	COE-220DC
110/50 AC **(2)**	**110/50/60 AC**	666 or 667	60 VA	58 VA	COI-110/50/60AC	yellow	COE-110/50/60AC
115/60 AC	**115/60 AC (4)**		-	80 VA	-	-	COE-115/60AC
120/60 AC	**120/60 AC (5)**		60 VA	-	COI-120/60AC	white	-
230/50 AC **(2)**	**230/50/60 AC**		60 VA	58 VA	COI-230/50/60AC	light blue	COE-230/50/60AC
230/60 AC	**230/60 AC**		60 VA	80 VA	COI-230/60AC	silver	COE-230/60AC

(1) For other supply voltages see technical tables E010, E015
(2) Coil can be supplied also with 60 Hz: in this case the performances are reduced by 10 ÷ 15%
(3) Average values measured at nominal hydraulic condition and ambient temperature 20°C;
When AC solenoid is energized, the inrush current is approx 3 times the holding current
(4) Only for AGAM-*-E
(5) Only for AGAM-*-I

7 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR AGAM WITH SOLENOID VALVE

The connectors must be ordered separately.

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tech table K800

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

9 OPTIONS

E = external pilot
WP = prolunged manual override protected by rubber cap - only for AGAM with pilot solenoid valve
Y = external drain - only for AGAM with pilot solenoid valve

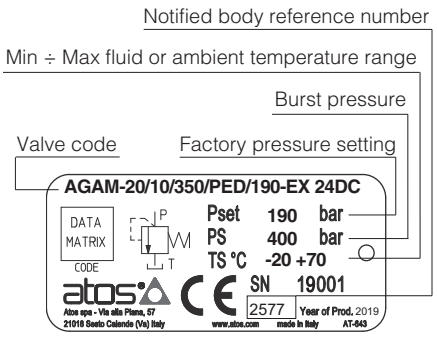
10 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 11 .

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
AGAM-10	25
AGAM-20	25
AGAM-32	25

⚠ Any tampering of the lead sealing invalidates the certification

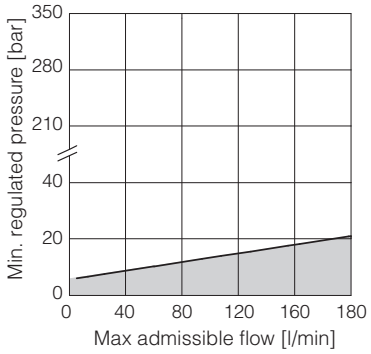
11 NAMEPLATE MARKING



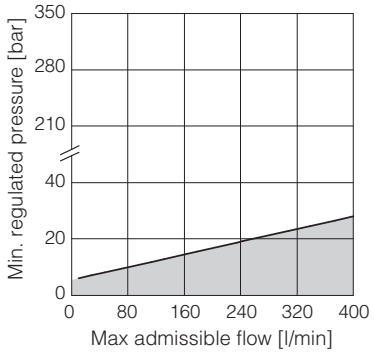
Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

12 PERMISSIBLE RANGE - based on mineral oil ISO VG 46 at 50°C

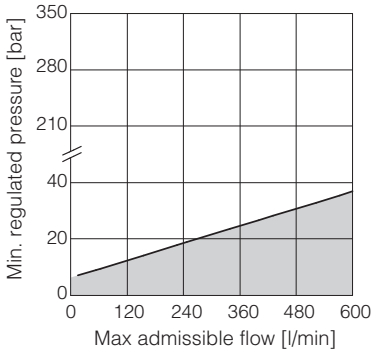
AGAM-10 /PED



AGAM-20 /PED



AGAM-32 /PED



Notes:

1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting.**

Pressure / flow values located in gray areas cannot be performed.

⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

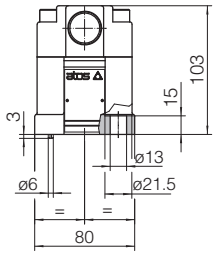
13 INSTALLATION DIMENSIONS [mm]

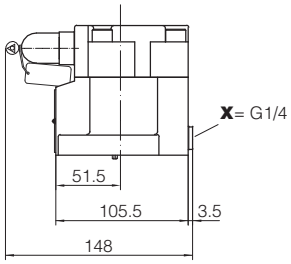
AGAM-10

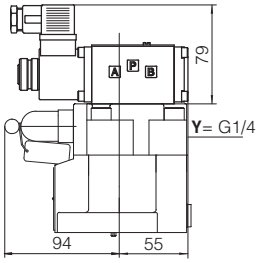
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-06-09-1-97
Fastening bolts: 4 socket head screws M12x35 class 12.9
Tightening torque = 125 Nm

	Mass [kg]
AGAM-10	3,6

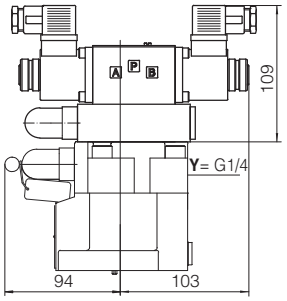
	Mass [kg]	
	with option IX	with option EX
AGAM-10/10	5,1	5,4
AGAM-10/11		
AGAM-10/20	6,2	6,5
AGAM-10/21		
AGAM-10/22	5,9	6,2
AGAM-10/32	6,3	6,9



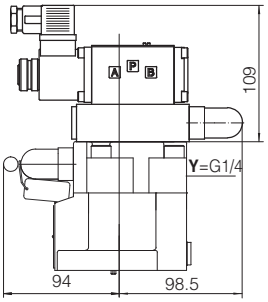




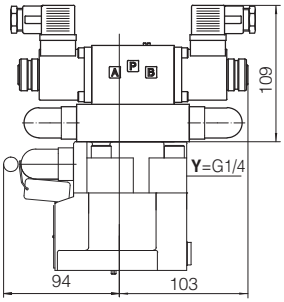
AGAM-10/10/-IX**
AGAM-10/11/-IX**



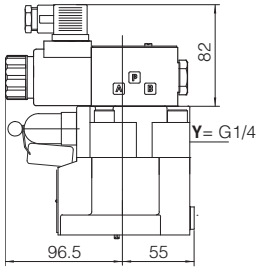
AGAM-10/20/-IX**
AGAM-10/21/-IX**



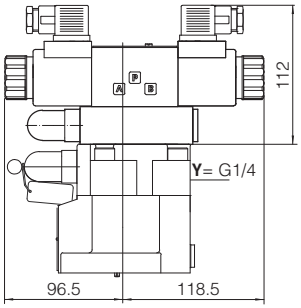
AGAM-10/22/-IX**



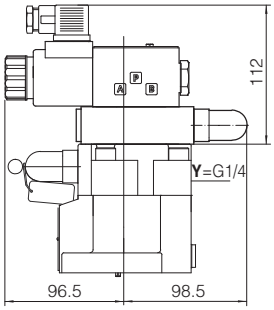
AGAM-10/32/-IX**



AGAM-10/10/-EX**
AGAM-10/11/-EX**



AGAM-10/20/-EX**
AGAM-10/21/-EX**



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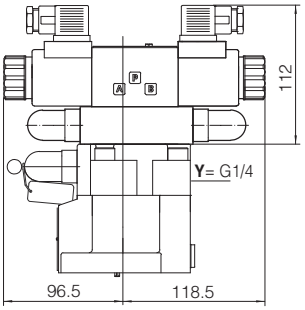


AGAM-10/32/-EX**

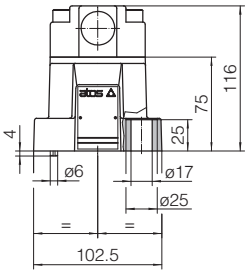
Overall dimensions refer to valves with connectors type 666

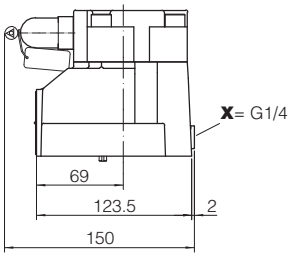
AGAM-20

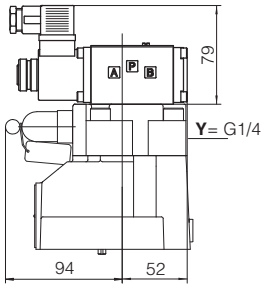
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-08-11-1-97
Fastening bolts:
4 socket head screws M16x50 class 12.9
Tightening torque = 300 Nm

	Mass [kg]
AGAM-20	4,8

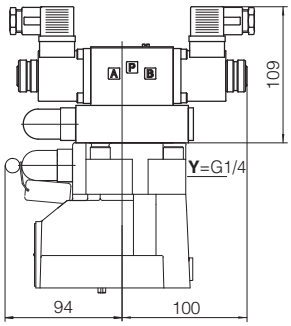
	Mass [kg]	
	with option IX	with option EX
AGAM-20/10	6,3	6,6
AGAM-20/11		
AGAM-20/20	7,4	7,7
AGAM-20/21		
AGAM-20/22	7,1	7,4
AGAM-20/32	7,5	8,1



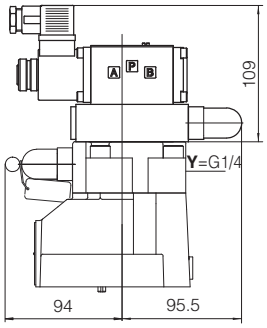




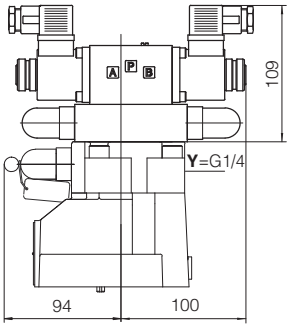
AGAM-20/10/-IX**
AGAM-20/11/-IX**



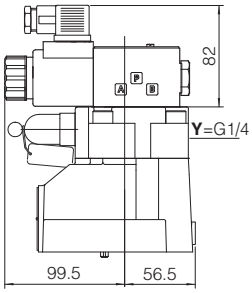
AGAM-20/20/-IX**
AGAM-20/21/-IX**



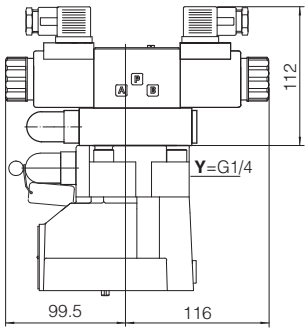
AGAM-20/22/-IX**



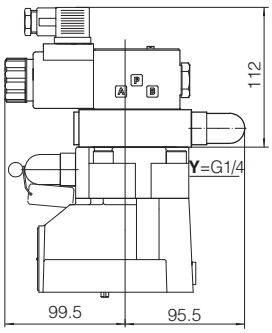
AGAM-20/32/-IX**



AGAM-20/10/-EX**
AGAM-20/11/-EX**



AGAM-20/20/-EX**
AGAM-20/21/-EX**



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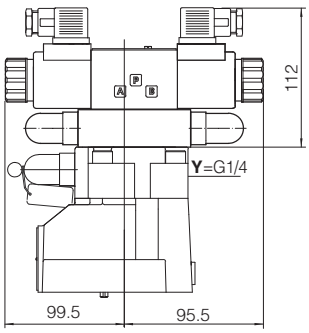


AGAM-20/32/-EX**

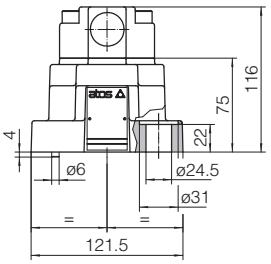
Overall dimensions refer to valves with connectors type 666

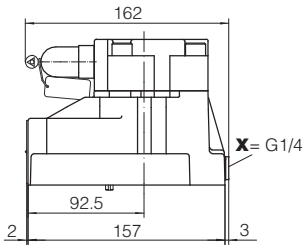
AGAM-32

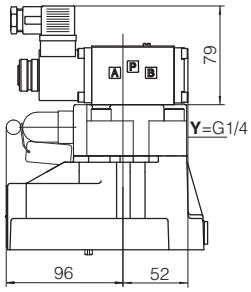
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)
Fastening bolts:
4 socket head screws M20x60 class 12.9
Tightening torque = 600 Nm

	Mass [kg]
AGAM-32	6.2

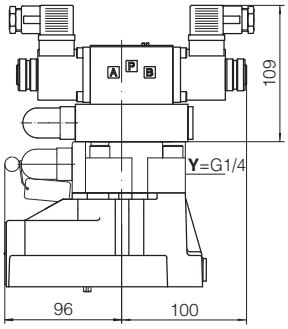
	Mass [kg]	
	with option IX	with option EX
AGAM-32/10	7,7	8
AGAM-32/11		
AGAM-32/20	8,8	8,1
AGAM-32/21		
AGAM-32/22	8,5	8,8
AGAM-32/32	8,9	9,5



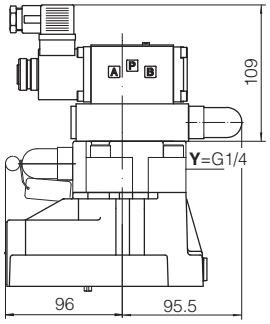




AGAM-32/10/-IX**
AGAM-32/11/-IX**



AGAM-32/20/-IX**
AGAM-32/21/-IX**



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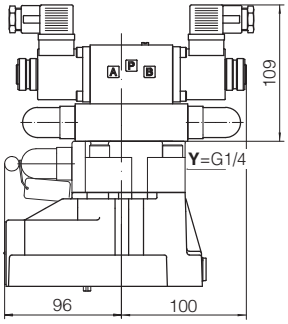
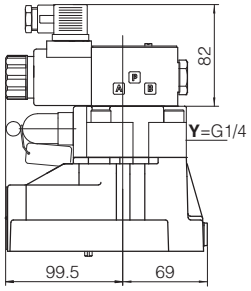
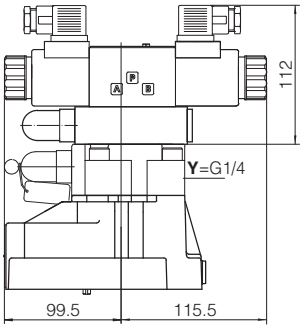


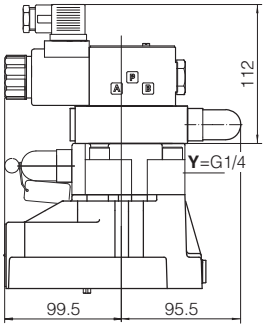
AGAM-32/32/-IX**



AGAM-32/10/-EX**
AGAM-32/11/-EX**



AGAM-32/20/-EX**
AGAM-32/21/-EX**



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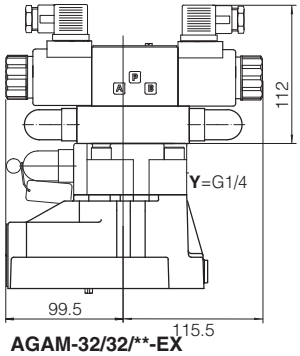


AGAM-32/32/-EX**

Overall dimensions refer to valves with connectors type 666

14 MOUNTING SUBPLATES - see table K280

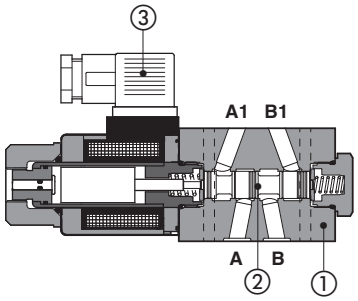
Valve	Subplate model	Port location	Ports			Ø Counterbore [mm]			Mass [Kg]
			P	T	X	P	T	X	
AGAM-10	BA-306	Ports P, T, X underneath;	G 1/2"	G 3/4"	G 1/4"	30	36,5	21,5	1,5
AGAM-20	BA-406		G 3/4"	G 3/4"	G 1/4"	36,5	36,5	21,5	3,5
	BA-506		G 1"	G 1"	G 1/4"	46	46	21,5	3,5
AGAM-32	BA-706		G 1 1/2"	G 1 1/2"	G 1/4"	63,5	63,5	21,5	6

15 RELATED DOCUMENTATION

CY900	Operating and maintenance information for PED certified valves

Solenoid modular valves

direct, modular, spool type



HF-0611

① Body
② Spool
③ Coil electric connector (to be ordered separately)

HF are spool type, direct operated solenoid valves in modular execution, normally used for shut-off or to by-pass the hydraulic user lines.

The modular execution permits to make compact functional circuits, by the stack mounting with other modular valves and solenoid valves size 06.

Mounting Surface: **ISO 4401 size 06**
Max flow: **60 l/min**
Max pressure: **350 bar**

1 MODEL CODE

HF-0	61	1	/	A	-	E	X	24DC	**	/*

Modular directional valve, size 06

Valve configuration, see section 2
61 = single solenoid, central plus external position, spring centered
67 = single solenoid, central plus external position, spring offset

Spool type: **1**, **3**, **4** see section 2

Options:
A = solenoid mounted at side of port B
B = orientation of coil and proximity connectors rotated of 180°
WP = prolunged manual override protected by a rubber cap

00-AC = AC solenoids without coils
00-DC = DC solenoids without coils
E = solenoid OE for AC and DC supply

X = without connector, only for **E** solenoid
See section 6 for available connectors, to be ordered separately

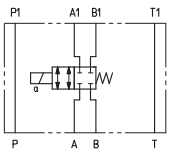
Coils with special connectors
XJ = AMP Junior Timer connector
XK = Deutsch connector
XS = Lead Wire connection

Voltage code, see section 7

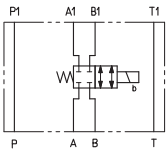
Series number

Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR

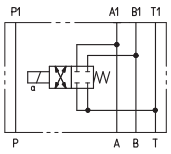
2 CONFIGURATION



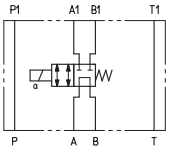
HF-0611



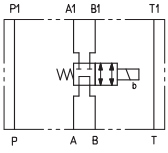
HF-0611/A



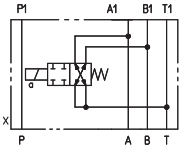
HF-0613



HF-0614



HF-0614/A



HF-0673

3 MAIN CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Compliance	CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	**Standard** -30°C ÷ +70°C **/PE** option -20°C ÷ +70°C **/BT** option -40°C ÷ +70°C
Flow direction	As shown in the symbols of table 2
Operating pressure	Ports P,A,B: **350** bar; Port T: **210** bar (DC solenoid); **160** bar (AC solenoid)
Maximum flow	**60 l/min**

3.1 Coils characteristics

Insulation class	**H** (180°C) for DC coils **F** (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with mating connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 7
Supply voltage tolerance	± 10%
Certification	**cURus** North American standard

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

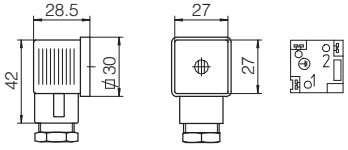
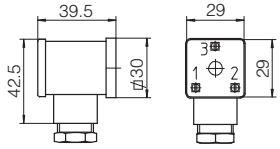
5 OPTIONS

A = Solenoid mounted at side of port B. In standard versions, solenoid is mounted at side of port A.

B = Orientation of coil and proximity connectors rotated of 180°

WP = Prolunged manual override protected by a rubber cap (not for FV)

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666, 667 (for AC or DC supply)	**669** (for AC supply)	**CONNECTOR WIRING**	
		**666, 667** 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	**669** 1,2 = Supply voltage VAC 3 = Coil ground
		SUPPLY VOLTAGES	
		666 All voltages	**667** 24 AC or DC 110 AC or DC 220 AC or DC
			669 110/50 AC 110/60 AC 230/50 AC 230/60 AC

Note: for electronic connectors type **E-SD**, see tab. K500

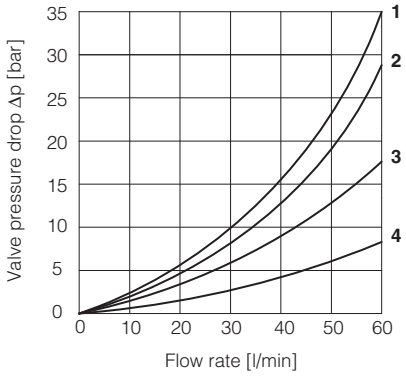
7 ELECTRIC FEATURES

External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption (2)	Code of spare coil
12 DC	**12 DC**	666 or 667	30 W	COE-12DC
14 DC	**14 DC**			COE-14DC
24 DC	**24 DC**			COE-24DC
28 DC	**28 DC**			COE-28DC
48 DC	**48 DC**			COE-48DC
110 DC	**110 DC**			COE-110DC
125 DC	**125 DC**			COE-125DC
220 DC	**220 DC**			COE-220DC
110/50 AC	**110/50/60 AC**		58 VA (3)	COE-110/50/60AC (1)
230/50 AC	**230/50/60 AC**			COE-230/50/60AC (1)
115/60 AC	**115/60 AC**		80 VA (3)	COE-115/60AC
230/60 AC	**230/60 AC**			COE-230/60AC
110/50 AC - 120/60 AC	**110 RC**	669	30 W	COE-110RC
230/50 AC - 230/60 AC	**230 RC**			COE-230RC

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.
(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

8 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

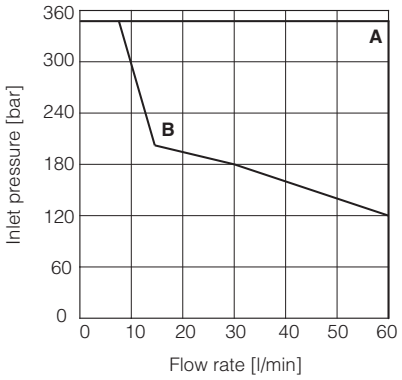
Flow direction / Valve type	**A→A1**	**B→B1**	**A→B**	**A1→T**	**B1→T**
HF-0611	1	2			
HF-0614	1	2	3		
HF-0673	3	3		4	4



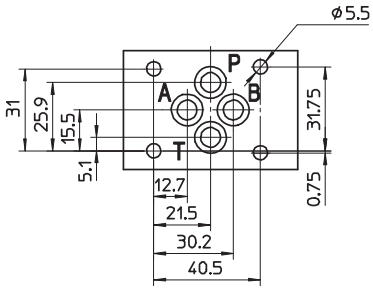
9 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%)

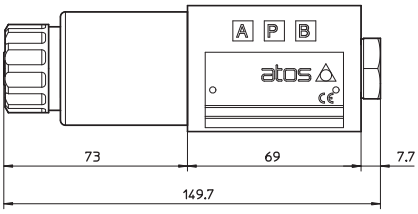
Valve type	Curve
HF-0611	**A**
HF-0614, HF-0673	**B**

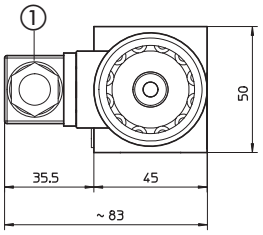


10 DIMENSIONS [mm]



ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Seals: 4 OR 108
Ports P, A, B, T: Ø = 7.5 mm (max).



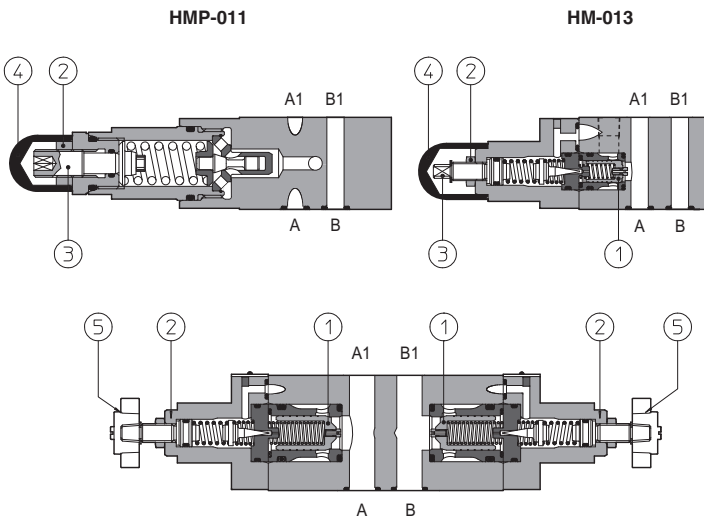


HF-0611
HF-0613
HF-0614
HF-0673

① = Power supply connector code 666, 667 or 669, to be ordered separately

Modular relief valves type HMP, HM, KM

ISO 4401 sizes 06 and 10



HMP are direct operated pressure relief valves.
HM and **KM** are double stage pressure relief valves with balanced poppet ①.

The pressure adjustment is operated by loosening the locking nut ② and turning the screw ③ protected by cap ④. Optional versions with setting adjustment by handwheel ⑤ instead of the screw are available on request.
Clockwise rotation increases the pressure.

Valve size and max flow:

HMP = size 06, max flow: 35 l/min
HM = size 06, max flow: 60 l/min
KM = size 10, max flow: 120 l/min

Mounting surface: **ISO 4401 size 06, 10**
Max pressure: up to **350 bar**

1 MODEL CODE

HM	-	011	/	210	/	V	**	/	*

Modular pressure relief valve size:
HMP = 06
HM = 06
KM = 10

Configuration, see section 2
011 = single on port P, dicharge to port T
012 = double on ports A and B, discharge to port T
013 = single on port A, discharge to port T
014 = single on port B, discharge to port T
015 = double on ports A and B, with the relieved pressure cross-discharged

Pressure range

HMP:	HM and KM:
50 = 2÷ 50 bar	**50** = 4÷ 50 bar
100 = 3÷100 bar	**100** = 5÷100 bar
210 = 10÷210 bar	**210** = 5÷210 bar
350 = 15÷350 bar	**350** = 5÷350 bar

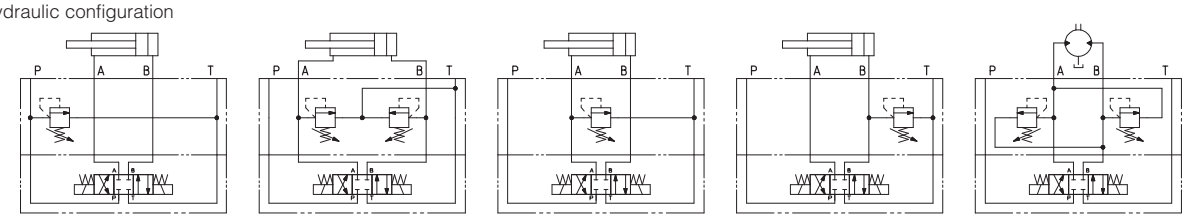
Options:
V = setting adjustment by handwheel instead of a grub screw protected by cap
Only for HMP:
R = reduced leakage for special applications
VF = regulating knob
VS = regulating knob with safety locking

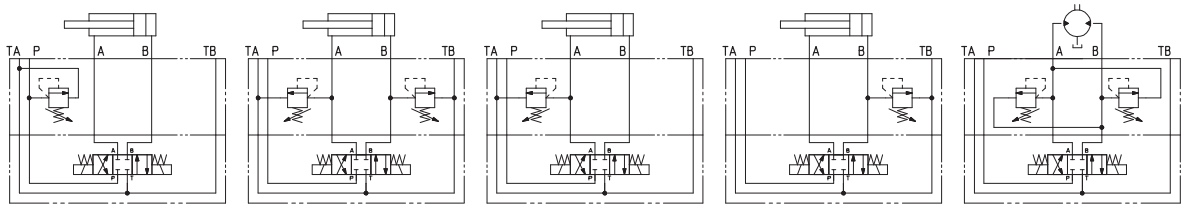
Series number

Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC CHARACTERISTICS

Hydraulic configuration





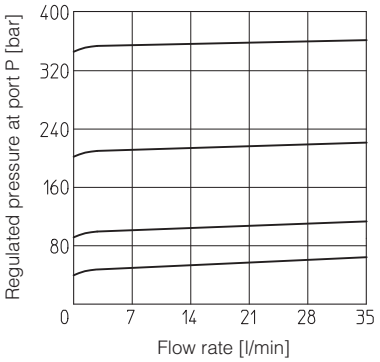
Valve model		HMP	HM	KM
Max flow	[l/min]	35	60	120
Pressure range	[bar]	2÷50; 3÷100; 10÷210; 15÷350	4÷50; 5÷100; 5÷210; 5÷350	

3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

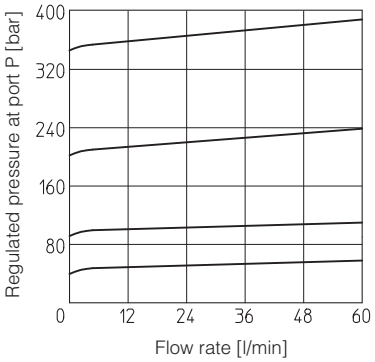
Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (Based on mineral oil ISO VG 46 at 50°C)

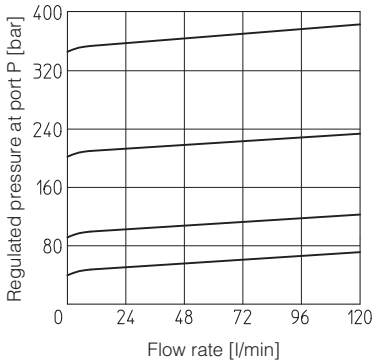
HMP



HM

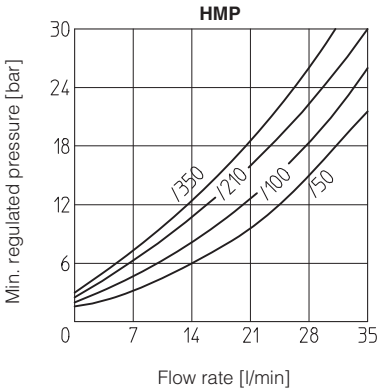


KM

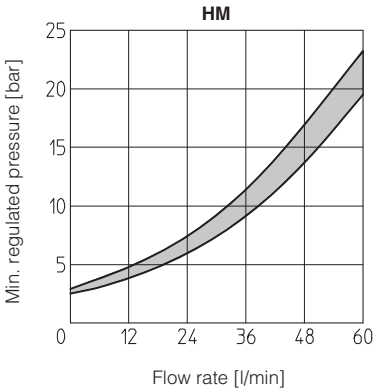


5 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS (Based on fluid viscosity of 25 mm²/s at 40°C)

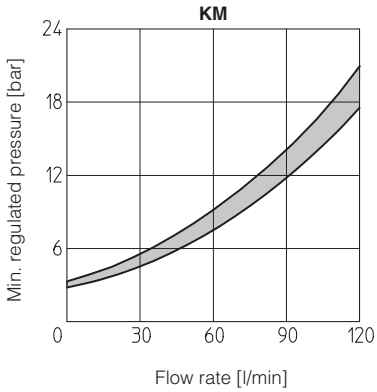
HMP



HM

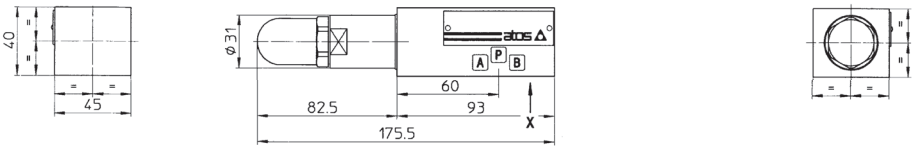


KM



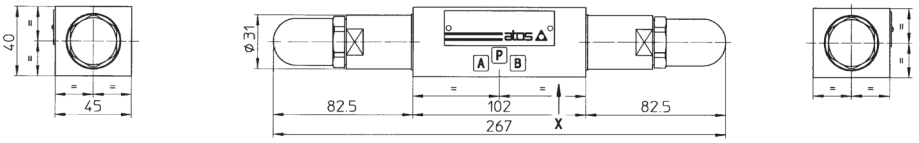
6 INSTALLATION DIMENSIONS OF HMP VALVES [mm]

HMP-011



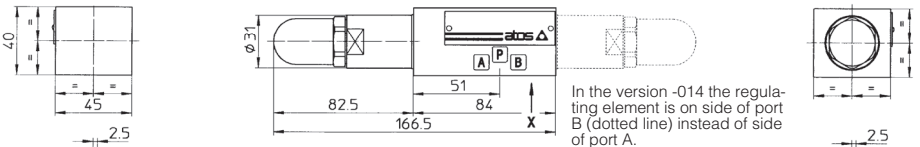
Mass: 1,4 Kg

HMP-012



Mass: 1,7 Kg

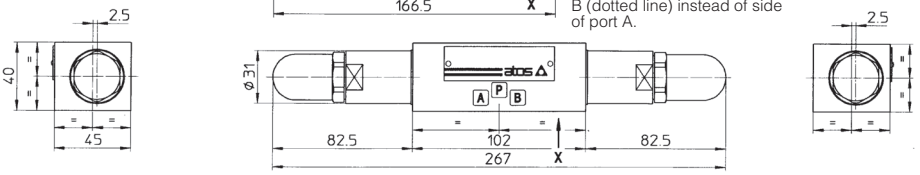
HMP-013
HMP-014



In the version -014 the regulating element is on side of port B (dotted line) instead of side of port A.

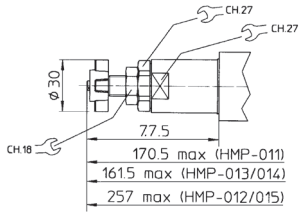
Mass: 1,2 Kg

HMP-015

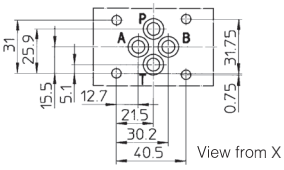


Mass: 1,7 Kg

Adjustment device for option /V

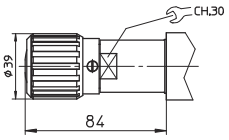


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm
Seals: 4 OR 108



View from X

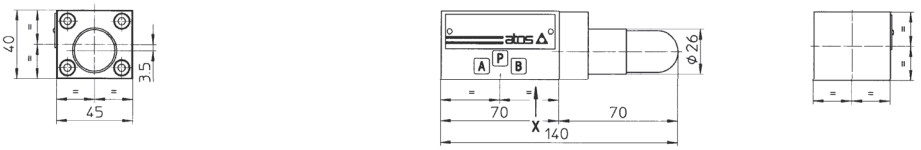
Adjustment device for option /VF and /VS



Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

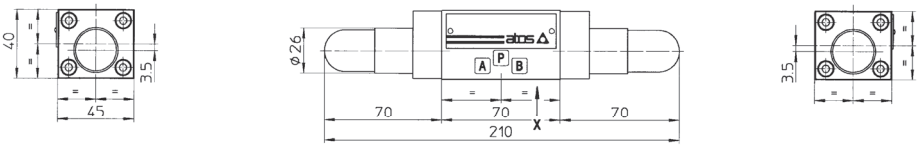
7 INSTALLATION DIMENSIONS OF HM VALVES [mm]

HM-011
HM-014



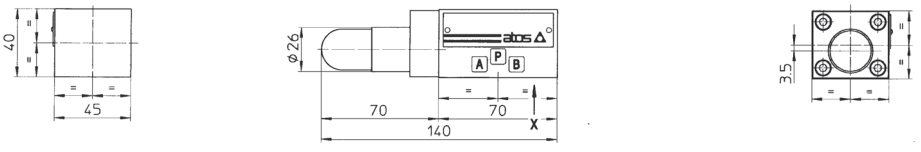
Mass: 1,1 Kg

HM-012
HM-015



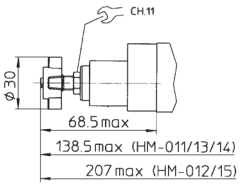
Mass: 1,3 Kg

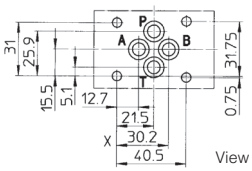
HM-013



Mass: 1,1 Kg

Adjustment device for option /V





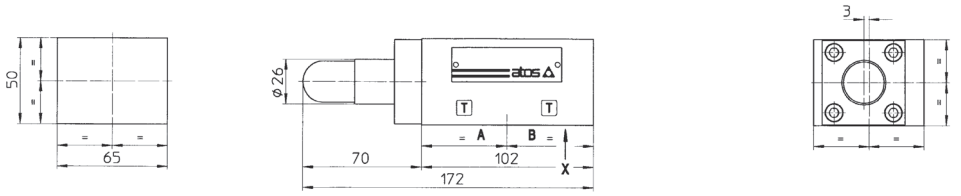
View from X

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm
Seals: 4 OR 108

Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

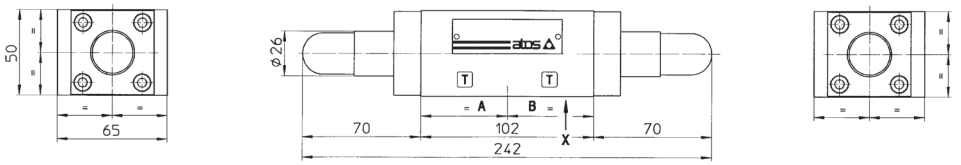
8 INSTALLATION DIMENSIONS OF KM VALVES [mm]

KM-011



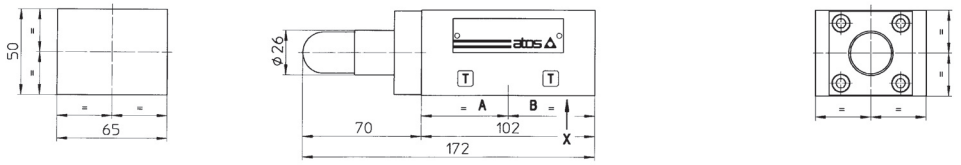
Mass: 2,5 Kg

KM-012



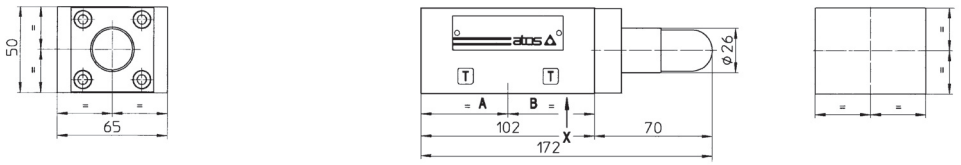
Mass: 2,8 Kg

KM-013



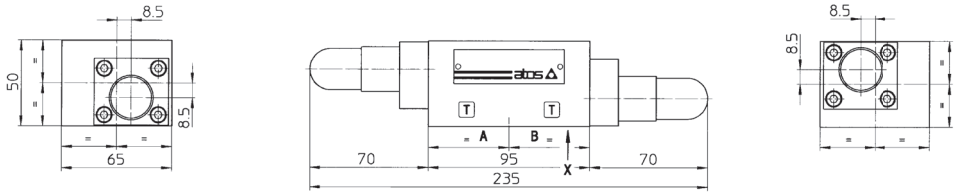
Mass: 2,5 Kg

KM-014



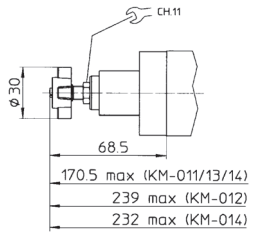
Mass: 2,5 Kg

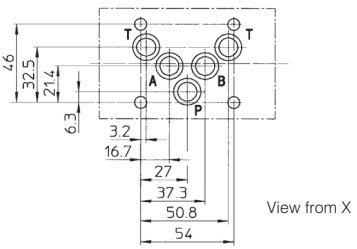
KM-015



Mass: 2,5 Kg

Adjustement device for option /V





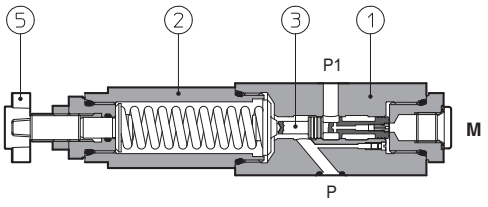
View from X

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports A, B, P, T: Ø = 11,2 mm
Seals: 5 OR 2050

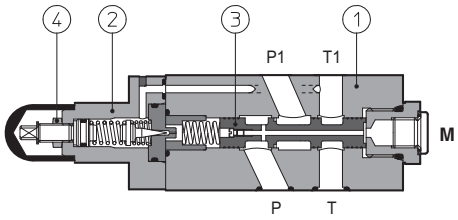
Fastening bolts: n° 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

Modular sequence valves type HS-011 and KS-011

spool type, ISO 4401 size 06 and 10



HS-011/*/V**



KS-011

HS are direct sequence valves, spool type ③.
KS are double stage ① ② sequence valves, spool type ③.

Pressure adjustment is operated by loosening the locking nut ④ and turning the setting screw in the normal model.
Optional versions with a handwheel ⑤ are available on request.
Clockwise rotation increases the pressure.

Valve size and max flow:

HS = size 06, flow up to 40 l/min
KS = size 10, flow up to 80 l/min

Mounting surface: **ISO 4401 size 06, 10**
Max pressure: **350 bar** (HS)
315 bar (KS)

1 MODEL CODE

HS	-	011	/	210	/	V	**	/	*

Modular sequence valve, size:
HS = 06
KS = 10

Configuration, see section 2
011 = single, acting on port P, drain to port T

Pressure range:

for HS:	for KS:
32 = 3 - 32 bar	
100= 20 - 100 bar	**100**= 7 - 100 bar
210= 50 - 210 bar	**210**= 8 - 210 bar

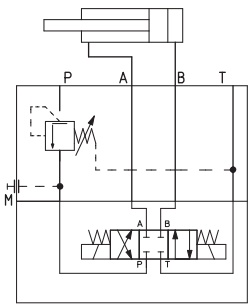
Options:
V = setting adjustment by handwheel instead of a grub screw protected by cap
Only for HS:
VF = regulating knob
VS = regulating knob with safety locking

Series number

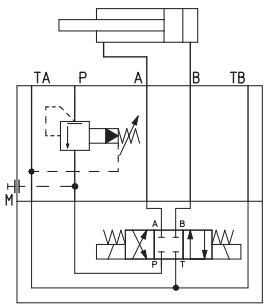
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC CHARACTERISTICS

Hydraulic configuration



HS-011



KS-011

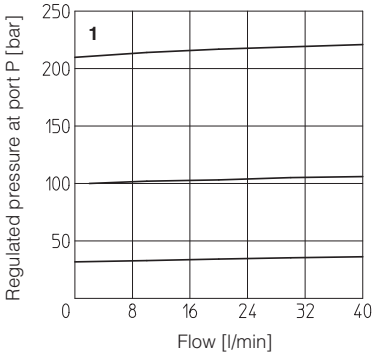
Valve model		HS-011/32	HS-011/100	HS-011/210	KS-011/100	KS-011/210
Max flow	[l/min]	40			80	
Max drain	[cm³/min]	50			50	
Pressure range	[bar]	3 - 32	20 - 100	50 - 210	7 - 100	8 - 210
Max inlet pressure	[bar]	350			315	
Max pressure on port T	[bar]	160			160	

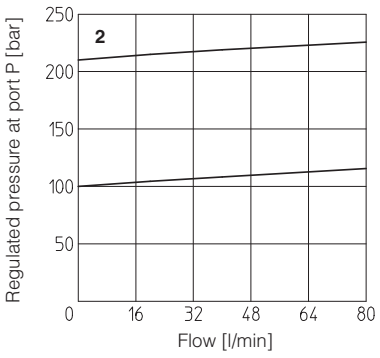
3 MAIN CHARACTERISTICS SEALS and HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

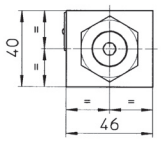
1 = HS
2 = KS

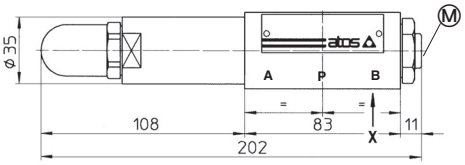


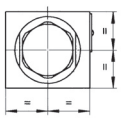


5 INSTALLATION DIMENSIONS [mm]

HS-011

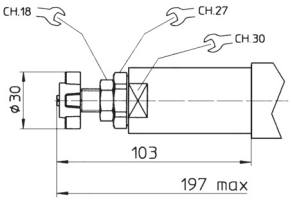




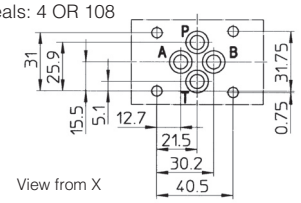


Ⓜ = Pressure gauge port = G 1/4"

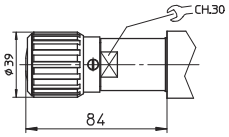
Adjustment device for option/V



ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm
Seals: 4 OR 108



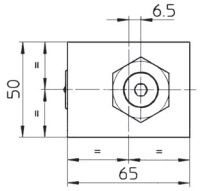
Adjustment device for option /VF and /VS

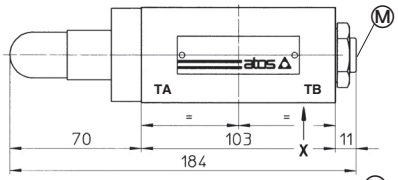


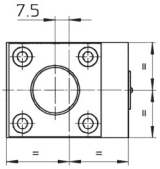
Fastening bolts: n°4 socket head screws M5. The lenght depends on number and type of modular elements associated.

Mass: 2 Kg

KS-011

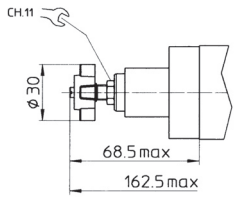


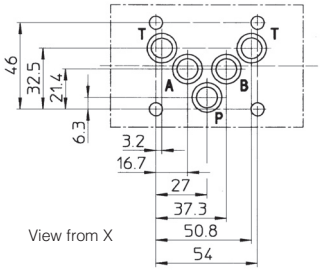




Ⓜ = Pressure gauge port = G 1/4"

Adjustment device for option/V





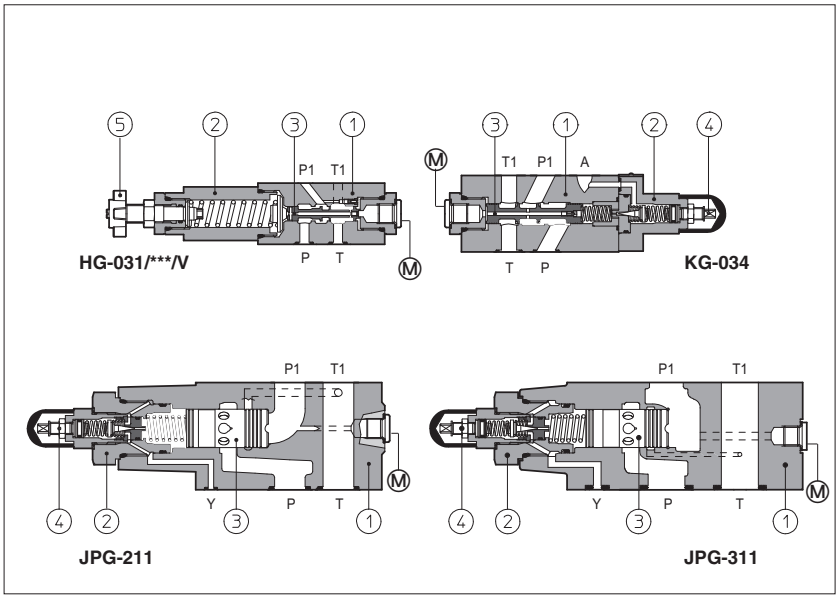
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports A, B, P, T: Ø = 11,2 mm
Seals: 5 OR 2050

Fastening bolts: n°4 socket head screws M6. The lenght depends on number and type of modular elements associated.

Mass: 3 Kg

Modular reducing valves type HG, KG, JPG-2 and JPG-3

spool type, ISO 4401 sizes 06, 10, 16 and 25



HG, KG, JPG are pressure reducing valves, spool type ③, designed to operate in oil hydraulic systems.
HG are direct, three way valves;
KG are double stage ① ②, three way valves;
JPG are double stage ① ②, two way valves.
Clockwise rotation increases the pressure.

Valve size and max flow:

HG = size 06 flow up to 50 l/min;
KG = size 10 flow up to 100 l/min;
JPG-2 = size 16 flow up to 250 l/min;
JPG-3 = size 25 flow up to 300 l/min;

Mounting surface:
ISO 4401 size 06, 10, 16 and **25**

Max pressure: **350 bar** for HG
315 bar for KG and JPG

1 MODEL CODE

HG-0	31	/	210	/	V	**	/	*

HG-0
Modular pressure reducing valve, size:
HG-0 = 06 **JPG-2** = 16
KG-0 = 10 **JPG-3** = 25

Configuration, see section 2
two way (**only for JPG**):
11 = reduced pressure on P port
three way (**only for HG-0 and KG-0**):
31 = reduced pressure on P port
33 = reduced pressure on A port
34 = reduced pressure on B port

210
Pressure range

HG	KG	JPG
32 = 3 - 32 bar	**100** = 20 - 100 bar	**100** = 7 - 100 bar	**100** = 6 - 100 bar
50 = 2 - 50 bar	**210** = 50 - 210 bar	**210** = 8 - 210 bar	**210** = 70 - 210 bar
75 = 10 - 75 bar			

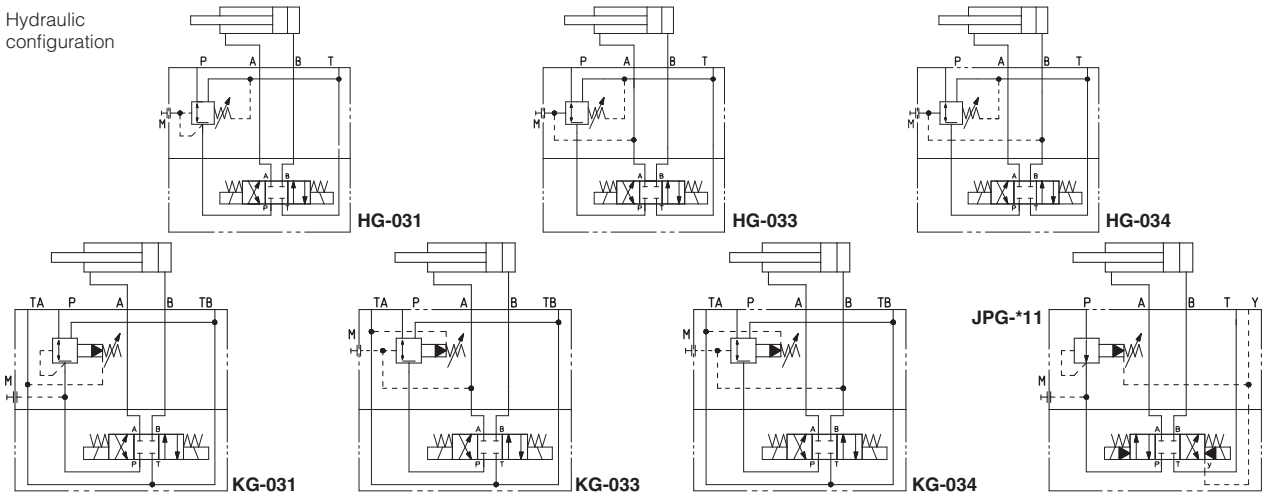
V
Options:
V = setting adjustment by handwheel instead of a grub screw protected by cap
Only for HG:
VF = regulating knob **/VS** = regulating knob with safety locking

******
Series number

*****
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC CHARACTERISTICS

Hydraulic configuration



Valve model		HG-03*/32	HG-03*/50	HG-03*/75	HG-03*/100	HG-03*/210	KG-03*/100	KG-03*/210	JPG-211/100	JPG-211/210	JPG-311/100	JPG-311/210
Max flow	[l/min]	50					100		250		300	
Pressure range	[bar]	3 ÷ 32	2 ÷ 50	10 ÷ 75	20 ÷ 100	50 ÷ 210	7 ÷ 100	8 ÷ 210	6 ÷ 100	70 ÷ 210	6 ÷ 100	70 ÷ 210
Max inlet pressure	[bar]	350					315		315		315	
Max pressure on port T	[bar]	160					160		160		160	

3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

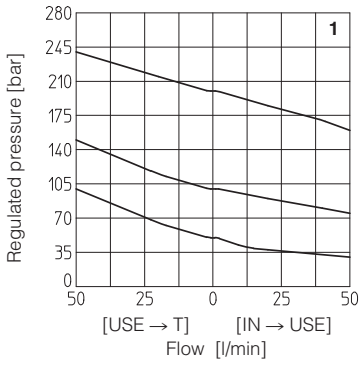
4 DIAGRAMS OF HG-03*

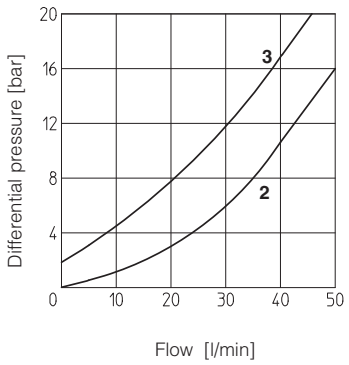
based on mineral oil ISO VG 46 at 50°C

1 = regulated pressure variation versus flow:
- between use port and discharge port
- between inlet port and use port

2 = differential pressure variation versus flow between inlet port and use port

3 = differential pressure variation versus flow between use port and discharge port





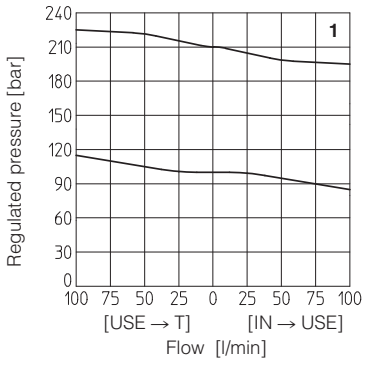
5 DIAGRAMS OF KG-03*

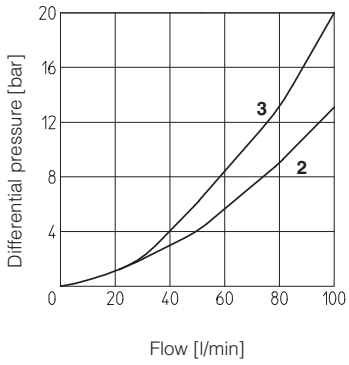
based on mineral oil ISO VG 46 at 50°C

1 = regulated pressure variation versus flow:
- between use port and discharge port
- between inlet port and use port

2 = differential pressure variation versus flow between inlet port and use port

3 = differential pressure variation versus flow between use port and discharge port



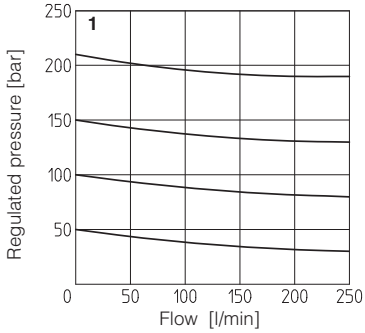


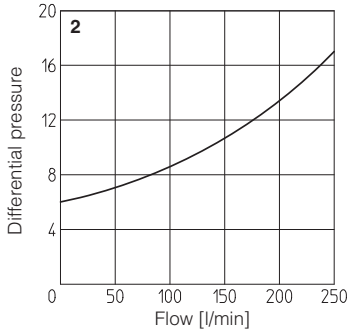
6 DIAGRAMS OF JPG-211

based on mineral oil ISO VG 46 at 50°C

1 = regulated pressure variation versus flow between inlet port and use port

2 = differential pressure variation versus flow between use port and discharge port



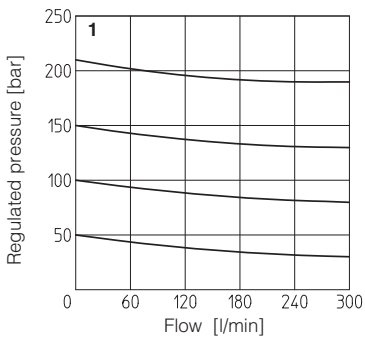


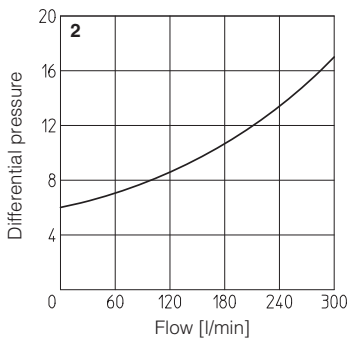
7 DIAGRAMS OF JPG-311

based on mineral oil ISO VG 46 at 50°C

1 = regulated pressure variation versus flow between inlet port and use port

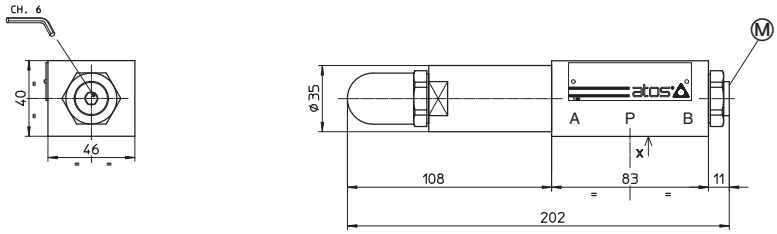
2 = differential pressure variation versus flow between use port and discharge port





8 INSTALLATION DIMENSIONS OF HG-0 VALVES [mm]

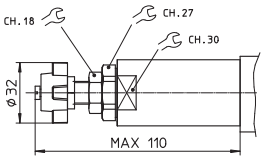
HG-03*



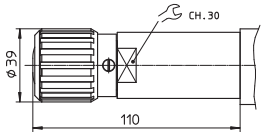
Ⓜ = Pressure gauge port = G 1/4"

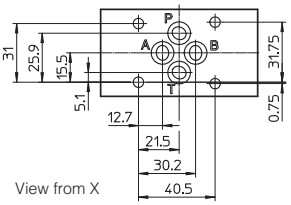
Mass: 2,3 Kg

Adjustment device for option /V



Adjustment device for option /VF and /VS



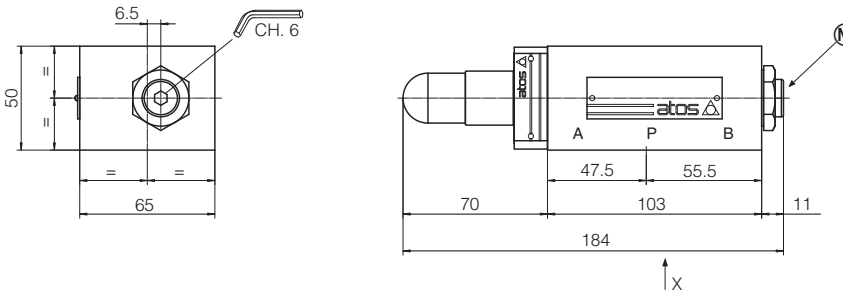


ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm
Seals: 4 OR 108

Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

9 INSTALLATION DIMENSIONS OF KG-0 VALVES [mm]

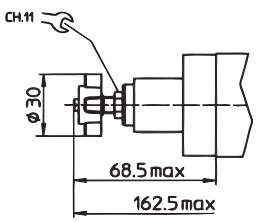
KG-03*

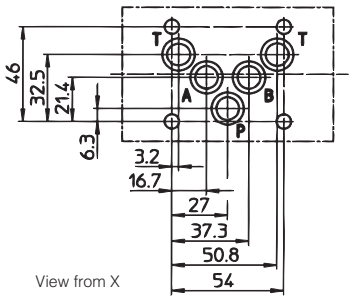


Ⓜ = Pressure gauge port = G 1/4"

Mass: 3,8 Kg

Adjustment device for option /V



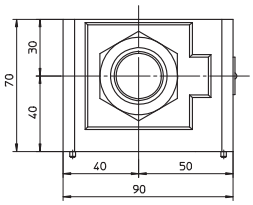


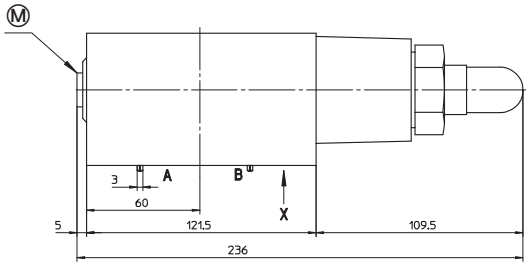
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports A, B, P, T: Ø = 11,2 mm
Seals: 5 OR 2050

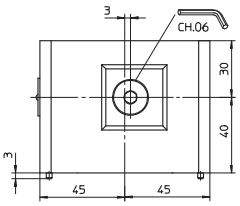
Fastening bolts: n° 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPG-2 VALVES [mm]

JPG-211



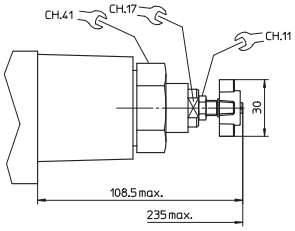


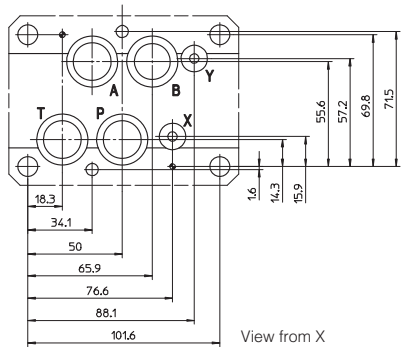


Ⓜ = Pressure gauge port = G 1/4"

Mass: 9 Kg

Adjustment device for option /V



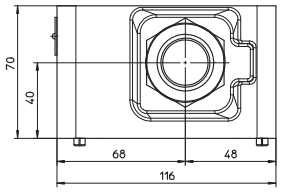


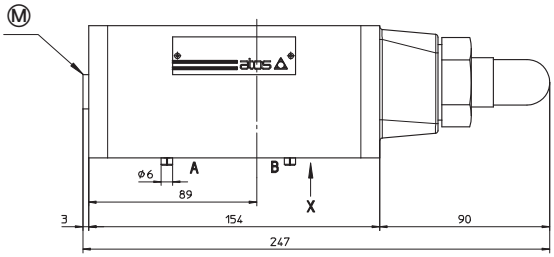
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø 7 mm
Seals: 4 OR 130: 2 OR 109

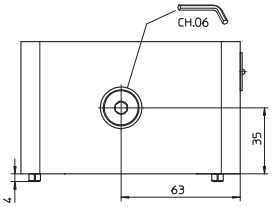
Fastening bolts: n° 4 socket head screws M10 and n° 2 M6. The lenght depends on number and type of modular elements associated.

11 INSTALLATION DIMENSIONS OF JPG-3 VALVES [mm]

JPG-311



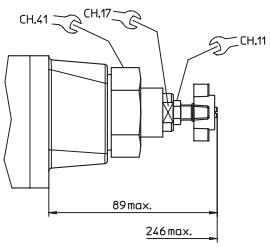


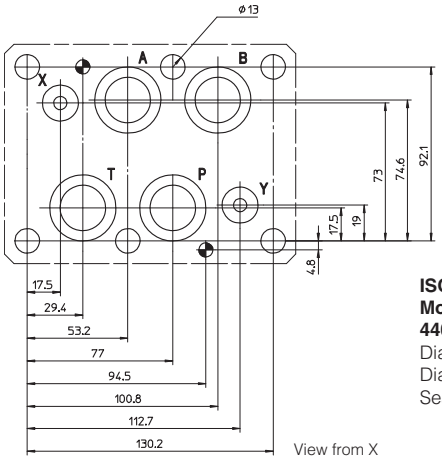


Ⓜ = Pressure gauge port = G 1/4"

Mass: 9 Kg

Adjustment device for option /V



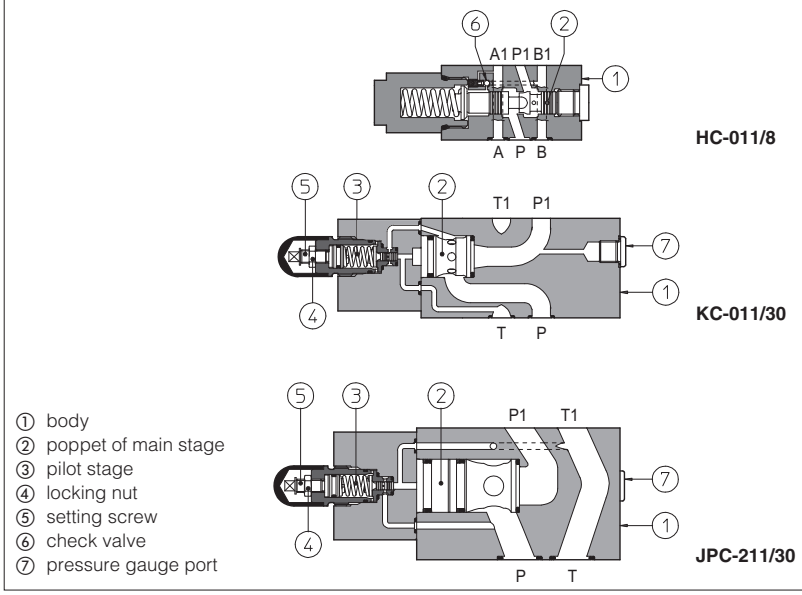


ISO 4401: 2005
Mounting surface:
4401-08-08-0-05 (without port L)
Diameter of ports A, B, P, T: Ø = 24 mm
Diameter of ports X, Y: Ø 7 mm
Seals: 4 OR 130: 2 OR 109

Fastening bolts: n° 6 socket head screws M12. The lenght depends on number and type of modular elements associated.

Modular pressure compensators type HC, KC, and JPC-2

ISO 4401 sizes 06, 10 and 16



① body
② poppet of main stage
③ pilot stage
④ locking nut
⑤ setting screw
⑥ check valve
⑦ pressure gauge port

HC, **KC** and **JPC** are two way pressure compensators for modular assembling with on/off and proportional directional control valves.

They keep a constant differential pressure (Δp) across port P and port A or B in order to maintain a constant flow rate against pressure variations. Automatic piloting selection ⑥ is included.

Fixed Δp is available only for size 06. Adjustment of desired Δp is operated by loosening the locking nut ④ and turning the setting screw ⑤ of pilot device.
Clockwise rotation increases Δp.

HC = size 06, flow up to 50 l/min.
KC = size 10, flow up to 100 l/min.
JPC = size 16, flow up to 200 l/min.

Mounting surface:
ISO 4401 size 06, 10, 16

Max pressure: **350 bar**

1 MODEL CODE

HC-0	-	11	30	/	M	**	/	*

HC-0: Modular pressure compensator, size:
HC-0 = 06
KC-0 = 10
JPC-2 = 16

11: Configuration, see section 2
11 = two way execution with constant Δp beetween P port and user port

30: Adjustable Δp (for all sizes):
30 = 5 - 35 bar

8: Fixed Δp (only for size 06):
8 = 8 bar

M: Option (only for HC-011/30)
M = fit for manometer port P1

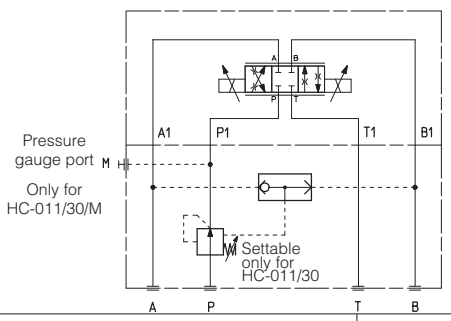
**: Series number

*: Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

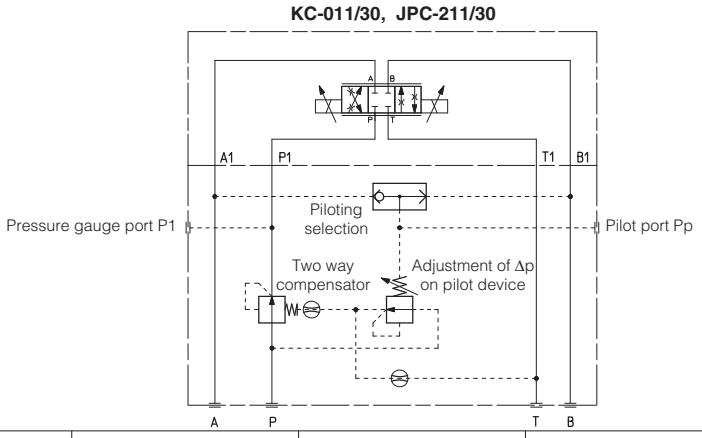
2 HYDRAULIC CHARACTERISTICS

Hydraulic configuration

HC-011/8, HC-011/30



KC-011/30, JPC-211/30



Valve model		HC-011/8	HC-011/30	KC-011/30	JPC-211/30
Max flow	[l/min]	50		100	200
Max inlet pressure	[bar]	350			
Regulating Δp (1)	[bar]	8	5 - 35	5 - 35	

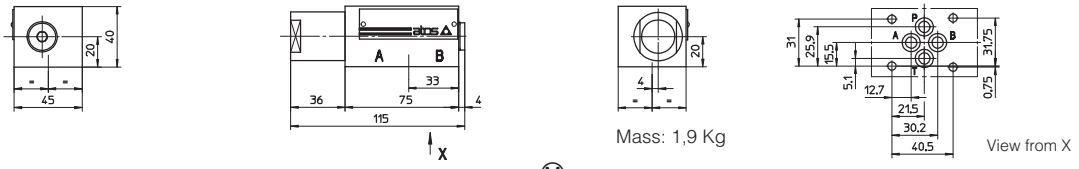
(1) The Δp for single flow path is fixed at 8 bar or is adjustable between 5 and 35 bar; it corresponds to values of total Δp across the valve of 16 bar or between 10 and 70 bar. Threaded plugged ports Pp and P1 are suitable for pressure adjustment or check of Δp value for single flow path (reading difference between Pp and P1 values).

3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

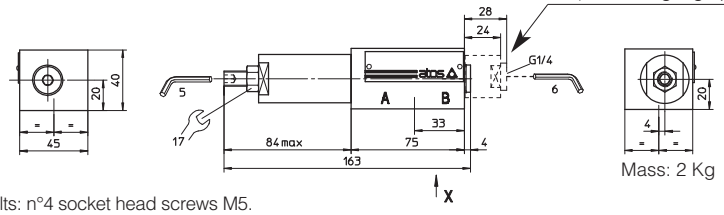
Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 INSTALLATION DIMENSIONS [mm]

HC-011/8



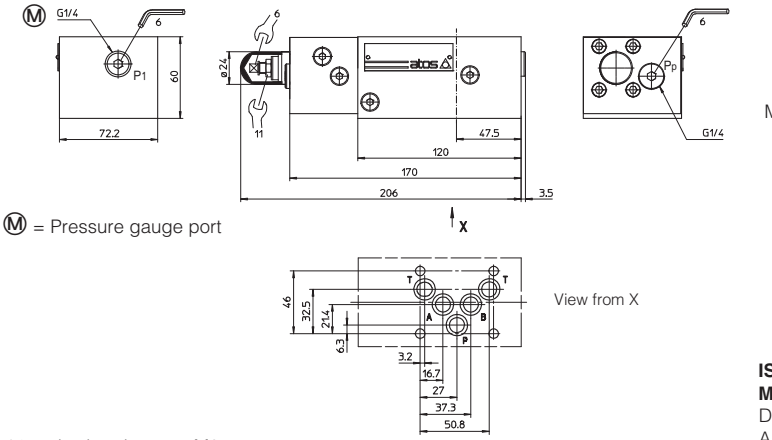
HC-011/30



Fastening bolts: n°4 socket head screws M5.
The lenght depends on number and type of modular elements associated.

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports
A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

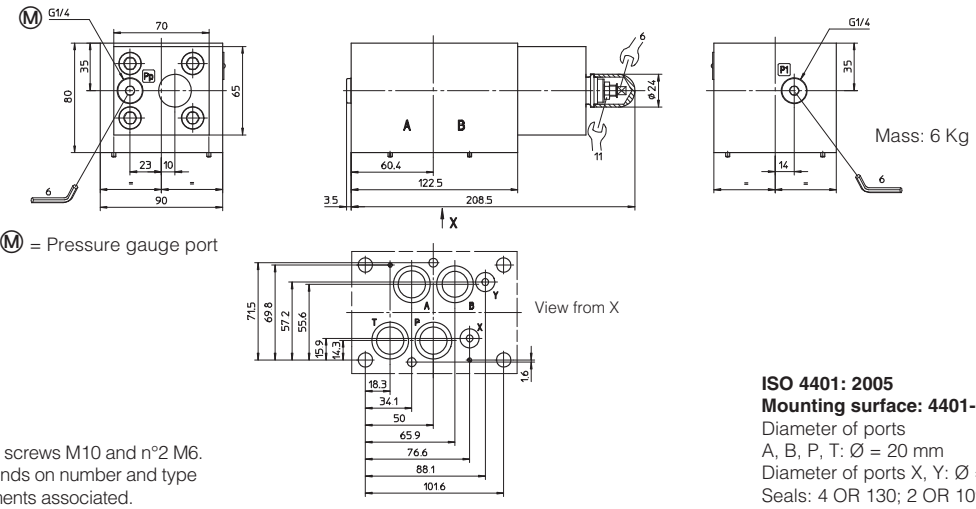
KC



Fastening bolts: n°4 socket head screws M6.
The lenght depends on number and type of modular elements associated.

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports
A, B, P, T: Ø = 11,2 mm (max)
Seals: 2 OR 108, 5 OR 2050

JPC

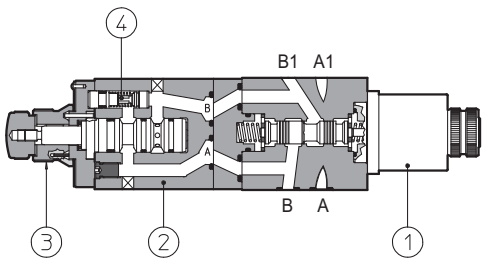


Fastening bolts:
n°4 socket head screws M10 and n°2 M6.
The lenght depends on number and type
of modular elements associated.

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports
A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 130; 2 OR 109

Modular fast/slow valves type DHQ

compensated flow control and by-pass solenoid valve, ISO 4401 size 06



DHQ-014

DHQ are modular units composed by one by-pass solenoid valve ① and one 2-way pressure compensated flow control valve ② type QV-06 (tab. C210).

The flow control valve is provided with a built-in check valve ④ to allow the free flow in the opposite direction.

The flow adjustment is obtained by turning the graduated micrometer knob ③. Clockwise rotation decreases the throttling (passage reduced).
Optional versions with locking key on the adjustment knob are available on request.

Mounting surface:
ISO 4401 size 06

Max controlled flow: up to 1,5-6-11-16-24 l/min (depending on models);

Free flow up to 36 l/min.

Max pressure: up to **250 bar**

1 MODEL CODE

DHQ-0	13	/	C	/	6	/	K	-	I	X	24DC	**	/	*

DHQ-0: Modular flow control unit, pressure compensated, size:
DHQ-0 = 06

13 / C: Configuration, see section 2
control of flow discharged from the actuator
13 = on port A
14 = on port B
16 = on port T
control of flow entering the actuator:
11 = on port P
23 = on port A
24 = on port B
C = flow controlled when solenoid is de-energized
O = flow controlled when solenoid is energized

6: Maximum adjustable controlled flow:
1 = 1,5 l/min; **6** = 6 l/min; **11** = 11 l/min; **16** = 16 l/min; **24** = 24 l/min
00 = whitout flow control valve

K: Options:
K = with lock key for the setting knob **V** = without by-pass check valve

I: Type of solenoid:
I = solenoid OI for AC and DC supply with **cURus** certification

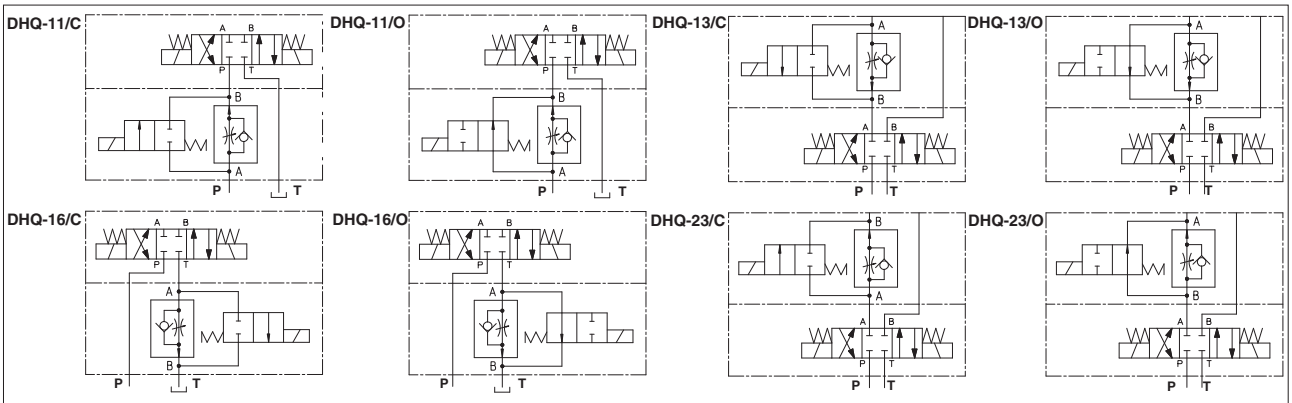
X: **X** = without connector **(1):**
See section 7 for available connectors, to be ordered separately
-00 = solenoid valve without coils

24DC: Supply voltage, see section 4

******: Series number

*****: Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC CHARACTERISTICS



DHQ-014/*, DHQ-024/* are similar to corresponding DHQ-013/*, DHQ-023/* but control the flow through port B of solenoid valve

Valve model		/1	/6	/11	/16	/24
Max regulated flow	[l/min]	1,5	6	11	16	24
Min regulated flow	[cm³/min]	50	50	50	50	50
Regulating Δp	[bar]	3	3	5	6,5	8
Max flow through check valve	[l/min]	24				
Max free flow		36 l/min				
Max flow on port A	[l/min]	24				
Max pressure	[bar]	250				

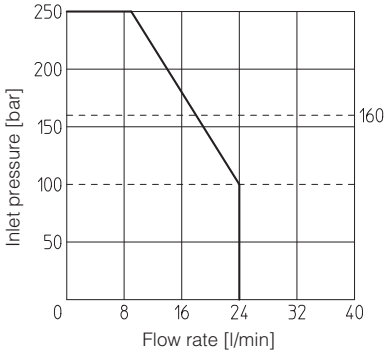
3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 ELECTRIC/ELECTRONIC CONNECTORS AND ELECTRIC FEATURES

For electric/electronic connectors (to be ordered separately) and electric features of DHQ units, see tab. E010.

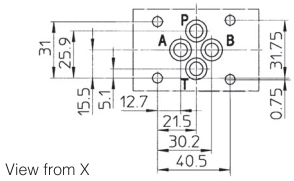
5 OPERATING LIMITS



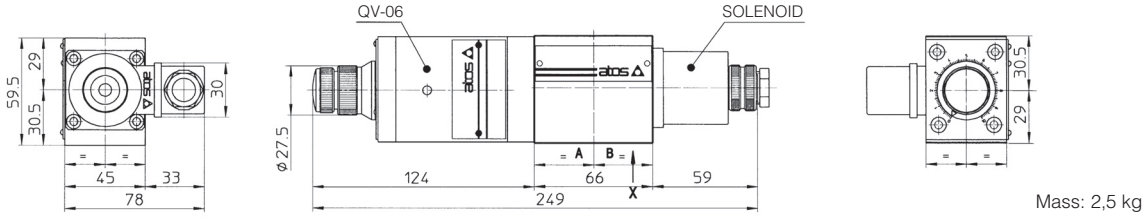
6 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports P, A, B, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

Fastening bolts: 4 socket head screws M5.
The lenght depends on number and type
of modular elements associated



View from X



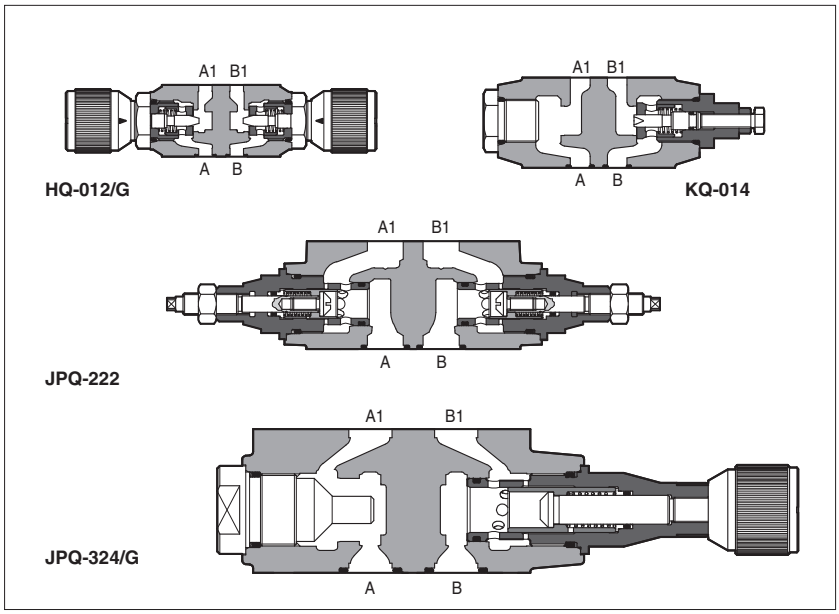
Mass: 2,5 kg

In versions -014 and -024 the position of valve QV-06 and of solenoid are inverted.

Overall dimensions refer to valves with connectors type 666

Modular throttle valves type HQ, KQ, JPQ

flow control, ISO 4401 sizes 06, 10, 16 and 25



HQ, **KQ** and **JPQ** are flow throttling valves, not compensated, and with check valve to allow free flow in the opposite direction.
The flow adjustement is done by turning the setting screw in the normal model.
Optional versions with a graduate micrometer knob are available on request.
Clockwise rotation increases the throttling (passage reduced).

Valve size and max flow:
HQ-0 = size 06, flow up to 25 l/min for /U option, up to 80 l/min for standard
KQ-0 = size 10, flow up to 160 l/min
JPQ-2 = size 16, flow up to 200 l/min
JPQ-3 = size 25, flow up to 300 l/min

Mounting surface:
ISO 4401 size 06, 10, 16 and **25**
Max pressure: **350 bar** (HQ, JPQ)
315 bar (KQ)

1 MODEL CODE

HQ-0	13	/	G	**	/	*

HQ-0
Modular flow control valve, size:
HQ-0 = 06
KQ-0 = 10
JPQ-2 = 16
JPQ-3 = 25

13
Configuration, see section 2
meter OUT control:
12 = double, acting on port A and B
13 = single, acting on port A
14 = single, acting on port B
meter IN control:
22 = double, acting on port A and B
23 = single, acting on port A
24 = single, acting on port B

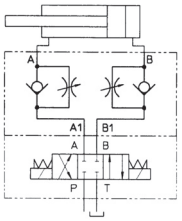
G
Options:
U = better accuracy for reduced flow (only for HQ-0)
G = adjustment by graduated micrometer

******
Series number

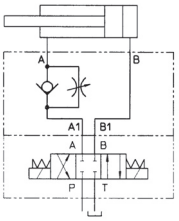
*****
Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 VALVE CONFIGURATION

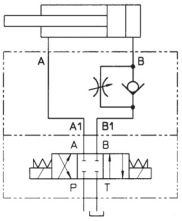
Meter OUT control



HQ-012
KQ-012
JPQ-212
JPQ-312

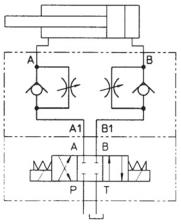


HQ-013
KQ-013
JPQ-213
JPQ-313

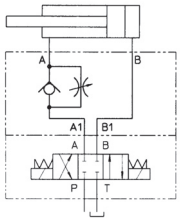


HQ-014
KQ-014
JPQ-214
JPQ-314

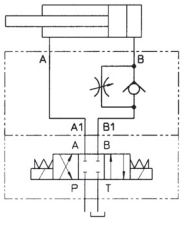
Meter IN control



HQ-022
KQ-022
JPQ-222
JPQ-322



HQ-023
KQ-023
JPQ-223
JPQ-323



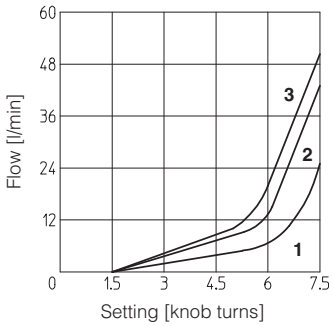
HQ-024
KQ-024
JPQ-224
JPQ-324

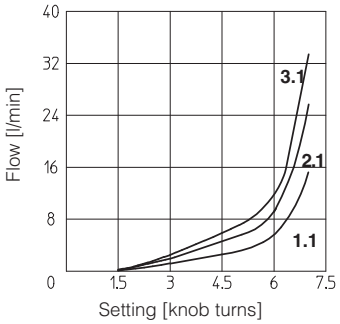
3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

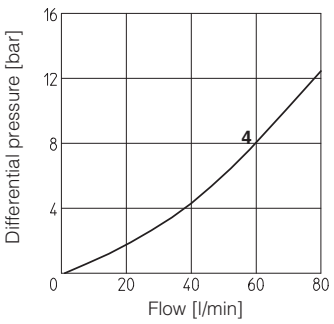
Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 DIAGRAMS OF HQ-0 based on mineral oil ISO VG 46 at 50°C

1 = Regulation diagram at Δp 10 bar (1.1 = option /U)
2 = Regulation diagram at Δp 30 bar (2.1 = option /U)
3 = Regulation diagram at Δp 50 bar (3.1 = option /U)
4 = Q/Δp diagram for free flow through the non-return valve

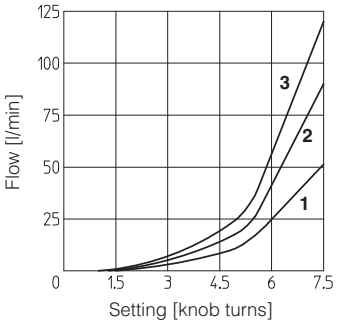


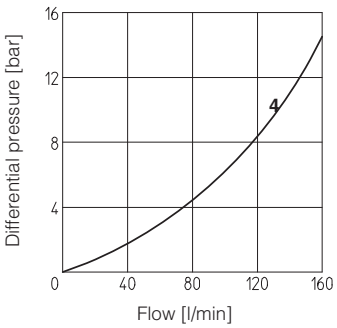




5 DIAGRAMS OF KQ-0 based on mineral oil ISO VG 46 at 50°C

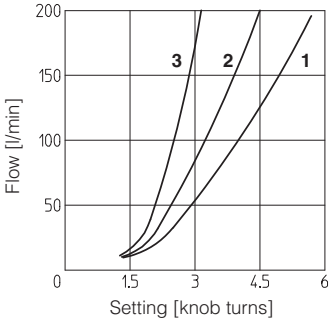
1 = Regulation diagram at Δp 10 bar
2 = Regulation diagram at Δp 30 bar
3 = Regulation diagram at Δp 50 bar
4 = Q/Δp diagram for free flow through the non-return valve

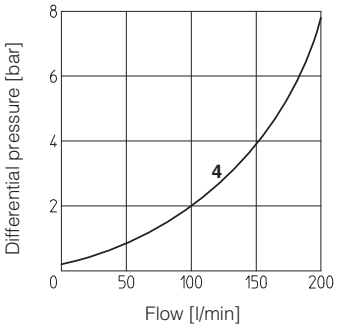




6 DIAGRAMS OF JPQ-2 based on mineral oil ISO VG 46 at 50°C

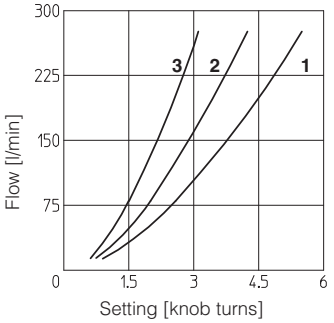
1 = Regulation diagram at Δp 10 bar
2 = Regulation diagram at Δp 30 bar
3 = Regulation diagram at Δp 50 bar
4 = Q/Δp diagram for free flow through the non-return valve

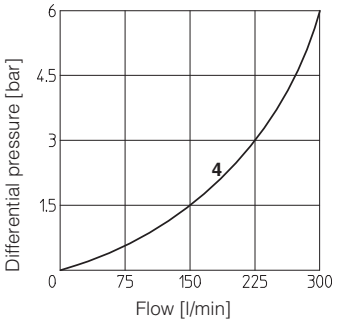




7 DIAGRAMS OF JPQ-3 based on mineral oil ISO VG 46 at 50°C

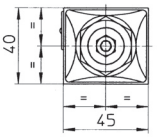
1 = Regulation diagram at Δp 10 bar
2 = Regulation diagram at Δp 30 bar
3 = Regulation diagram at Δp 50 bar
4 = Q/Δp diagram for free flow through the non-return valve

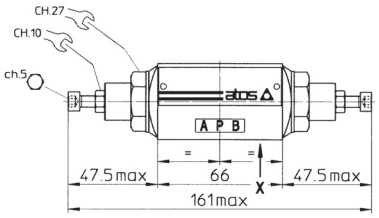




8 INSTALLATION DIMENSIONS OF HQ-0 VALVES [mm]

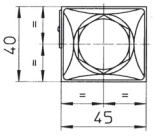
HQ-012
HQ-022

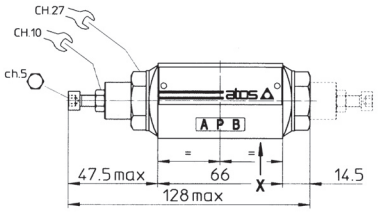




Mass: 1,1 Kg

HQ-013
HQ-014
HQ-023
HQ-024

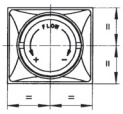


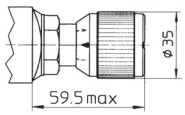


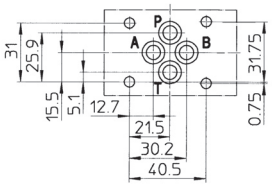
In version -014 and -024 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 1,2 Kg

/G OPTION





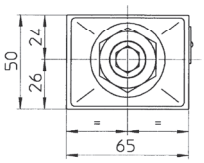


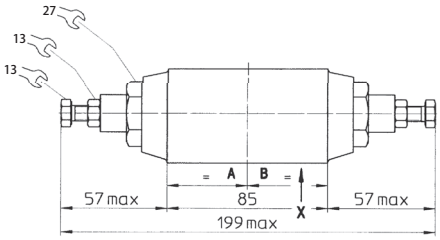
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

9 INSTALLATION DIMENSIONS OF KQ-0 VALVES [mm]

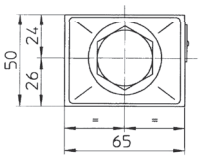
KQ-012
KQ-022

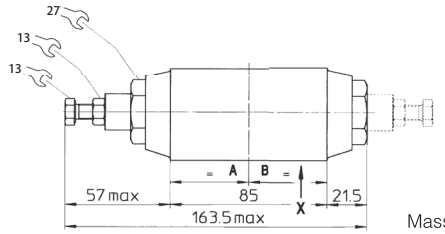




Mass: 2 Kg

KQ-013
KQ-014
KQ-023
KQ-024

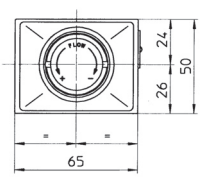


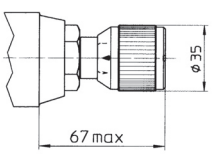


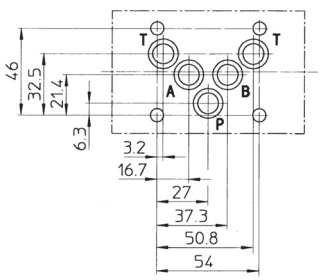
In version -014 and -024 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 2,2 Kg

/G OPTION





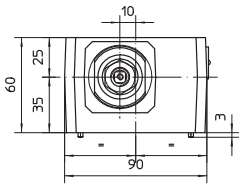


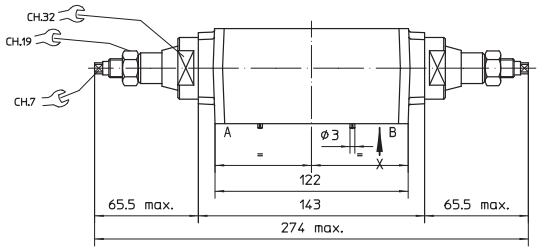
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports, A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050

Fastening bolts: n° 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPQ-2 VALVES [mm]

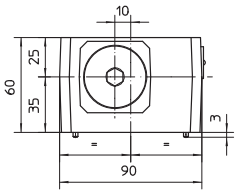
JPQ-212
JPQ-222

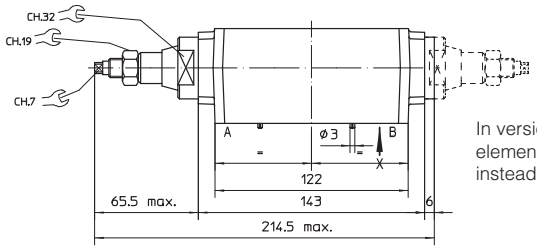




Mass: 4,6 Kg

JPQ-213
JPQ-214
JPQ-223
JPQ-224

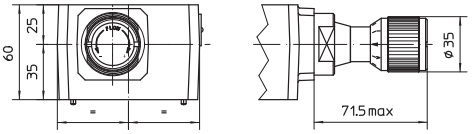


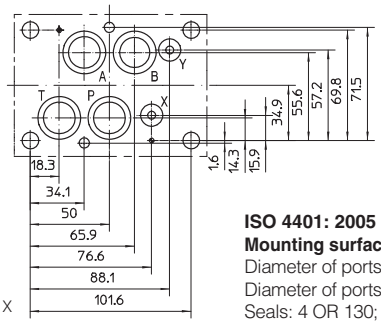


In version -214 and -224 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 4,3 Kg

/G OPTION





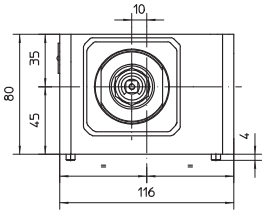
View from X

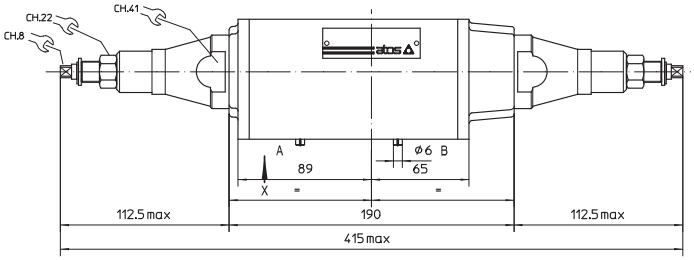
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 130; 2 OR 109

Fastening bolts: n° 4 socket head screws M10 and n° 2 M6. The lenght depends on number and type of modular elements associated.

11 INSTALLATION DIMENSIONS OF JPQ-3 VALVES [mm]

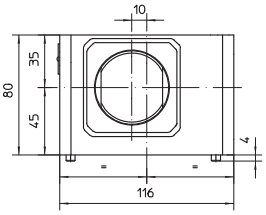
JPQ-312
JPQ-322

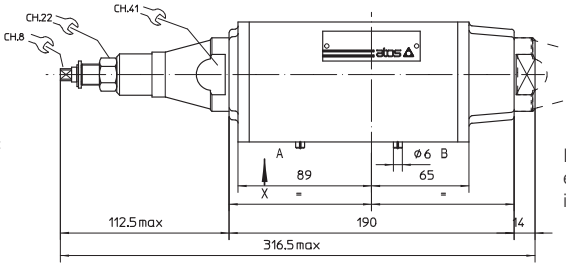




Mass: 10,7 Kg

JPQ-313
JPQ-314
JPQ-323
JPQ-324

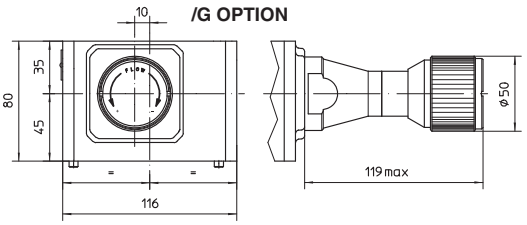


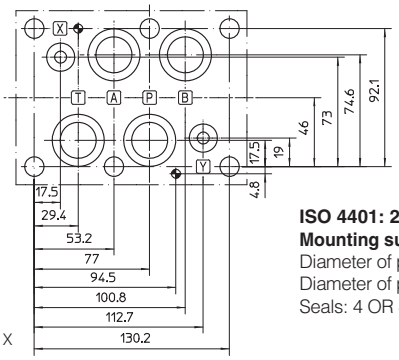


In version -314 and -324 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 9,5 Kg

/G OPTION





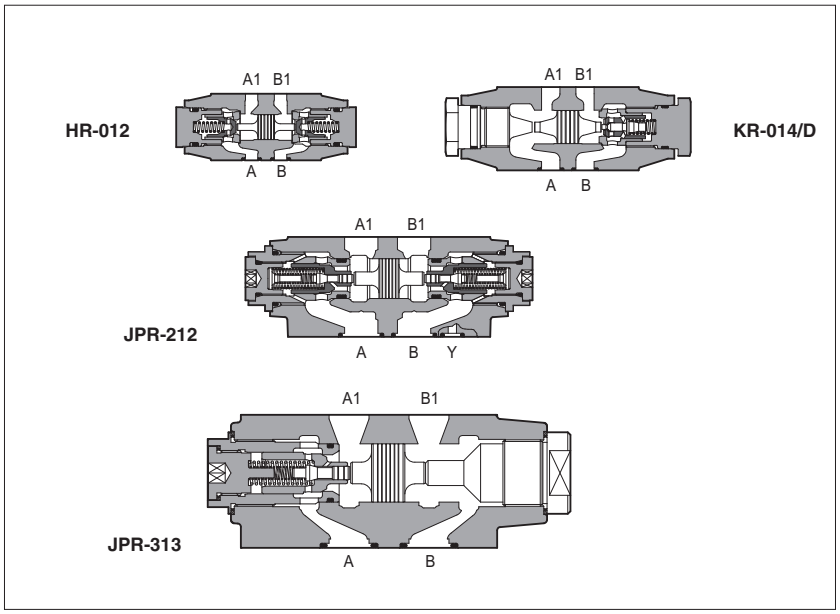
View from X

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
Diameter of ports A, B, P, T: Ø = 24 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 4112; 2 OR 3056

Fastening bolts: n° 6 socket head screws M12. The lenght depends on number and type of modular elements associated.

Modular check valves type HR, KR, JPR

direct or pilot operated, ISO 4401 sizes 06, 10, 16 and 25



HR, KR are check valves available as direct or pilot operated models.
JPR are pilot operated check valves.

Optional versions with decompression are available on request for some models of KR.

HR-0 = size 06: flow up to 60 l/min, pressure up to 350 bar.

KR-0 = size 10: flow up to 120 l/min, pressure up to 315 bar.

JPR-2 = size 16: flow up to 200 l/min, pressure up to 350 bar.

JPR-3 = size 25: flow up to 300 l/min, pressure up to 350 bar.

Valves are designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE

HR-0	12	/	4	/	*	**	/	*

HR-0

Modular check valve, size:
HR-0 = 06 **JPR-2** = 16
KR-0 = 10 **JPR-3** = 25

12

Configuration, see section 2
direct operated (only for HR and KR):
02 = double, acting on port A and B
03 = single, acting on port A
04 = single, acting on port B
11 = single, acting on port P
16 = single, acting on port T

pilot operated:
12 = double, acting on port A and B
13 = single, acting on port A
14 = single, acting on port B

4

Spring cracking pressure:
for HR and KR
– = 0,5 bar (std.) **4** = 4 bar
2 = 2 bar **8** = 8 bar
for JPR
– = 0,5 bar (std)

*****

Options (only for KR-012, -013, -014):
D = with decompression (only with cracking pressure standard = 1 bar)

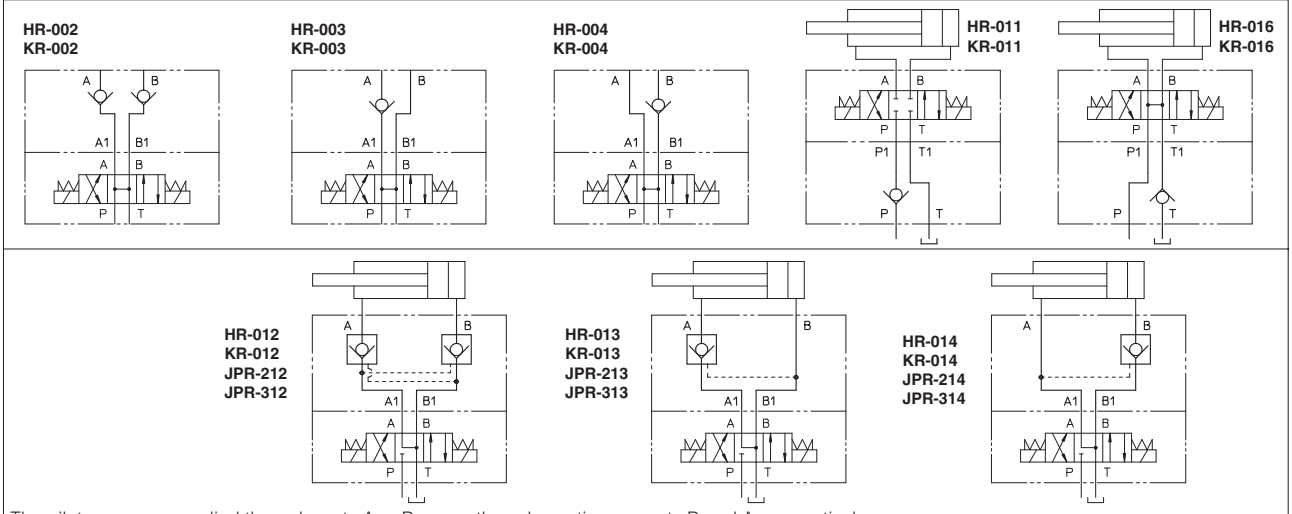
******

Series number

*****

Seals material, see section 3:
- = NBR
PE = FKM
BT = HNBR

2 VALVE CONFIGURATION



The pilote pressure applied through ports A or B opens the valve acting on ports B and A, respectively.
The minimum pilot pressure is a function of the area ratio, see the following table.

VALVE TYPE	AREA RATIO
HR	3,3:1
KR	3,3:1 (standard); 11:1 (option /D decompression system)
JPR-2	13,6:1 (standard version equipped with decompression system)
JPR-3	17:1 (standard version equipped with decompression system)

3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** = -30°C ÷ +80°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

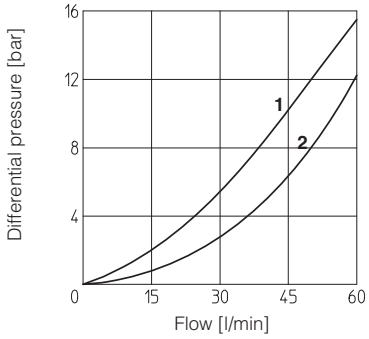
4 DIAGRAMS OF HR-0
based on mineral oil ISO VG 46 at 50°C

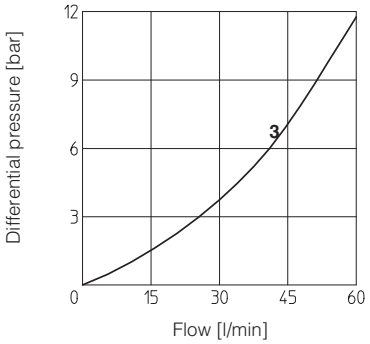
Flow through check valve:

1 = A→A1; B→B1 of
HR-012, HR-013, HR-014

2 = A1→A; B1→B of
HR-012, HR-013, HR-014

3 = HR-011, HR-016





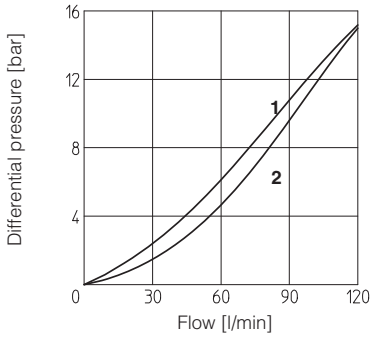
5 DIAGRAMS OF KR-0
based on mineral oil ISO VG 46 at 50°C

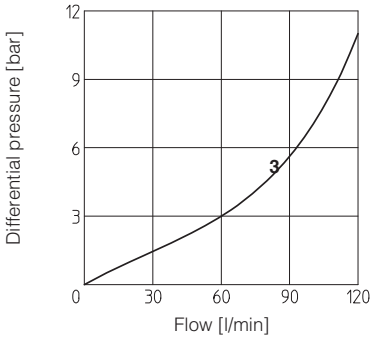
Flow through check valve:

1 = A→A1; B→B1 of
KR-012, KR-013, KR-014

2 = A1→A; B1→B of
KR-012, KR-013, KR-014

3 = KR-011, KR-016



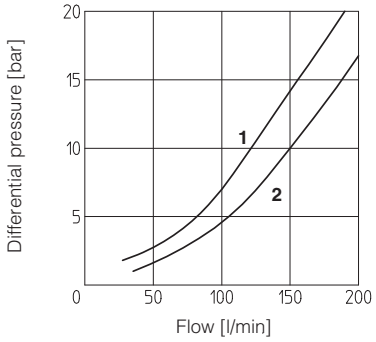


6 DIAGRAMS OF JPR-2
based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

1 = A→A1; B→B1 of
JPR-212, JPR-213, JPR-214

2 = A1→A; B1→B of
JPR-212, JPR-213, JPR-214

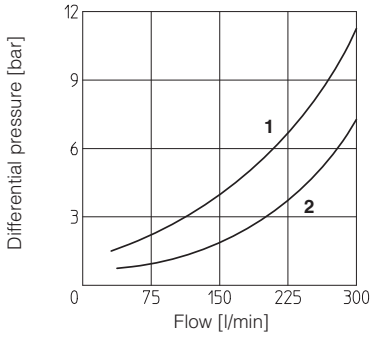


7 DIAGRAMS OF JPR-3
based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

1 = A→A1; B→B1 of
JPR-312, JPR-313, JPR-314

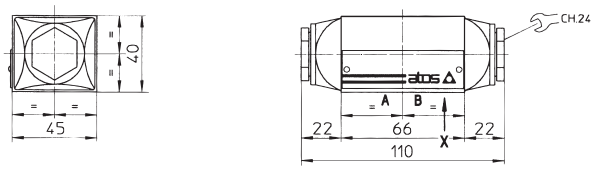
2 = A1→A; B1→B of
JPR-312, JPR-313, JPR-314



8 INSTALLATION DIMENSIONS OF HR-0 VALVES [mm]

HR-002
HR-003
HR-004
HR-012
HR-013
HR-014

LATERAL VIEW



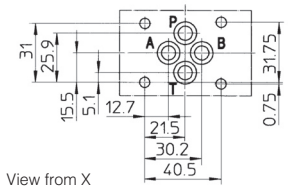
Mass: 1 Kg

HR-011
HR-016

LATERAL VIEW

Mass: 0,7 Kg

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108



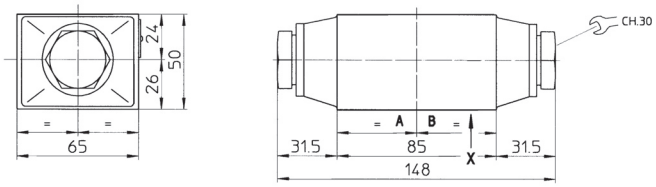
View from X

Fastening bolts: n° 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

9 INSTALLATION DIMENSIONS OF KR-0 VALVES [mm]

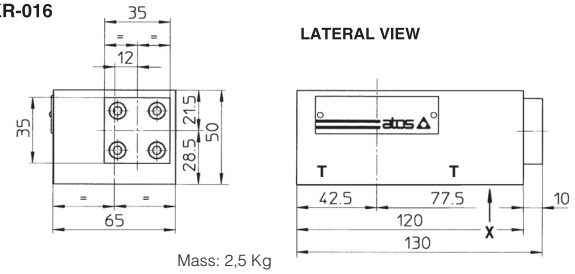
KR-012
KR-002
KR-003
KR-004
KR-013
KR-014

LATERAL VIEW



Massa: 2,3 Kg

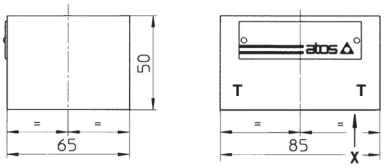
KR-016



Mass: 2,5 Kg

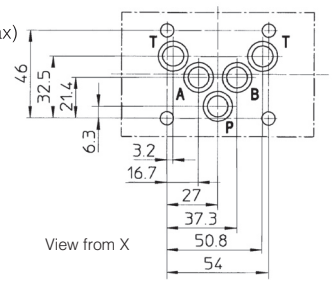
KR-011

LATERAL VIEW



Mass: 1,7 Kg

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports, A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050



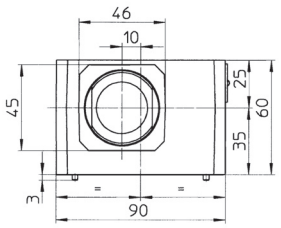
View from X

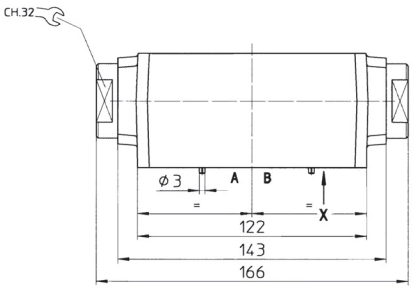
Fastening bolts: n° 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPR-2 VALVES [mm]

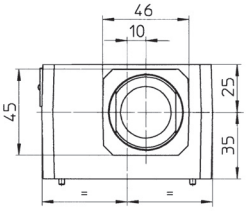
JPR-212
JPR-213
JPR-214

LATERAL VIEW



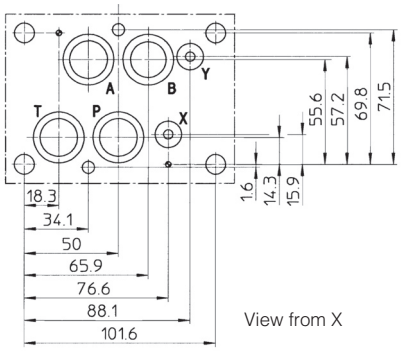


LATERAL VIEW



Mass: 4,4 Kg

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 130; 2 OR 109



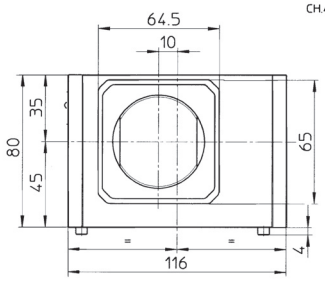
View from X

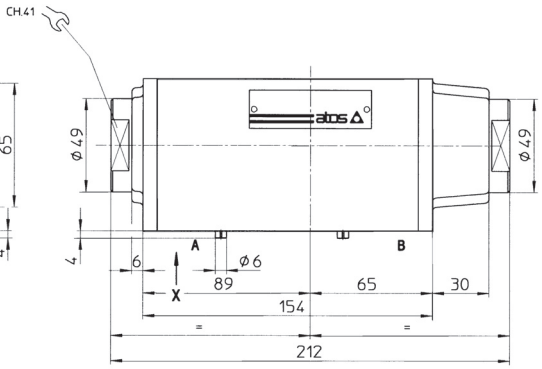
Fastening bolts: n° 4 socket head screws M10 and n° 2 M6. The lenght depends on number and type of modular elements associated.

11 INSTALLATION DIMENSIONS OF JPR-3 VALVES [mm]

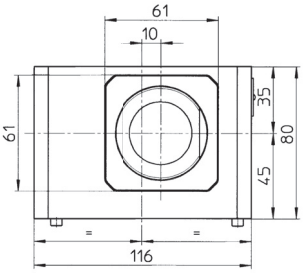
JPR-312
JPR-313
JPR-314

LATERAL VIEW B



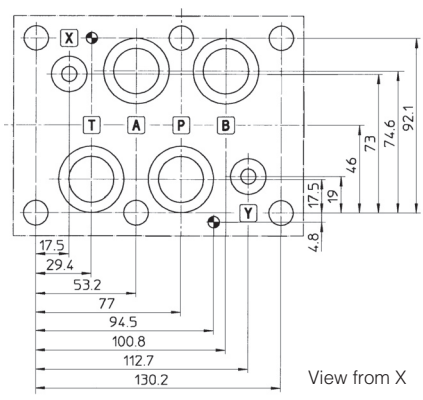


LATERAL VIEW A



Mass: 9,9 Kg

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
Diameter of ports A, B, P, T: Ø = 24 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 4112; 2 OR 3056

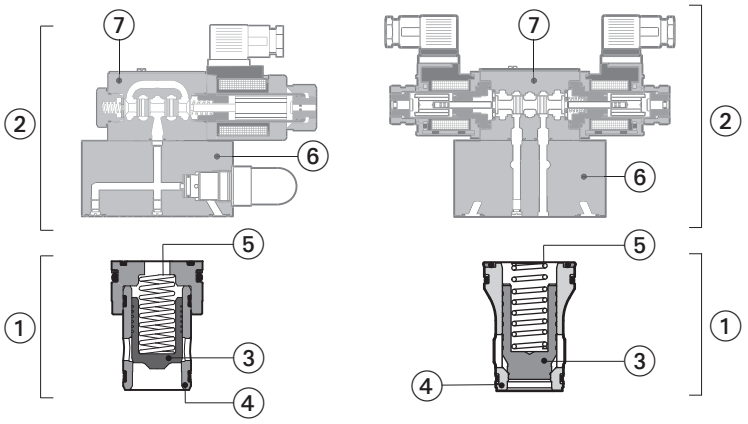


View from X

Fastening bolts: n° 6 socket head screws M12. The lenght depends on number and type of modular elements associated.

ISO cartridges type SC LI

2 way slip-in directional, pressure, flow, check controls



① Slip-in cartridge type SC LI

② Functional cover type LI*

2way slip-in cartridges are designed in conformity with ISO 7368 standard cavities for installation in compact manifolds. They are available in several versions to perform directional, pressure, flow and check controls in combination with relevant functional covers.
They permit to control very high flow rates at low pressure drops, reducing the manifold dimensions respect to subplate valves.

The slip-in cartridge ① is made by a poppet ③ sliding into a sleeve ④ and kept in closed position by a spring ⑤ available with different cracking pressure valves.

The functional covers ② are made by a closing element with ISO mounting surface ⑥ provided with internal piloting lines for the cartridge operation. They can be equipped with pilot valves ⑦ and devices performing the specific control (pressure relief, flow metering, directional, check)

Sizes: **16 to 100** ISO 7368

Max flow up to **9000 l/min** at Δp 5 bar

Max pressure **420 bar**

1 MODEL CODE

SC LI	-	16	43	1	*	/	*

Cartridge according to ISO 7368

Size - see section 5
16 25 32 40 50 63 80 100

Type of poppet (1) - see section 5

Spring cracking pressure (1)

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

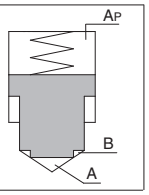
(1) See technical table:

H030 for directional controls
H020 for flow controls
H010 for pressure controls
H040 for check controls

2 MAIN CHARACTERISTCS

Assembly position / location	Any position
Cavity dimensions	ISO 7368, see technical table P006
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	**Standard** execution = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Operating pressure	**420 bar**, see technical table of specific valve
Maximum flow	see section 5

3 SC LI CARTRIDGE AREAS



A = seat area
B = anular area
AP = piloting area

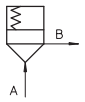
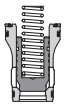
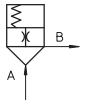
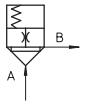
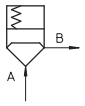
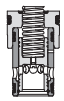
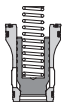
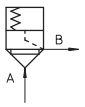
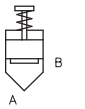
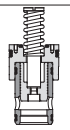
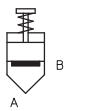
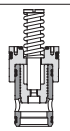
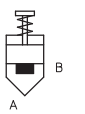
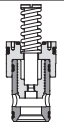
Pressure applied to areas A and B acts to open the poppet.

Pressure applied to area AP plus the spring force act to close the poppet

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

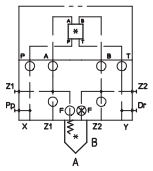
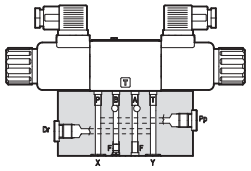
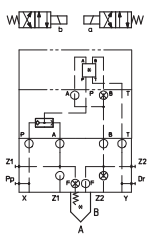
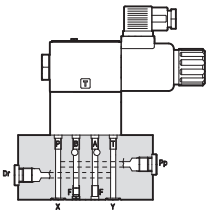
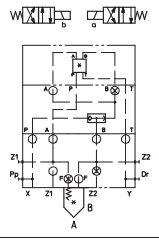
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

5 TYPE OF POPPET FOR SC LI SLIP-IN CARTRIDGES

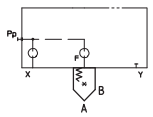
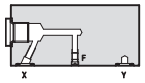
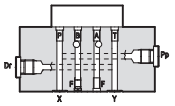
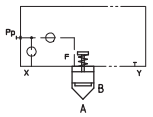
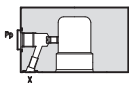
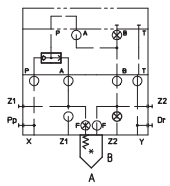
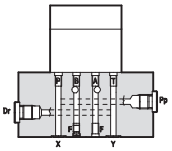
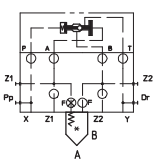
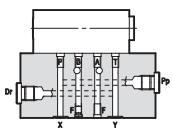
Size / Type	SC LI-16	SC LI-25	SC LI-32	SC LI-40	SC LI-50	SC LI-63	SC LI-80	SC LI-100	Functional sketch (hydraulic symbol)	Typical section	Area ratio	Related functional cover
31	●	●	●	●	●	●	●	–			1 : 1	Poppet type LIMM, LIMHA, LIMHC, LIC, LICM
Qmax [l/min] Δp = 5 bar	180	380	650	1100	2000	3200	5000					
32	●	●	●	●	●	●	●	●			1 : 1,1	Poppet type LIDA, LIDD, LIDB, LIDBH, LIDEW
Qmax [l/min] Δp = 5 bar	270	550	1000	1700	2500	4000	5500	9000				
33	●	●	●	●	●	●	●	●			1 : 1,5	Poppet type LIDA, LIDD, LIDB, LIDBH, LIDEW
Qmax [l/min] Δp = 5 bar	270	550	1000	1700	2500	4000	5500	9000				
34	●	○	○	–	–	–	–	–			1 : 1	Poppet type LIMM, LIMHA, LIMHC
Qmax [l/min] Δp = 5 bar	200											
35	●	●	●	●	●	–	–	–			1 : 1,1	Poppet type LIMM, LIMHA, LIMHC
Qmax [l/min] Δp = 5 bar	200	400	670	1200	2200							
36	●	●	●	●	●	●	●	–			1 : 1	Spool type LIC, LICM
Qmax [l/min] Δp = 5 bar	180	380	650	1100	2000	3200	5000					
37	●	●	●	●	–	–	–	–			1 : 1	Spool type LIRA
Qmax [l/min] Δp = 5 bar	160	270	540	840								
42	●	●	●	●	●	●	●	–			1 : 1,1	Poppet type with dumping nose LIDA, LIDD, LIDB, LIDBH, LIDEW
Qmax [l/min] Δp = 5 bar	240	500	800	1400	2200	3300	4000					
43	●	●	●	●	●	●	●	●			1 : 1,5	Poppet type with dumping nose LIDA, LIDD, LIDB, LIDBH, LIDEW
Qmax [l/min] Δp = 5 bar	240	500	800	1400	2200	3300	4000	6300				
52	●	●	●	●	●	–	–	–			1 : 1,1	Poppet type LIDA
Qmax [l/min] Δp = 5 bar	170	300	450	900	1800							
62	●	●	●	○	●	–	–	–			1 : 1,1	Poppet type LIDO
Qmax [l/min] Δp = 5 bar	170	300	450	900	1800							
63	●	●	●	○	●	–	–	–			1 : 1,1	Poppet type with dumping nose LIDO
Qmax [l/min] Δp = 5 bar	170	300	450	900	1800							
69	–	●	●	●	●	–	–	–			1 : 1,6	
Mass [kg]	0,2	0,5	0,9	1,7	3,0	7,0	13	22				

● normally available from stock
○ on request
– not available

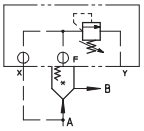
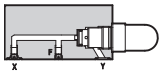
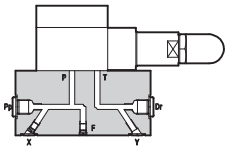
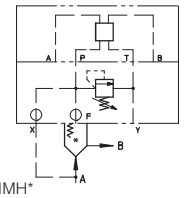
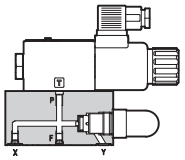
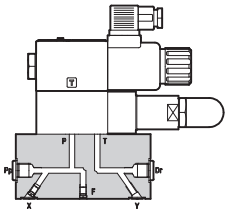
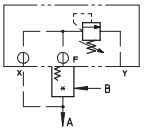
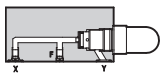
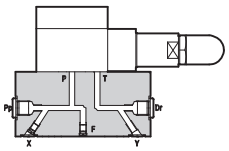
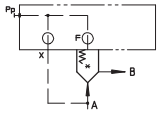
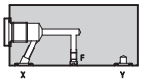
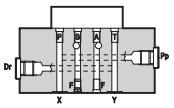
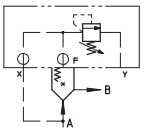
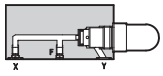
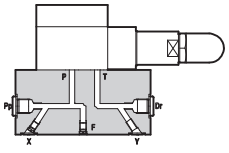
6 FUNCTIONALS COVERS - DIRECTIONAL CONTROL, see table H030

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 100	SC LI cartridges
Direct operated directional control valve with solenoid valve for pilot selection **LIDEW***	16 25 32 40 50 63 80 100			SC LI-**32* SC LI-**33* size 16 ... 100 SC LI-**42* size 16 ... 80 SC LI-**43* size 16 ... 100
Direct operated directional control valve with solenoid valve and shuttle valve for pilot selection **LIDBH1A** = open when solenoid is de-energized **LIDBH1C** = closed when solenoid is de-energized	16 25 32 40 50 63 80 100	**1A**  **1C**		SC LI-**32* SC LI-**33* size 16 ... 100 SC LI-**42* size 16 ... 80 SC LI-**43* size 16 ... 100
Direct operated directional control valve with solenoid and shuttle valve for pilot selection **LIDBH2A** = when solenoid is de-energized only connections X→F **LIDBH2C** = when solenoid is de-energized only connections Z1→F	16 25 32 40 50 63 80 100	**2A**  **2C**		SC LI-**32* SC LI-**33* size 16 ... 100 SC LI-**42* size 16 ... 80 SC LI-**43* size 16 ... 100

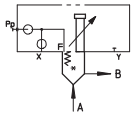
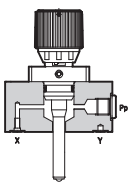
7 FUNCTIONALS COVERS - CHECK FUNCTION, see table H040

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 25	Functional cover size 32 ÷ 80	SC LI cartridges
Direct operated check valve normally closed **LIDA**	16 25 32 40 50 63 80				SC LI-**32* SC LI-**33* size 16 ... 80 SC LI-**42* SC LI-**43* size 16 ... 80 SC LI-**52* size 16 ... 50
Direct operated check valve normally open **LIDO**	16 25 32 40 50				SC LI-**62* SC LI-**63* size 16, 25, 32, 50
Direct operated check valve with shuttle valve for pilot selection **LIDB**	16 25 32 40 50 63				SC LI-**32* SC LI-**33* size 16 ... 63 SC LI-**42* SC LI-**43* size 16 ... 63
Direct operated check valve with hydraulically operated pilot check valve **LIDR**	16 25 32 40 50 63		01/20 		SC LI-**32* SC LI-**33* size 16 ... 63 SC LI-**42* SC LI-**43* size 16 ... 63

8 TYPICAL FUNCTIONS OF COVERS - PRESSURE CONTROL, see table H010

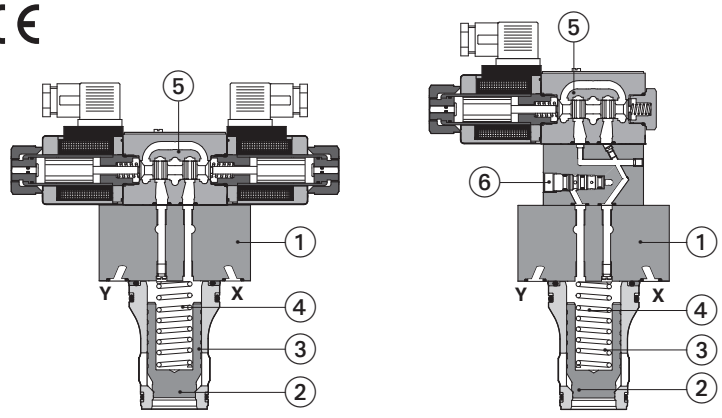
Function and type of control	Size	Hydraulic symbol	Functional cover size 6 ÷ 32	Functional cover size 40 ÷ 80	SC LI cartridges
Pressure relief control with manual setting **LIMM**	16 25 32 40 50 63 80				SC LI-**31* size 16... 80 SC LI-**34* size 16 SC LI-**35* size 16...50
Pressure relief control with solenoid valve for venting **LIMHA** = unloading when solenoid is de-energized **LIMHC** = unloading when solenoid is energized	16 25 32 40 50 63 80	A W W C  LIMH*			SC LI-**31* size 16...80 SC LI-**34* size16 SC LI-**35* size16...50
Pressure reducing control with manual setting. Open in resting position **LIRA**	16 25 32 40				SC LI-**37* size 16...40
Pressure compensator to be coupled with flow control valves **LIC**	16 25 32 40 50 63 80				SC LI-**31* size 16...80 SC LI-**36* size 16...80
Pressure compensator with mechanical max pressure regulation to be coupled with flow control valves. **LICM**	16 25 32 40 50 63 80				SC LI-**31* size 16...80 SC LI-**36* size 16...80

9 FUNCTIONAL COVERS - FLOW CONTROL, see table H020

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 63	SC LI cartridges
Flow control with stroke limiter **LIDD**	16 25 32 40 50 63			SC LI-**32* SC LI-**33* size 16...63 SC LI-**42* SC LI-**43* size 16...63

ISO cartridge valves type LIDEW* and LIDBH*

directional control, high flow, **Pmax 420 bar**



LIDEW4-3-E **LIDBH1A-3-E**

① Functional cover
② Poppet
③ Sleeve
④ Spring
⑤ Pilot slenoid valve
⑥ Shuttle valve

Directional control valves in ISO cartridge design, used to intercept or to permit the flow passage according to the selected pilot control. They are made by a functional cover ① and a 2-way **SC LI** slip-in cartridge.

LIDEW: functional cover with or without pilot solenoid valve for cartridge operation, available in different configurations depending to the function to be performed.

LIDBH as LIDEW plus shuttle valve for pilot pressure selection.

The SC LI slip-in cartridge is available with different poppet shape to optimize the control, see section 6.

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position by the spring ④ available with different cracking pressure values.

Size: **16** to **100** ISO 7368

Max flow up to **9000** l/min at Δp = 5 bar

Max pressure up to **420 bar**

1 **MODEL CODE OF FUNCTIONAL COVERS** - for model code of slip-in cartridge, see section 5

LI	D	EW	1	-	3	/	*	-	E	X	24DC	**	/	*	*

LI — Cover according to ISO 7368

D = directional function

EW = with or whithout pilot solenoid valve
BH = as EW plus shuttle valve for pilot selection

Cover configuration see section 2
LIDEW: **-** (without pilot valve)
LIDEW: **1**, **2**, **4**, **5**, **6**
LIDBH: **1A**, **1C**, **2A**, **2C**

Size:
1 = 16 **2** = 25 **3** = 32 **4** = 40
5 = 50 **6** = 63 **8** = 80 **10** = 100

Options, see section 3

Pilot solenoid valve (1)
for size 1 to 6: **I** = DHI, **Pmax 350 bar**
E = DHE, **Pmax 350 bar**
EP = DHEP, **Pmax 420 bar**
for size 8 and 10: **E** = DKE, **Pmax 350 bar**
EP = DKEP, **Pmax 420 bar**

X = without connector
See section 9 for available connectors, to be ordered separately
00 = solenoid valve without coils (for **I**)
00-AC = AC solenoid valve without coils (for **E** and **EP**)
00-DC = DC solenoid valve without coils (for **E** and **EP**)

Voltage code see section 8

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

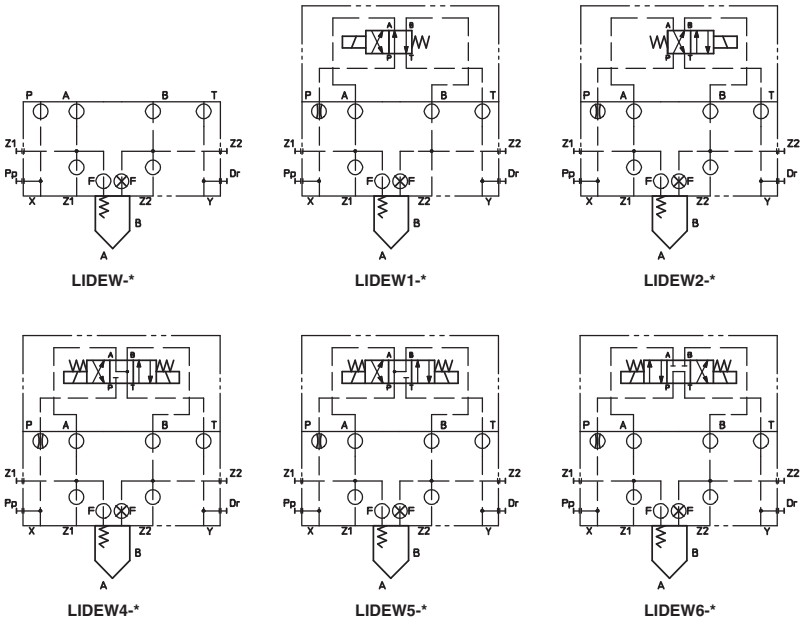
Optional different setting of calibrated plugs in the pilot channels, see sections 3, 4

(1) for solenoid valve's characteristics, see following technical tables:

DHI tech. table E010
DHE tech. table E015
DHEP tech. table TE030
DKE tech. table E025
DKEP tech. table TE030

2 HYDRAULIC SYMBOLS (cover configuration)

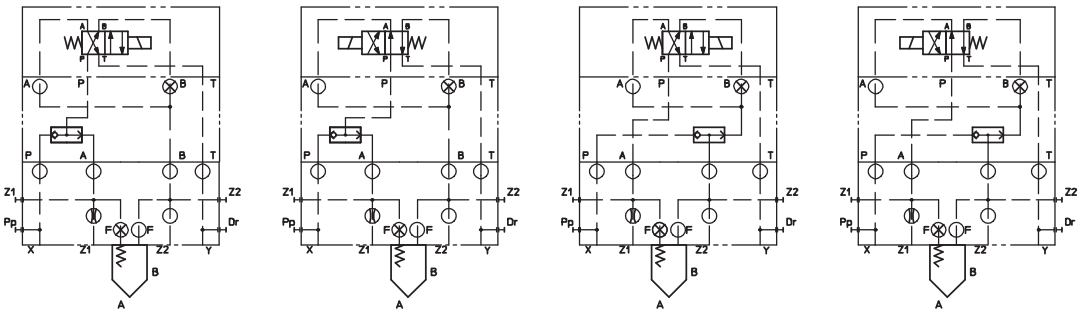
LIDEW



LIDEW-* LIDEW1-* LIDEW2-*

LIDEW4-* LIDEW5-* LIDEW6-*

LIDBH



LIDBH1A-* LIDBH1C-* LIDBH2A-* LIDBH2C-*

3 OPTIONS

For LIDEW*, LIDBH* covers (sizes 40…100):
/E = with external attachments Pp and underneath port X supplied plugged;

For all the models:
/B = cartridge piloted via port "B" of solenoid pilot valve;
/F = prearranged for coupling to an intermediate element with poppet position detector for safety function. See tab. EY120.
/WP = prolonged manual override protected by rubber cap for solenoid pilot valve. See table K150.
*** = Calibrated plugs different from standard ones reported in section 7. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIDEW2	-	1	/*	EX	24DC	**	P	06

P

Channel where the orifice has to be provided:
P = channel X, port P **Z1** = channel Z1
F = channel F **Z2** = channel Z2

06

Size of the throttling hole in teths of millimeters:
05 = 0,5 mm **10** = 1 mm **17** = 1,7 mm
06 = 0,6 mm **12** = 1,2 mm **20** = 2 mm
08 = 0,8 mm **15** = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Cover / Port	LIDEW*-1 LIDBH*-1	LIDEW*-2 LIDBH*-2	LIDEW*-3 LIDBH*-3	LIDEW*-4 LIDBH*-4	LIDEW*-5 LIDBH*-5	LIDEW*-6 LIDBH*-6	LIDEW*-8 LIDBH*-8	LIDEW*-10 LIDBH*-10
Z1 (only for LIDBH*-*)	M4 12A	M4 12A	M6 15A	M6 17A	M6 20A	M6 20A	M8 20A	M8 20A
P	M6 12A	M6 12A	M6 15A	M6 17A	M6 20A	M6 20A	M8 20A	M8 25A

M4 ÷ M8 = screw size; **12A ÷ 20A** = calibrated orifices diameter in tenths of mm; **A** = short calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES

SC LI	-	16	43	1	40	/	*

Cartridge according to ISO 7368

Size, the same of relevant cover:

16 25 32 40 50 63 80 100

Type of poppet

32, 33 (size 16 to 100) = without damping nose
42 (size 16 to 80) = as 32 but with damping nose
43 (size 16 to 100) = as 33 but with damping nose

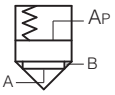
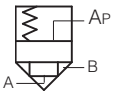
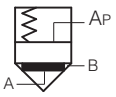
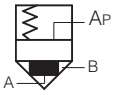
Series number

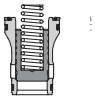
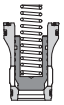
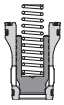
Seals material:
- = NBR
PE = FKM
BT = HNBR

Spring cracking pressure:

1 = 0,3 bar for poppet 32, 42
1 = 0,6 bar for poppet 33, 43
2 = 1,5 bar for poppet 32, 42
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

6 TYPE OF POPPET

Type of poppet	**32**	**33**	**42**	**43**
Functional sketch (Hydraulic symbol)				

Operating pressure		**420 bar max**			
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 9	Size **16**	270	270	240	240
	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
	80	5500	5500	4000	4000
	100	9000	9000	-	6300
Typical section					
Area ratio A:Ap		**1:1,1**	**1:1,5**	**1:1,1**	**1:1,5**
Cracking pressure A→B	Spring **1**	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	2,5 bar	3 bar	2,5 bar
	6	6 bar	6 bar	6 bar	6 bar
Cracking pressure B→A	Spring **1**	3 bar	0,9 bar	3 bar	0,9 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	3,8 bar	32,5 bar	3,8 bar
	6	59,4 bar	9 bar	59,4 bar	9 bar

7 MAIN CHARACTERISTCS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location		Any position		
Subplate surface finishing		Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849		150 years, for further details see technical table P007		
Compliance		CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature		**Standard** execution = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level		ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR, HNBR	HFC	
Flow direction		From A→B or B→A		
Functional cover operating pressure	Pilot valve **I**	Ports A, B, X, Z_1, Z_2: **350** bar	Port Y: **120** bar	
	Pilot valve **E**	Ports A, B, X, Z_1, Z_2: **350** bar	Port Y: **210** bar for DC version; **160** bar for AC version	
	Pilot valve **EP**	Ports A, B, X, Z_1, Z_2: **420** bar	Port Y: **210** bar for DC version; **160** bar for AC version	

7.1 Coils characteristics

Insulation class	Pilot valve **E**, **EP: H** (180°C) for DC coils **F** (155°C) for AC coils Pilot valve **I: H** (180°C) for DC or AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 8
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

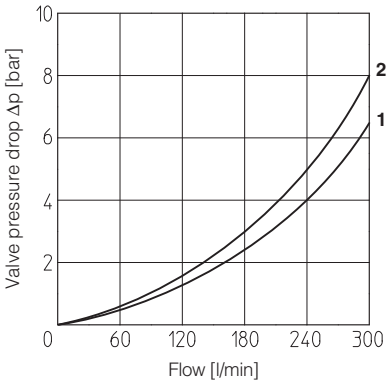
8 ELECTRIC FEATURES

Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption (3)	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE, DHEP
DHI DHE DHEP	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W (DHI) 30 W (DHEP)	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	**110/50/60 AC** **115/60 AC** (5) **120/60 AC** (6) **230/50/60 AC** **230/60 AC**	666 or 667	60 VA (DHI) 58 VA (DHEP) (4)	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC
DKE DKEP	12 DC 14 DC 24 DC 28 DC 110 DC 220 DC 110/50/60 AC (2) 230/50/60 AC (2) 115/60 AC 230/60 AC 110/50/60 AC 230/50/60 AC		**12 DC** **14 DC** **24 DC** **28 DC** **110 DC** **220 DC** **110/50/60 AC** **230/50/60 AC** **115/60 AC** **230/60 AC** **110 DC** **220DC**	666 or 667	36 W	CAE-12DC CAE-14DC CAE-24DC CAE-28DC CAE-110DC CAE-220DC	-	
					100 VA (7)	CAE-110/50/60AC CAE-120/60AC	-	
					130 VA (7)	CAE-230/50/60AC CAE-230/60AC		
				669	36 W	CAE-110DC CAE-220DC		

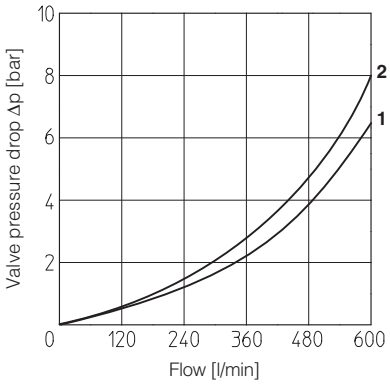
(1) For other supply voltages available on request see technical tables E010, E015, E025, TE030.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15%. The power consumption is 55 VA (DHI), 58 VA (DHE, DHEP) and 90 VA (DKE, DKEP)
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(5) Only for DHE, DHEP
(6) Only for DHI
(7) When solenoid is energized, the inrush current is approx 3 times the holding current.

9 **Q/Δp DIAGRAMS** based on mineral oil ISO VG 46 at 50 °C

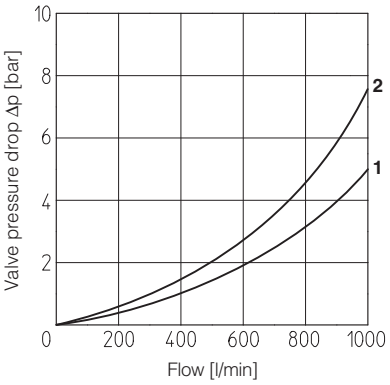
size 16



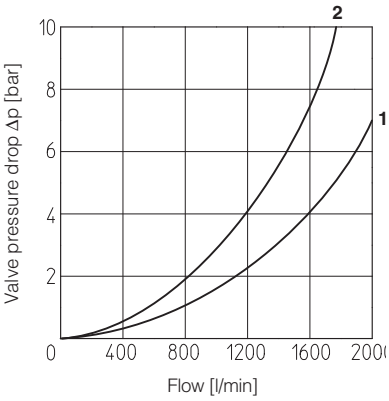
size 25



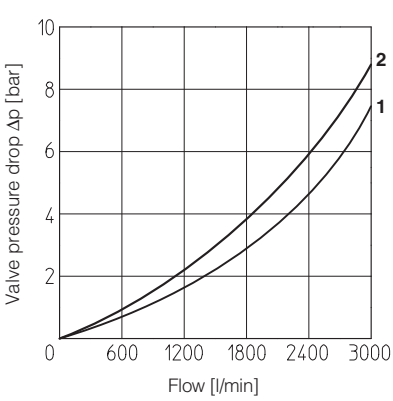
size 32



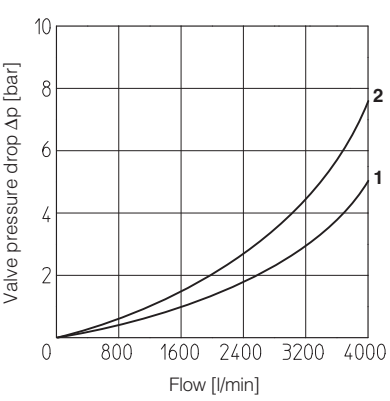
size 40



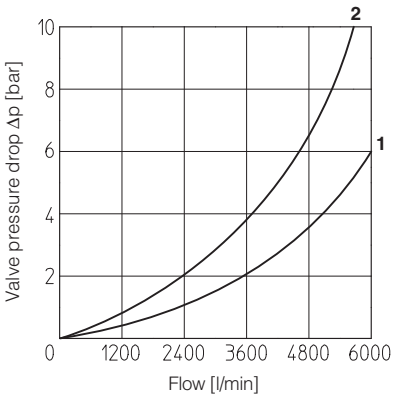
size 50



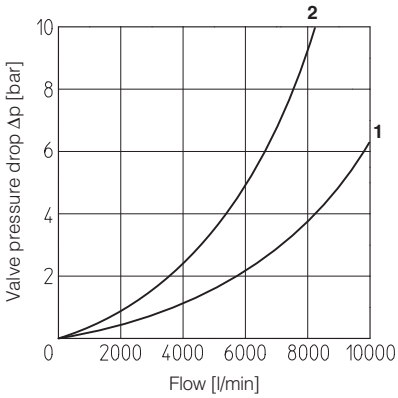
size 63



size 80



size 100

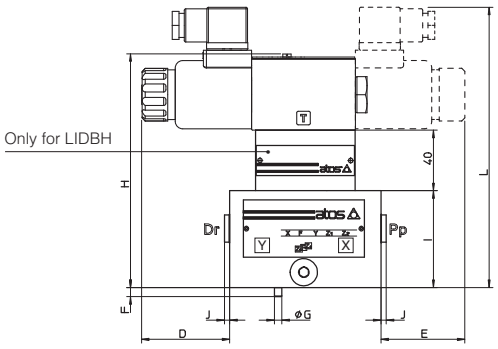


1 = poppet type 32 and 33
2 = poppet type 42 and 43

10 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions see tech. table P006

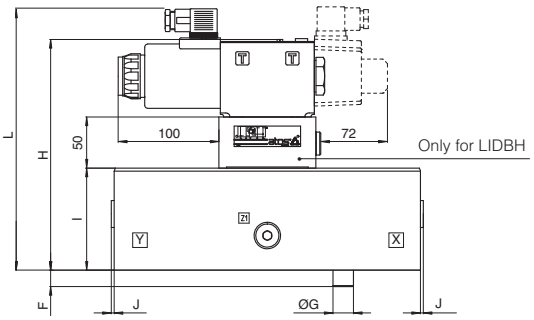
Size 16 ÷ 63

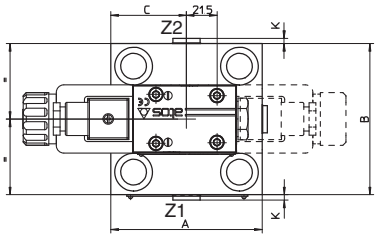
Drawing of size 50
dotted line: example of double solenoid version

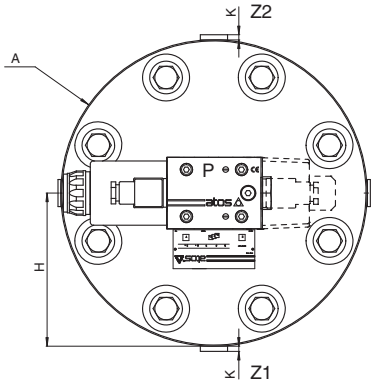


Size 80 and 100

dotted line: example of AC solenoid verison







Notes referred to the below table:

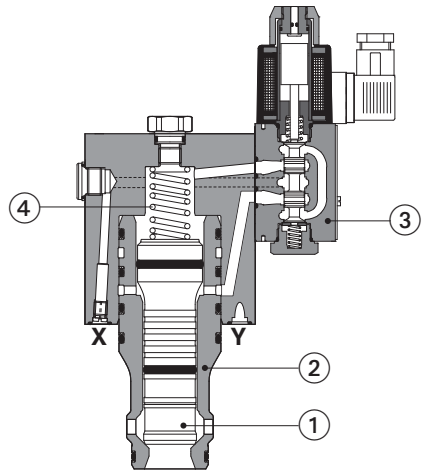
(1) LIDEW1*, LIDBH*A: solenoid at side of port Y of cover;
LIDEW2*, LIDBH*C: solenoid at side of port X of cover;

Size (1)	A	B	C	D max	E max	F	G	H max **LIDEW**	H max **LIDBH**	I	L max	J	K	Ports Pp-Dr	Ports Z_1-Z_2	Seals	Fastening bolts	Tightening torque [Nm]	Mass [Kg]
16	70	65	29	83,5	70,5	4	3	90,5	130,5	40	125	-	-	_	-	4 OR-108	Nr. 4 M8x45	35	2,6 ÷ 3
25	85	85	42,5	69,5	69,5	6	5	90,5	130,5	40	125	-	-	_	-	4 OR-108	Nr. 4 M12x45	125	3 ÷ 3,4
32	100	100	50	62,5	42,5	6	5	100,5	140,5	50	135	-	-	_	-	4 OR-2043	Nr. 4 M16x55	300	3,5 ÷ 4
40	125	125	62,5	49,5	49,5	6	5	110,5	150,5	60	145	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	6,4 ÷ 6,9
50	140	140	70	42	42	4	6	120,5	160,5	70	155	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	9,5 ÷ 10
63	180	180	90	22	22	4	6	130,5	170,5	80	165	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	17,3÷17,7
80	Ø250	-	125	-	-	6	8	152,5	202,5	80	187	3,5	3,5	G 3/8	G 3/8	4 OR-4075	Nr. 8 M24x90	1000	27,1÷27,7
100	Ø300	-	150	-	-	8	10	182,5	222,5	100	217	3,5	3,5	G 1/2	G 1/2	4 OR-4093	Nr. 8 M30x120	2100	53÷54

Overall dimensions refer to the pilot valves with connectors type 666

On-off active cartridges type LIDAS, 2-way

directional control



① = main poppet
② = cartridge sleeve
③ = solenoid pilot valve (LIDASH-*)
④ = spring

LIDASH-3231-EX

LIDAS are 2-way ISO cartridge valves with active pilot control, normally used to shut-off the hydraulic line.
The particular poppet sealing grants leak-free characteristics.

The poppet ① is hydraulically operated in both directions, ensuring in this way higher reliability and faster response time respect to the conventional spring operated cartridge valves.
The spring ④ ensures the valve closing in absence of pressure in the system.
They are available in different executions:
LIDAS: without pilot solenoid valve
LIDASH: with on-off pilot solenoid valve

Sizes:**16 to 50** ISO 7368
Max flow up to **2100 l/min** with Δp = 5 bar
Max pressure: up to **420 bar**

1 MODEL CODE

LIDAS	H	-	40	43	3	-	E	X	24DC	**	*

LIDAS
On-off active cartridges, according to ISO 7368

H
Pilot solenoid valve
- = without pilot solenoid valve
H = with pilot solenoid valve

40
Size: **16 25 32 40 50**

43
Poppet type: see section 2
31, **33**
43 (with dumping nose)

3
3 = spring cracking pressure 3 bar

E
Only for LIDASH - Pilot solenoid valve:
I = DHI, **Pmax 350 bar**
E = DHE, **Pmax 350 bar**
EP = DHEP, **Pmax 420 bar**

X
Only for LIDASH
X = without connector
See section 4 for available connectors, to be ordered separately
-00 = solenoid valve without coils (for **I**)
-00-AC = AC solenoid valve without coils (for **E** and **EP**)
-00-DC = DC solenoid valve without coils (for **E** and **EP**)

24DC
Only for LIDASH
Voltage code, see section 6

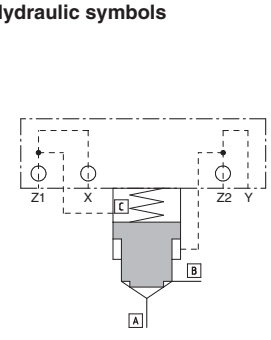
******
Series number

*****
Seals material:
- = NBR
PE = FKM
BT = HNBR

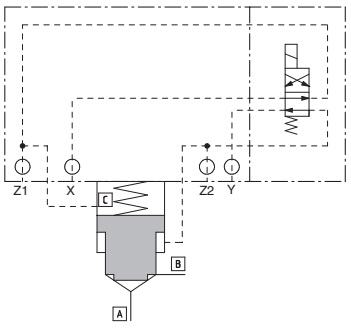
Note: for certified safety version conforming to 2006/42/EC, with inductive position switch (option /FV) see table EY120

2 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols



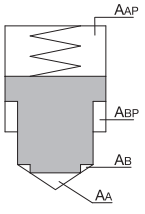
LIDAS



LIDASH

Cartridge areas

A_A = main flow (side A)
A_B = main flow (side B)
A_{AP} = piloting area (close)
A_{BP} = piloting area (open)



Thanks to the areas ratio AAP/(AA+AB), the valve closing is always ensured with a piloting pressure (X port) equal to the line pressure (A or B line).

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS

Assembly position / location			Any position								
Subplate surface finishing			Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)								
MTTFd valves according to EN ISO 13849			LIDAS = 150 years LIDASH = 75 years								
Compliance			CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006								
Flow direction			B → A (preferred) or A → B								
Piloting		**LIDAS**	Pressure to **X** = **close** Pressure to **Y** = **open**								
		LIDASH	De-energized = **close** Energized = **open**								
Operating pressure	LIDAS		Ports A, B, X, Z_1, Z_2, Y: **420** bar								
	LIDASH	Pilot valve **I**	Ports A, B, X, Z_1, Z_2: **350** bar Port Y: **120** bar								
		Pilot valve **E**	Ports A, B, X, Z_1, Z_2: **350** bar Port Y: **210** bar for DC version; **160** bar for AC version								
		Pilot valve **EP**	Ports A, B, X, Z_1, Z_2: **420** bar Port Y: **210** bar for DC version; **160** bar for AC version								
Size			**16**		**25**		**32**		**40**		**50**
Maximum flow		Poppet **31**	240		450		700		1400		2100
at Δp = 5 bar [l/min]		Poppet **33**	220		400		600		1300		2000
		Poppet **43**	200		360		550		1100		1800
Poppet characteristics		Poppet type	**31**	**33, 43**	**31**	**33, 43**	**31**	**33, 43**	**31**	**33, 43**	**31**	**33, 43**
A_A [cm²]			2,27	1,43	4,91	3,46	8,04	5,30	12,56	8,04	19,63	13,85
A_B (% of A_A)			0	58,6	0	41,7	0	51,5	0	56,3	0	41,7
A_{BP} (% of A_A)			67,5	107,0	63,8	90,5	56,3	85,2	56,3	87,9	69	97,8
A_{AP} (% of A_A)			167,5	265,6	163,8	232,2	156,3	236,7	156,3	244,1	169	239,2
A_A / (A_A + A_B) poppet ratio			1 for poppet **31** 0,6 for poppet **33, 43**									
A_{AP} / (A_A + A_B) piloting ratio			1,6 for poppet **31** 1,6 for poppet **33, 43**									

3.1 Coils characteristics (only for LIDASH)

Insulation class	Pilot valve **E**, **EP: : H** (180°C) for DC coils **F** (155°C) for AC coils Pilot valve **I: H** (180°C) for DC or AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 6
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

5 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - the connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source.
669	With built-in rectifier bridge for supplying DC coils by alternating current (AC 110V and 230V - Imax 1A).

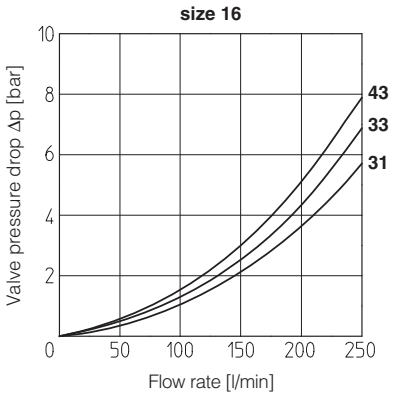
For other available connectors, see tab. K500

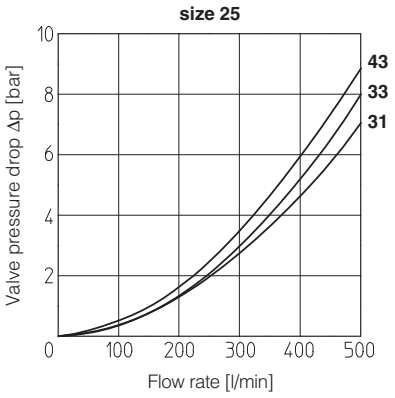
6 ELECTRIC FEATURES - coils for pilot solenoid valves

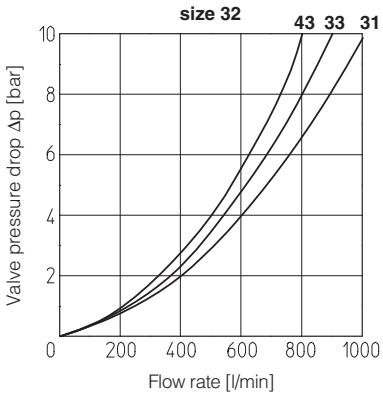
Valve	External supply nominal voltage ± 10%	**Voltage code**	Type of connector	Power consumption **(3)**		Code of spare coil		
				DHI	**DHE DHEP**	**DHI**	Colour of coil label **DHI**	**DHE, DHEP**
DHI DHE DHEP	6 DC	**6 DC** (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	**12 DC**				COU-12DC	green	COE-12DC
	14 DC	**14 DC**				COU-14DC	brown	COE-14DC
	24 DC	**24 DC**				COU-24DC	red	COE-24DC
	28 DC	**28 DC**				COU-28DC	silver	COE-28DC
	48 DC	**48 DC**				COU-48DC	silver	COE-48DC
	110 DC	**110 DC**				COU-110DC	gold	COE-110DC
	125 DC	**125 DC**				COU-125DC	blue	COE-125DC
	220 DC	**220 DC**				COU-220DC	black	COE-220DC
	24/50 AC	**24/50/60 AC** (4)		60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC							
	48/50 AC	**48/50/60 AC** (4)				COI-48/50/60AC (1)	white	-
	48/60 AC							
	110/50 AC	**110/50/60 AC**			58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC
	115/60 AC (5)	**115/60 AC**		-	80 VA	-		COE-115/60AC
	120/60 AC (4)	**120/60 AC**		60 VA	-	COI-120/60AC	white	-
	230/50 AC	**230/50/60 AC**			58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	230/60 AC	**230/60 AC**			80 VA	COI-230/60AC	silver	COE-230/60AC
	110/50 AC	**110RC**	669	33 W	30 W	COU-110RC	gold	COE-110RC
	120/60 AC							
	230/50 AC	**230RC**				COU-230RC	blue	COE-230RC
	230/60 AC							

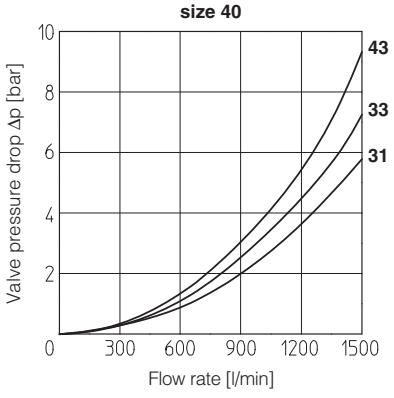
(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (-I) and 58 VA (-E, -EP)
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(4) Only for pilot valve DHI
(5) Only for pilot valve DHE, DHEP

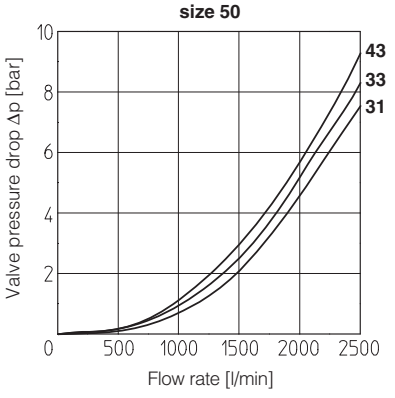
7 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50 °C





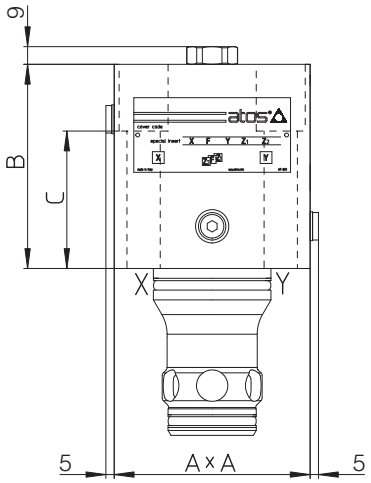




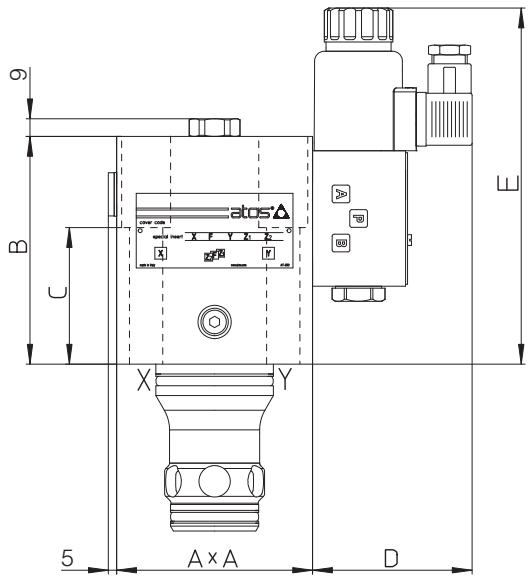


31 = poppet type 31
33 = poppet type 33
43 = poppet type 43

8 INSTALLATION DIMENSIONS [mm]



LIDAS					
Size	A	B	C	Fastening bolts class 12.9	Weight (Kg)
16	65	85	64	N°4 M8x80 35 Nm	2,8
25	85	102	75	N°4 M12x95 125 Nm	5,7
32	100	104	70	N°4 M16x90 300 Nm	7,3
40	125	111	39	N°4 M20x70 600 Nm	14,5
50	140	135	49	N°4 M20x80 600 Nm	120

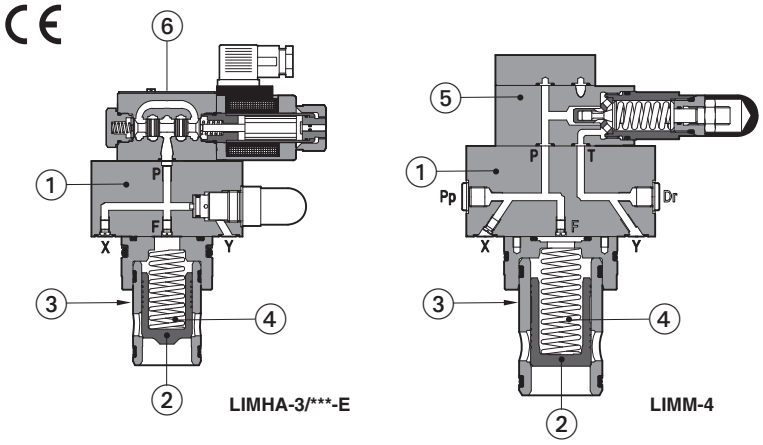


LIDASH								
Size	Pilot valve	A	B	C	D max ①	E max ②	Fastening bolts class 12.9	Weight (Kg)
16	DHI	72x65	95	64	79,5	152	N°4 M8x80 35 Nm	4,3
	DHE(P)				86	167		4,4
25	DHI	85	115	77	79,5	165	N°4 M12x95 125 Nm	7,2
	DHE(P)				86	181		7,3
32	DHI	100	116	70	79,5	176	N°4 M16x90 300 Nm	8,8
	DHE(P)				86	192		8,9
40	DHI	125	125	39	79,5	180	N°4 M20x70 600 Nm	15,5
	DHE(P)				86	196		15,6
50	DHI	140	135	49	79,5	186	N°4 M20x80 600 Nm	20,5
	DHE(P)				86	202		20,6

Note: for mounting interface and cavity dimensions, see tech. table P006

ISO cartridge valves type LIM*, LIRA, LIC*

Pressure controls: relief, reducing, compensator - **Pmax 420 bar**



① Functional cover
② Poppet
③ Sleeve
④ Spring
⑤ Pressure relief pilot valve
⑥ Solenoid pilot valve

Pressure control valves in ISO cartridge design specific for relief, reducing or compensator functions

They are made by a functional cover ① and a 2-way **SC LI** slip-in cartridge.

Depending to the type of control, the cover is equipped with a pilot relief valve ⑤ for the max pressure regulation and a solenoid valve ⑥ for venting.

The SC LI slip-in cartridge is available with different poppet shape to optimize the pressure control, see section 4

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position by the spring ④ available with different cracking pressure values.

Size: **16 to 80** ISO 7368
Max flow up to **4900 l/min** at Δp = 5 bar
Max pressure: up to **420 bar**

1 **MODEL CODE OF FUNCTIONAL COVERS** - for model code of slip-in cartridge, see section 5

LI	MHA	-	1	/	210	/	V	-	I	X	24DC	**	/	*	F**

LI: Cover according to ISO 7368

Function:
MM = pressure relief control with manual setting;
MHA = pressure relief control with solenoid valve for venting. Unloading when solenoid is deenergized;
MHC = pressure relief control with solenoid valve for venting. Unloading when solenoid is energized;
RA = pressure reducing control with manual setting. Open in resting position;
C = pressure compensator to be coupled with flow control valves;
CM = pressure compensator with mechanical max pressure regulation to be coupled with flow control valves.

Size: **1** = 16; **2** = 25; **3** = 32; **4** = 40; **5** = 50; **6** = 63; **8** = 80
LIRA is available only in size 16, 25, 32, 40

Pressure range:
50 = 6 ÷ 50 bar;
100 = 8 ÷ 100 bar; **350** = 15 ÷ 350 bar;
210 = 10 ÷ 210 bar; **420** = 25 ÷ 420 bar **(1)**

Pilot solenoid valve only for LIMHA and LIMHC:
I = DHI, **Pmax 350 bar**
E = DHE, **Pmax 350 bar**
EP = DHEP, **Pmax 420 bar (1)**

Only for LIMHA and LIMHC
X = without connector
00 = solenoid valve without coils (for -I)
00-AC = AC solenoid valve without coils (for **E** and **EP**)
00-DC = DC solenoid valve without coils (for **E** and **EP**)
See tech. table K500 for available connectors, to be ordered separately

Voltage code only for LIMHA and LIMHC, see section 9

Series number

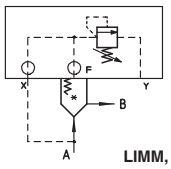
Seals material:
- = NBR
PE = FKM
BT = HNBR

Optional different setting of calibrated plugs in the pilot channels, see section 3, 4

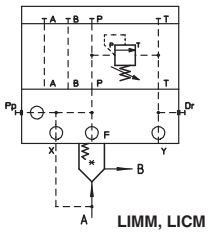
Options: see section 3

(1) Pressure range 420 bar not available for LIMH*-**I** and LIMH*-**E**; LIMH*-**EP** is available only for pressure range 420 bar

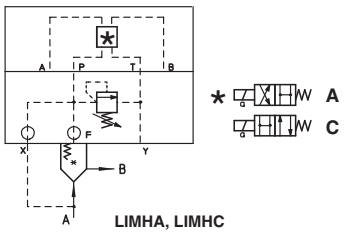
2 HYDRAULIC SYMBOLS



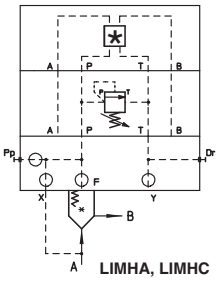
LIMM, LICM
size 16…32



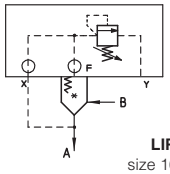
LIMM, LICM
size 40…80



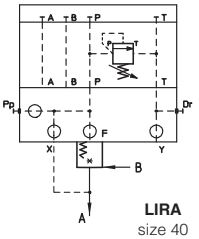
LIMHA, LIMHC
size 16…32



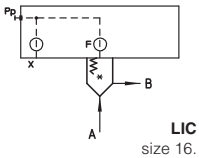
LIMHA, LIMHC
size 40…80



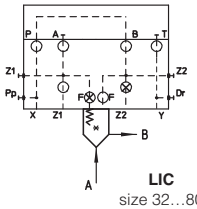
LIRA
size 16…32



LIRA
size 40



LIC
size 16…25



LIC
size 32…80

3 OPTIONS

Only for LIMM (size 16...32):
/P = predisposed for ISO 4401 size 06 mounting surface
Handwheel for pressure control, only for LIMM, LIMH*, LIRA, LICM (see tech. table K150):
/V = regulating handwheel (available for all the sizes)
/VF = regulating knob (available only for sizes 40…80)
/VS = manual override with safety locking (available only for sizes 40…80)
/WP = prolonged manual override protected by rubber cap for pilot solenoid valve

For all the models:
******* = calibrated plugs different from standard one. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIMHA - **1** / **210** - **IX** **24DC** ******

F
Channel where the orifice has to be provided: **X** = channel X **F** = channel F

06
Size of the throttling hole in tenths of millimeters: **05** = 0,5 mm **10** = 1 mm **06** = 0,6 mm **12** = 1,2 mm **08** = 0,8 mm **15** = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Port \ Cover	LIM*-1	LIRA-1	LICM-1	LIC-1	LIM*-2	LIRA-2	LICM-2	LIC-2	LIM*-3	LIRA-3	LICM-3	LIC-3	LIM*-4	LIRA-4	LICM-4	LIC-4	LIM*-5	LICM-5	LIC-5	LIM*-6	LICM-6	LIC-6	LIM*-8	LICM-8	LIC-8
X	M4 10A	M4 08A	M4 08A	- -	M4 10A	M4 08A	M4 08A	- -	M6 10A	M6 08A	M6 12A	M6 10A	M6 10A	M6 12A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M8 10A	M8 10A	M8 10A
F	M4 12F	M4 12A	M4 05F	M4 05F	M4 12F	M4 12A	M4 05F	M4 05F	M6 12F	M6 12A	M6 12F	M6 05F	M6 12F	M6 08A	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M8 12F	M8 12F	M8 12F

M4 ÷ M8 = screw size; **10A ÷ 12F** = calibrated orifice diameter in tenths of mm; **A** = short calibrated hole, **F** = long calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES

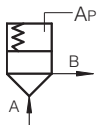
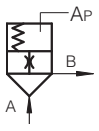
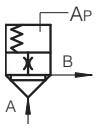
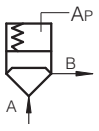
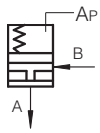
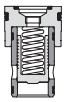
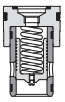
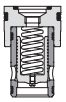
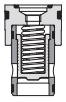
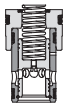
SC LI	-	16	31	2	**	/*
Cartridge according to ISO 7368					Series number	Seals material: **-** = NBR **PE** = FKM **BT** = HNBR

Size, the same of relevant cover:
16 = 16; **32** = 32; **50** = 50; **80** = 80
25 = 25; **40** = 40; **63** = 63;

Type of poppet
31 = (sizes 16…80) = for LIMM, LIMH*, LIC, LICM
34 = (size 16) = for LIMM, LIMH*
35 = (sizes 16…50) = for LIMM, LIMH*
36 = (sizes 16…80) = for LIC, LICM
37 = (sizes 16…40) = for LIRA

Spring cracking pressure:
1 = 0,3 bar for poppet 35;
2 = 1,2 bar for poppet 31, 34, 35;
3 = 3 bar for poppet 31, 34, 35;
4 = 4 bar for poppet 37;
6 = 6 bar for poppet 31, 34, 35, 36;
7 = 7 bar for poppet 37 (not available for size 40);

6 TYPE OF POPPET

Type of poppet		31	34	35	36	37
Operating pressure		**420 bar**				
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 8	Size **16**	180	180	180	180	140
	25	370	-	370	370	250
	32	630	-	630	630	500
	40	1100	-	1100	1100	750
	50	1900	-	1900	1900	-
	63	3100	-	-	3100	-
	80	4900	-	-	4900	-
Functional sketch (Hydraulic symbol)						
Typical section						
Area ratio A: AP		**1:1**	**1:1**	**1:1,1**	**1:1**	**1:1**

7 MAIN CHARACTERISTICS SEALS AND HYDRAULIC FLUIDS

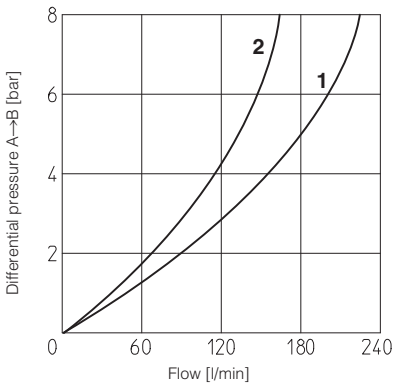
Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	**Standard** execution = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μm (β25 ≥75 recommended)		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Functional cover operating pressure all models except **LIMH***	Ports A, B, X: **420** bar;		
LIMH*-I	Ports A, B, X: **350** bar; Port T **120** bar		
LIMH*-E	Ports A, B, X: **350** bar; Port T **210** bar for DC version; **160** bar for AC version		
LIMH*-EP	Ports A, B, X: **420** bar; Port T **210** bar for DC version; **160** bar for AC version		

7.1 Coils characteristics

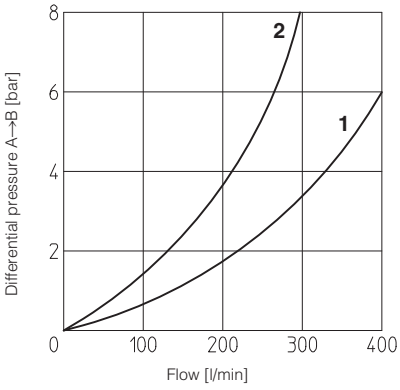
Insulation class	Pilot valve **E**, **EP: H** (180°C) for DC coils **F** (155°C) for AC coils Pilot valve **I: H** (180°C) for DC or AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	**IP 65** (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 9
Supply voltage tolerance	± 10%
Certification	**cURus** North American Standard

8 FLOW /Δp DIAGRAMS based on mineral oil ISO VG 46 at 50 °C

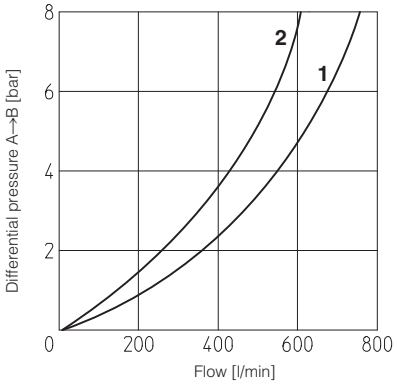
size 16



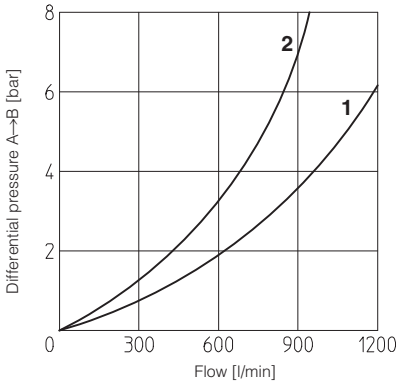
size 25



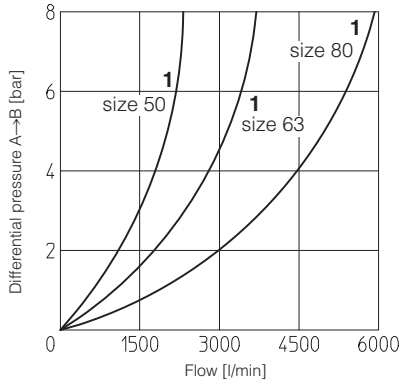
size 32



size 40



size 50, 63, 80



1 = poppet type 31, 34, 35, 36
2 = poppet type 37

Note:

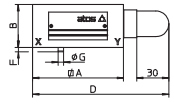
poppet type 34 only for size 16
poppet type 37 for size 16 to 50

9 ELECTRIC FEATURES

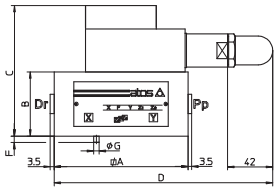
Solenoid valve type	External supply nominal voltage ± 10% (1)		**Voltage code**	Type of connector	Power consumption (3)	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE, DHEP
DHI DHE DHEP	DC	12 DC 24 DC 110 DC 220 DC	**12 DC** **24 DC** **110 DC** **220 DC**	666 or 667	33 W (DHI) 30 W (DHE, DHEP)	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	**110/50/60 AC** **115/60 AC** (5) **120/60 AC** (6) **230/50/60 AC** **230/60 AC**	666 or 667	60 VA (DHI) 58 VA (DHE, DHEP) (4)	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

(1) For other supply voltages available on request see technical tables E010, E015, TE030.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI)
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
(5) Only for DHE, DHEP
(6) Only for DHI

10 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions see tech. table P006

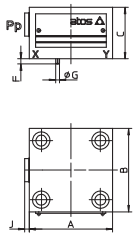


LIMM (size 16…32)
LIRA (size 16…32)
LICM (size 16…32)

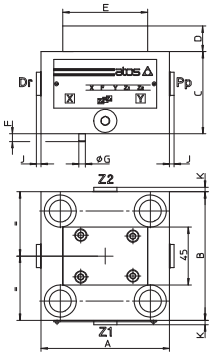


LIMM (size 40…80)
LIRA (size 40)
LICM (size 40…80)

Covers	A	B	C	D	F	G	Port Pp-Dr	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIMM-1 LIRA-1 LICM-1	65	40	-	107,5	4	3	-	2 OR 108	Nr. 4 M8x45	35	1,7
LIMM-2 LIRA-2 LICM-2	85	40	-	127,5	6	5	-	2 OR 108	Nr. 4 M12x45	125	2,2
LIMM-3 LIRA-3 LICM-3	100	50	-	142,5	6	5	-	2 OR 2043	Nr. 4 M16x55	300	3,5
LIMM-4 LIRA-4 LICM-4	125	60	122	195	6	5	G 1/4	2 OR 3043	Nr. 4 M20x70	600	8,9
LIMM-5 LICM-5	140	70	132	202,5	4	6	G 1/4	2 OR 3043	Nr. 4 M20x80	600	12,4
LIMM-6 LICM-6	180	80	142	222,5	4	6	G 3/8	2 OR 3050	Nr. 4 M30x90	2100	21,6
LIMM-8 LICM-8	Ø250	80	172	257,5	6	8	G 3/8	2 OR 4075	Nr. 8 M24x90	1000	30,5

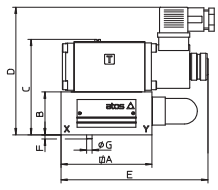


LIC (size 16 ÷ 25)

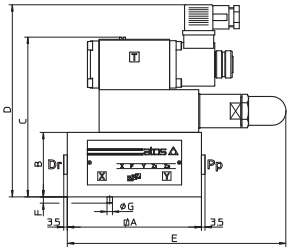


LIC (size 32…80)

Covers	A	B	C	D	E	F	G	K	J	Port Pp-Dr	Port Z_1-Z_2	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIC-1	65	65	40	-	-	4	3	-	3,5	G 1/4	-	2 OR 108	Nr. 4 M8x45	35	1,4
LIC-2	85	85	40	-	-	6	5	-	3,5	G 1/4	-	2 OR 108	Nr. 4 M12x45	125	1,8
LIC-3	100	100	50	20	66	6	5	-	3,5	G 1/4	-	4 OR 2043	Nr. 4 M16x55	300	2,3
LIC-4	125	125	60	20	66	6	5	-	3,5	G 1/4	-	4 OR 3043	Nr. 4 M20x70	600	6,2
LIC-5	140	140	70	20	66	4	6	3,5	3,5	G 1/4	G 1/4	4 OR 3043	Nr. 4 M20x80	600	9,3
LIC-6	180	180	80	20	66	4	6	3,5	3,5	G 3/8	G 3/8	4 OR 3050	Nr. 4 M30x90	2100	17,1
LIC-8	Ø 250	-	80	30	73	6	8	-	3,5	G 3/8	-	4 OR 4075	Nr. 8 M24x90	1000	27



LIMH* (size 16…32)



LIMH* (size 40…80)

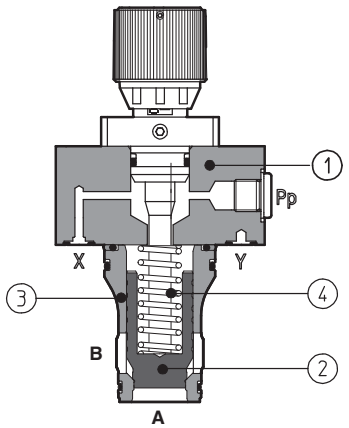
Covers	A	B	C max	D max	E	F	G	Port Pp-Dr	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIMHA-1 LIMHC-1	65 (1)	40	87,5	123,5	124,5	4	3	-	2 OR 108	Nr. 4 M8x45	35	3
LIMHA-2 LIMHC-2	85	40	87,5	123,5	134,5	6	5	-	2 OR 108	Nr. 4 M12x45	125	3,3
LIMHA-3 LIMHC-3	100	50	130,5	153,5	142,5	6	5	-	2 OR 2043	Nr. 4 M16x55	300	5
LIMHA-4 LIMHC-4	125	60	150,5	183,5	195	6	5	G 1/4	2 OR 3043	Nr. 4 M20x70	600	9,2
LIMHA-5 LIMHC-5	140	70	160,5	193,5	202,5	4	6	G 1/4	2 OR 3043	Nr. 4 M20x80	600	13,2
LIMHA-6 LIMHC-6	180	80	170,5	203,5	222,5	4	6	G 3/8	2 OR 3050	Nr. 4 M30x90	2100	22,5
LIMHA-8 LIMHC-8	Ø 250	80	200,5	233,5	257,5	6	8	G 3/8	2 OR 4075	Nr. 8 M24x90	1000	31,3

(1) Cover is not squared: 65x80
(2) Hexagon socket head screw according to DIN 912 class 12.9

Overall dimensions refer to the pilot valves with connectors type 666

ISO cartridge valves type LIDD

Flow control



① Functional cover
② Poppet
③ Sleeve
④ Spring

LIDD-2

LIDD are flow control valves not compensated, in ISO cartridge design, made by a functional "cover" ① and a 2-way SC LI slip-in cartridge.

Covers are provided with regulating screw to adjust the cartridge opening.

The cartridge is made by poppet ② sliding into a sleeve ③. The position of the spool or poppet and then the controlled flow, is manually set on the regulating screw of the cover; the cracking pressure value depends on poppet spring.

Size: **16 to 63** ISO 7368
Max flow up to **4000 l/min** at Δp 5 bar
Max pressure: **LIDD 420 bar**

1 MODEL CODE FOR COVERS - for model code of slip-in cartridge/spool, see section 3, 5

LI	**DD**	–	**1**	/	*	**	/*

LI: Cover according to ISO 7368

DD: Flow control valve: **DD** = normally closed with stroke limiter

1: Size for LIDD:
1 = 16 **4** = 40
2 = 25 **5** = 50
3 = 32 **6** = 63

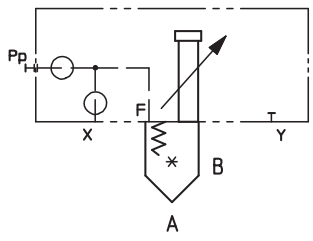
*: Options: see section 6

**: Series number
LIDD = **50** all sizes **(1)**

/*: Seals material:
- = NBR
PE = FKM
BT = HNBR

(1): New series 50 of LIDD cover is highly recommended in combination with new high flow cartridges series 40
The use of old cartridges series 10, 11 and 31 may cause the impossibility to fully close the poppet

2 HYDRAULIC SYMBOLS



3 MODEL CODE OF SLIP-IN CARTRIDGES - for LIDD

SC LI	-	16	43	1	40	/	*

Cartridge according to ISO 7368

Size, the same of relevant cover:
16 25 32 40 50 63

Type of poppet
32, 33 (size 16 to 100) = without damping nose
42 (size 16 to 80) = as 32 but with damping nose
43 (size 16 to 100) = as 33 but with damping nose

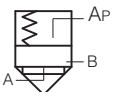
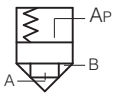
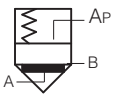
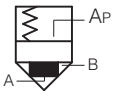
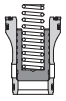
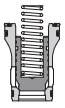
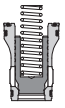
Series number **(1)**
40 = all sizes

Seals material:
- = NBR
PE = FKM
BT = HNBR

Spring cracking pressure:
1 = 0,3 bar for poppet 32, 42
1 = 0,6 bar for poppet 33, 43
2 = 1,5 bar for poppet 32, 42
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

(1) New series 40 is mechanically interchangeable with standard flow series 31, 11 and 10 - cavity according to ISO 7368
New series 50 of LIDD cover is highly recommended in combination with new cartridges series 40
The use of old cartridges series 10, 11 and 31 may cause the impossibility to fully close the poppet

4 TYPE OF POPPET

Type of poppet		**32**	**33**	**42**	**43**
Functional sketch (Hydraulic symbol)					
Operating pressure		**420 bar max**			
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 7	Size **16**	270	270	240	240
	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
Typical section					
Area ratio A:Ap		**1:1,1**	**1:1,5**	**1:1,1**	**1:1,5**
Cracking pressure A→B	Spring **1**	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	2,5 bar	3 bar	2,5 bar
	6	6 bar	6 bar	6 bar	6 bar
Cracking pressure B→A	Spring **1**	3 bar	0,9 bar	3 bar	0,9 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	3,8 bar	32,5 bar	3,8 bar
	6	59,4 bar	9 bar	59,4 bar	9 bar

5 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	**Standard** execution = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	A to B or B to A		
Functional cover operating pressure	ports X, Y: **420** bar		

6 OPTIONS

/E = with external attachments X and underneath port X supplied plugged;

******* = Calibrated plugs different from standard ones. LIDD covers in standard executions are not equipped with restrictors in the pilot channels. When ordering covers equipped with restrictors, it must be indicated at the end of the model code:

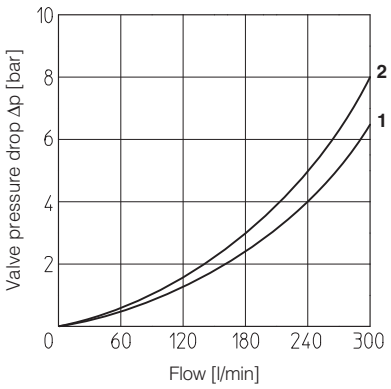
LIDD	-	1	/E	X	06
				Channel where the restrictor has to be provided: **X** = channel X	Size of the throttling hole in tenths of millimeters: **05** = 0,5 mm **10** = 1 mm **06** = 0,6 mm **12** = 1,2 mm **08** = 0,8 mm **15** = 1,5 mm

7 Q/ΔP DIAGRAMS - based on mineral oil ISO VG 46 at 50°C

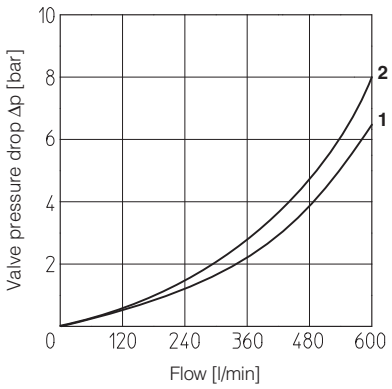
SC LI slip-in cartridges, poppet type 32, 33, 42, 43

1 = poppet type 32 and 33
2 = poppet type 42 and 43

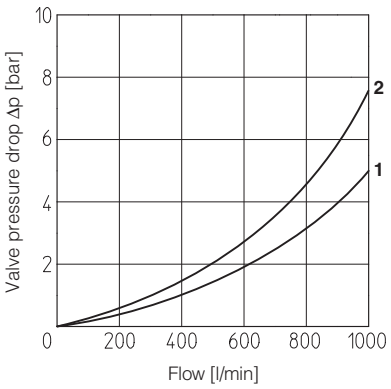
size 16



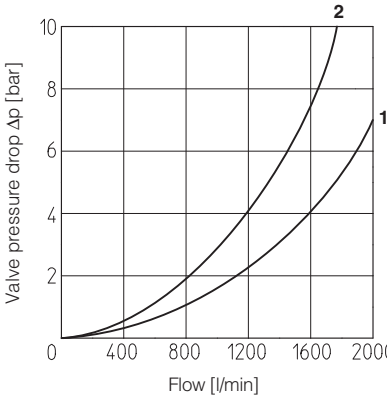
size 25



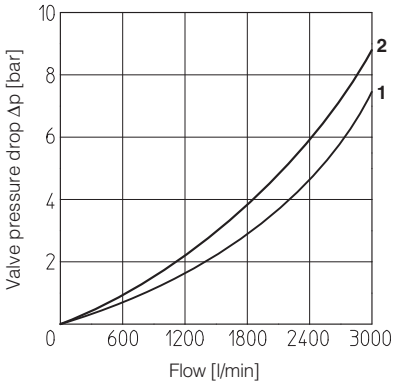
size 32



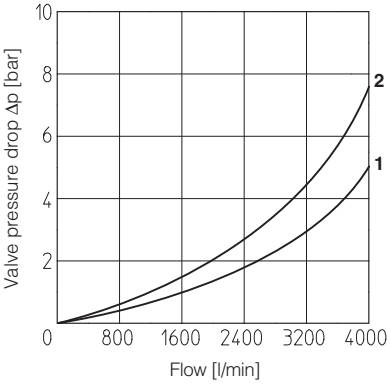
size 40



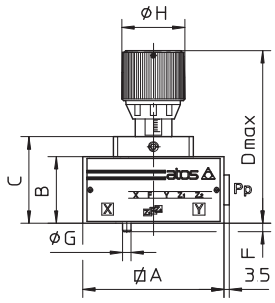
size 50



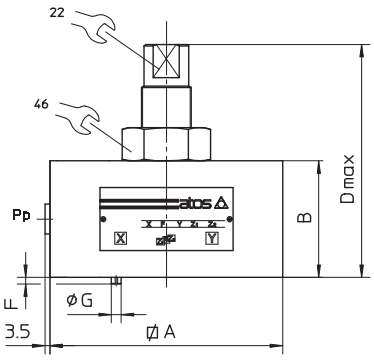
size 63



8 LIDD COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions, see tech. table P006



LIDD (dim. 16...40)



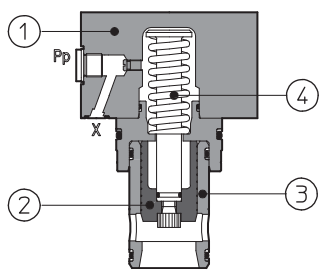
LIDD (size 50 ÷ 63)

Covers	A	B	C	D max	F	G	H	Port Pp	Seals	Fastening bolts (1)	Tightening torque [Nm]	Mass [Kg]
LIDD-1	65	40	52	104	4	3	38	G1/4	2 OR 108	Nr. 4 M8x45	35	2
LIDD-2	85	40	52	104	6	5	38	G1/4	2 OR 108	Nr. 4 M12x45	125	2,4
LIDD-3	100	50	75	156	6	5	50	G1/4	2 OR 2043	Nr. 4 M16x55	300	2,8
LIDD-4	125	60	85	166	6	5	50	G1/4	2 OR 3043	Nr. 4 M20x70	600	6,7
LIDD-5	140	70	-	140	4	6	-	G1/4	2 OR 3043	Nr. 4 M20x80	600	9,8
LIDD-6	180	80	-	151	4	6	-	G3/8	2 OR 3050	Nr. 4 M30x90	2100	17,5

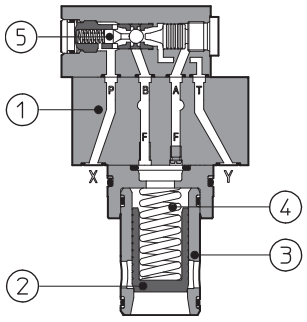
(1) Hexagon socket head screw according to DIN 912 class 12.9

ISO cartridge valves type LID*

Check function, high flow, **Pmax 420 bar**



LIDO-3



LIDR-3

① Functional cover
② Poppet
③ Sleeve
④ Spring
⑤ Pilot operated check valve

Directional control valves in ISO cartridge design, specific for check functions.
They are made by a functional cover ① and a 2-way **SC LI** slip-in cartridge.

Covers are available with different check functions:
LIDA, normally closed
LIDO, normally open
LIDB, normally closed with shuttle valve for pilot pressure selection
LIDR, normally closed with pilot operated check valve

The SC LI slip-in cartridge is available with different poppet shape to optimize the check control, see section 6.

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position (open position for type 62 and 63) by the spring ④ available with different cracking pressure values.

Size: **16 to 100** ISO 7368
Max flow up to **9000 l/min** at Δp = 5 bar
Max pressure up to **420 bar**

1 MODEL CODE OF FUNCTIONAL COVERS - for model code of slip-in cartridge, see section 5, 7

LI	D	A	-	1	/	*	**	/	**	*

LI: Cover according to ISO 7368

D = directional function

Cover configuration see section 2:
A = normally closed;
O = normally open;
B = with shuttle valve for pilot selection;
R = with hydraulically operated pilot check valve;

Size:
1 = 16; **4** = 40; **8** = 80 (only for LIDA)
2 = 25; **5** = 50; **10** = 100 (only for LIDA)
3 = 32; **6** = 63 (not for LIDO)
LIDO is available only in sizes 16 to 50

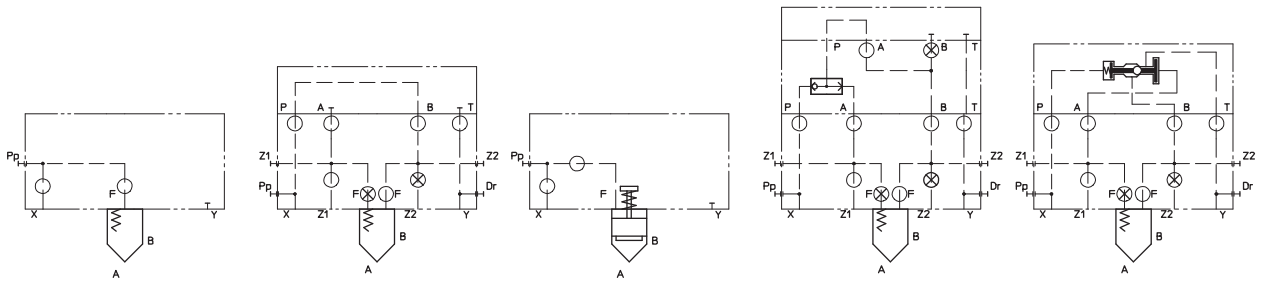
Options: see section 3

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

Optional different setting of calibrated plugs in the pilot channels, see section 3, 4

2 HYDRAULIC SYMBOLS (cover configuration)



LIDA size 16…25 | **LIDA** size 32…100 | **LIDO** size 16…50 | **LIDB** size 16…63 | **LIDR** size 16…63

3 OPTIONS

For LIDA (sizes 16 and 25), for LIDO (all sizes) LIDB (sizes 40 ÷ 63), LIDR (sizes 40 ÷ 63):
/E = with external attachments Pp and underneath port X supplied plugged;
For LIDA, LIDB, LIDR:
/F = prearranged for coupling to an intermediate element with position detector for safety valves, see tab. EY120.
For all models:
******* = Calibrated plugs different from standard ones reported in section 4. The restrictors configuration (if different from the standard) it must be indicated at the end of the model code:

LIDB	-	4	/E	**

P
Channel where the restrictor has to be provided: **P** = channel X, port P **Z1** = channel Z1 **F** = channel F **Z2** = channel Z2

06
Size of the throttling hole in tenths of millimiters: **05** = 0,5 mm **10** = 1 mm **17** = 1,7 mm **06** = 0,6 mm **12** = 1,2 mm **20** = 2 mm **08** = 0,8 mm **15** = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Port \ Cover	LIDA-1	LIDO-1	LIDB-1	LIDR-1	LIDA-2	LIDO-2	LIDB-2	LIDR-2	LIDA-3	LIDO-3	LIDB-3	LIDR-3	LIDA-4	LIDO-4	LIDB-4	LIDR-4	LIDA-5	LIDO-5	LIDB-5	LIDR-5	LIDA-6	LIDB-6	LIDR-6	LIDA-8	LIDA-10
X	- -	v	- -	- -	- -	M4 10A	- -	- -	- -	M6 12A	- -	- -	- -	M6 15F	- -	- -	- -	M6 15F	- -	- -	- -	- -	- -	- -	- -
P	- -	- -	- -	M6 12A	- -	- -	- -	M6 12A	- -	- -	- -	M6 15A	- -	- -	- -	M6 17A	- -	- -	- -	M6 20A	- -	- -	M6 20A	- -	- -
Z2	- -	- -	- -	M4 100F	- -	- -	- -	M6 300F	- -	- -	- -	M6 300F	- -	- -	- -	M6 300F	- -	- -	- -	M6 300F	- -	- -	M6 300F	- -	- -

M4 ÷ M6 = screw size **10A ÷ 300F** = calibrated orifices diameters in tenths oh mm; **A** = short calibrated hole, **F** = long calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES

SC LI	-	16	43	1	40	/	*

Cartridge according to ISO 7368

Size, the same of relevant cover:
16 25 32 40 50 63 80 100

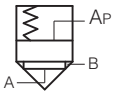
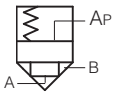
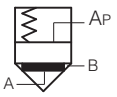
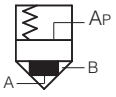
Type of poppet (not for LIDO)
32, 33 (size 16 to 100) = without damping nose
42 (size 16 to 80) = as 32 but with damping nose
43 (size 16 to 100) = as 33 but with damping nose

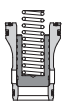
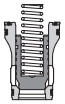
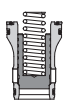
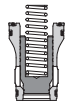
Spring cracking pressure:
1 = 0,3 bar for poppet 32, 42
1 = 0,6 bar for poppet 33, 43
2 = 1,5 bar for poppet 32, 42
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

6 TYPE OF POPPET

Type of poppet	**32**	**33**	**42**	**43**
Functional sketch (Hydraulic symbol)				

Operating pressure		**420 bar max**			
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 10	Size **16**	270	270	240	240
	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
	80	5500	5500	4000	4000
	100	9000	9000	-	6300
Typical section					
Area ratio A:Ap		**1:1,1**	**1:1,5**	**1:1,1**	**1:1,5**
Cracking pressure A→B	Spring **1**	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	2,5 bar	3 bar	2,5 bar
	6	6 bar	6 bar	6 bar	6 bar
Cracking pressure B→A	Spring **1**	3 bar	0,9 bar	3 bar	0,9 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	3,8 bar	32,5 bar	3,8 bar
	6	59,4 bar	9 bar	59,4 bar	9 bar

7 MODEL CODE OF SLIP-IN CARTRIDGES type 52, 62, 63 for LIDA and LIDO

SC LI	-	16	52	1	**	/*

Cartridge according to ISO 7368

Size, the same of relevant cover:
16 **25** **32** **40** **50**

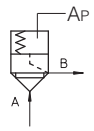
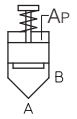
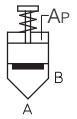
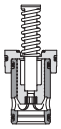
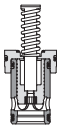
Type of poppet:
52 = normally closed, only for LIDA;
62 = normally open without damping nose, only for LIDO;
63 = normally open with damping nose, only for LIDO

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

Spring cracking pressure:
1 = 0,3 bar for poppet 52;
2 = 1,5 bar for poppet 52;
3 = 3 bar for all poppets
6 = 5,5 bar for all poppets

8 TYPICAL FUNCTIONS OF POPPETS

Type of poppet		52	62	63
Operating pressure		**420 bar**		
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 10	Size **16**	160		
	25	400		
	32	600		
	40	1200		
	50	1800		
Functional sketch (Hydraulic symbol)				
Typical section				
Area ratio A:AP		**1 : 1,1**	**1 : 1,1**	**1 : 1,1**
Cracking pressure A→B (1)	Spring **1**	0,3 bar	-	-
	2	1,5 bar	-	-
	3	3 bar	-	-
	6	6 bar	-	-

(1) Depending on the spring cracking pressure and the area ratio of the poppet

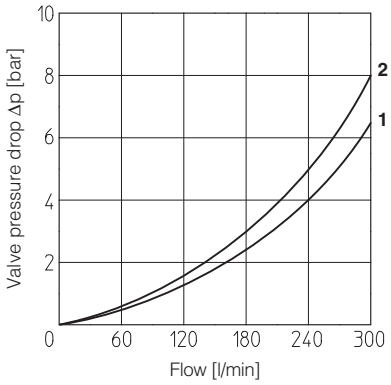
9 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	**Standard** execution = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Functional cover operating pressure	Ports P, A, B, X, Z1, Z2: **420** bar		

10 **Q/ΔP DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

10.1 SC LI slip-in cartridges, poppet type 32, 33, 42, 43

size 16



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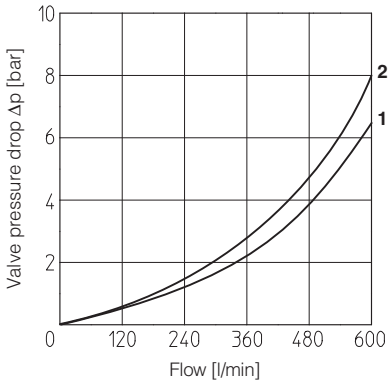

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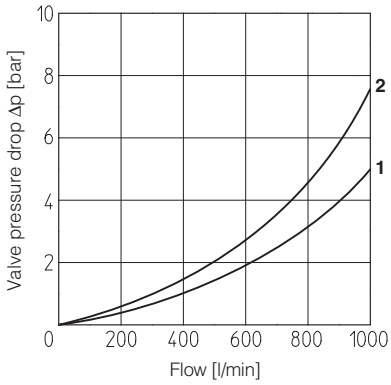
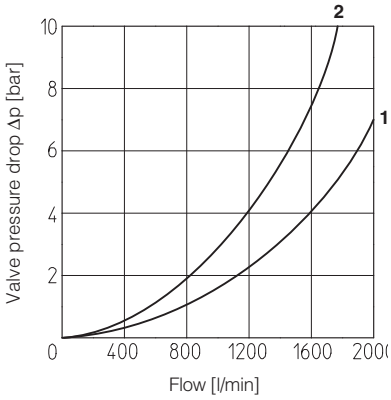
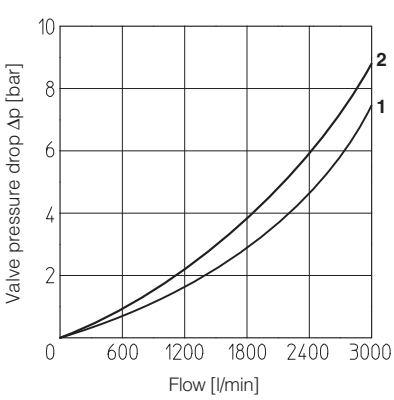


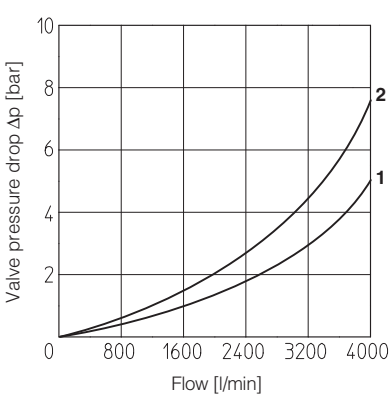
size 40



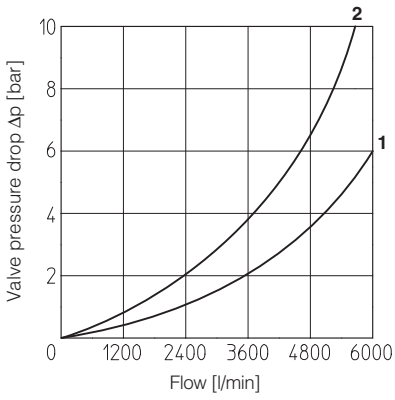
size 50



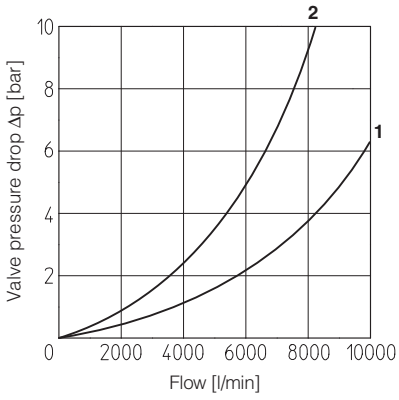
size 63



size 80



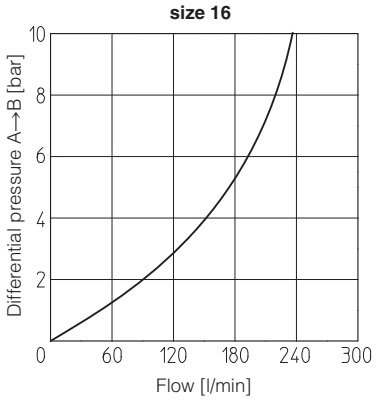
size 100

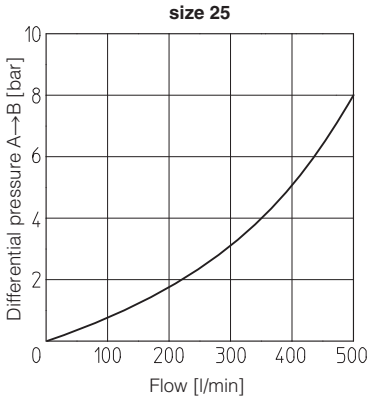


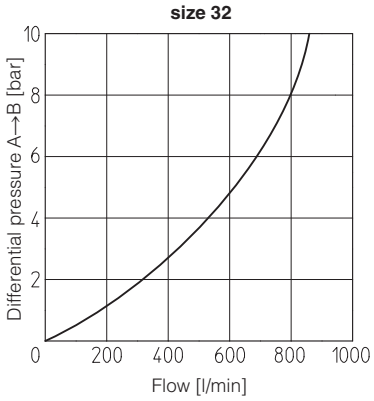
High flow - series 40

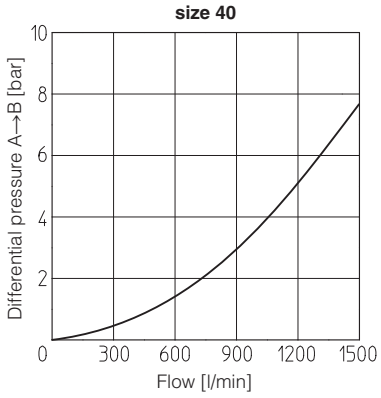
1 = poppet type 32 and 33
2 = poppet type 42 and 43

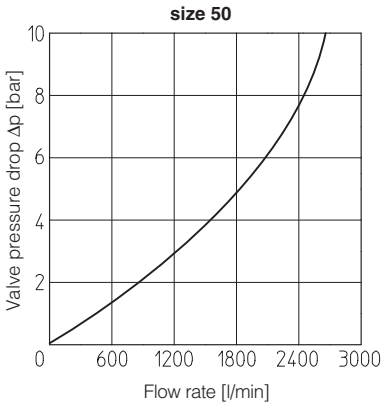
10.2 SC LI slip-in cartridges, poppet type 52, 62, 63





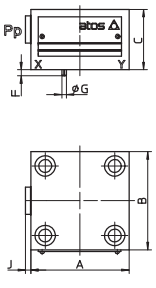




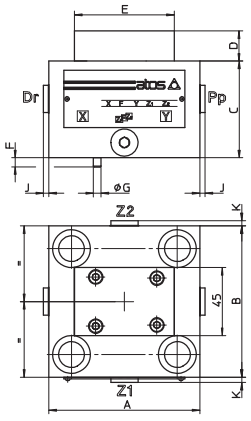


11 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions, see tech. table P006

LIDA



LIDA (size 16 ÷ 25)
LIDO (size 16…50)

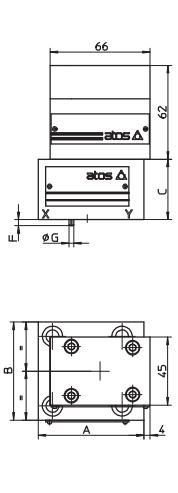


LIDA (size 32…100)
Note: for LIDA-80 and LIDA-100 the cover has round shape

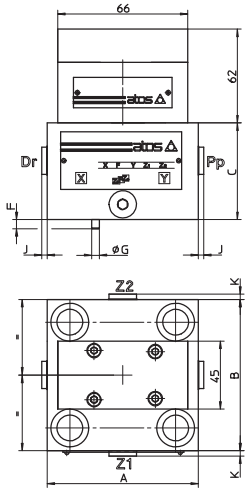
Covers (1)	A	B	C	D	E	F	G	K	J	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (3)	Tightening torque [Nm]	Mass [Kg]
LIDA-1 **LIDO-1**	65	65	40	-	-	4	3	-	3,5	G 1/4	-	2 OR-108 1 OR-108 (2)	Nr. 4 M8x45	35	1,4
LIDA-2 **LIDO-2**	85	85	40	-	-	6	5	-	3,5	G 1/4	-	2 OR-108 1 OR-108 (2)	Nr. 4 M12x45 (4)	125	1,8
LIDA-3 **LIDO-3**	100	100	50 60 (2)	20	66	6	5	-	- 3,5	G 1/4	-	4 OR-2043 1 OR-2043 (2)	Nr. 4 M16x55 (5)	300	2,3
LIDA-4 **LIDO-4**	125	125	60 100	20 -	66 -	6	5	-	3,5 3,5	G 1/4	-	4 OR-3043 1 OR-3043	Nr. 4 M20x70 (6)	600	6,2
LIDA-5 **LIDO-5**	140	140	70 110 (2)	20	66	4	6	3,5	3,5	G 1/4	G 1/4	4 OR-3043 1 OR-3043 (2)	Nr. 4 M20x80 (7)	600	9,3
LIDA-6	180	180	80	20	66	4	6	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	17,1
LIDA-8	Ø 250	-	80	30	73	6	8	3,5	3,5	G 3/8	G 3/8	4 OR-4075	Nr. 8 M24x90	1000	27
LIDA-10	Ø 300	-	150	30	73	8	10	3,5	3,5	G 1/2	G 1/2	4 OR-4093	Nr. 8 M30x120	2100	54

(1) For LIDO-2: the external attachment Pp is located at Y port side of the cover;
(2) Only for LIDO;
(3) Hexagon socket head screw according to DIN 912 class 12.9
(4) M12x50 for LIDO-2;
(5) M16x60 for LIDO-3;
(6) M20x100 for LIDO-4;
(7) M20x110 for LIDO-5;

LIDB



LIDB (size 16)

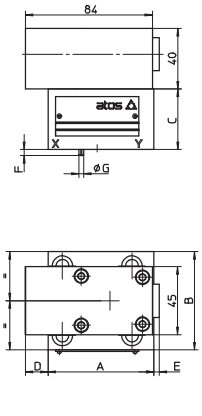


LIDB (size 25…63)

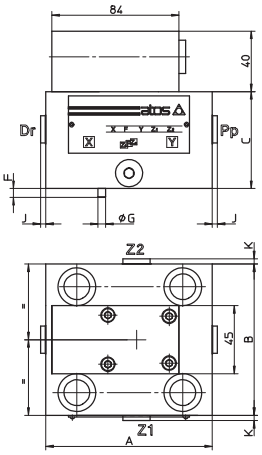
Covers	A	B	C	F	G	J	K	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIDB-1	70	65	40	4	3	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	2,2
LIDB-2	85	85	40	6	5	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	2,6
LIDB-3	100	100	50	6	5	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	3,1
LIDB-4	125	125	60	6	5	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7
LIDB-5	140	140	70	4	6	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,1
LIDB-6 (1)	180	180	80	4	6	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	17,9

(1) The position of external attachments Pp, Dr, Z1 and Z2 are inverted each others respect to the showed sketch
(2) Hexagon socket head screw according to DIN 912 class 12.9

LIDR



LIDR (size 16…32)



LIDR (size 40…63)

Covers	A	B	C	D	E	F	G	J	K	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIDR-1	70	65	40	4	3,5	4	3	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	2,5
LIDR-2	85	85	40	13,5	-	6	5	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	2,9
LIDR-3	100	100	50	6	-	6	5	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	3,4
LIDR-4	125	125	60	-	-	6	5	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7,3
LIDR-5	140	140	70	-	-	4	6	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,4
LIDR-6 (1)	180	180	80	-	-	4	6	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	18,3

(1) The position of external attachments Pp, Dr, Z1 and Z2 are inverted each others respect to the showed sketch
(2) Hexagon socket head screw according to DIN 912 class 12.9

4 PUMPS

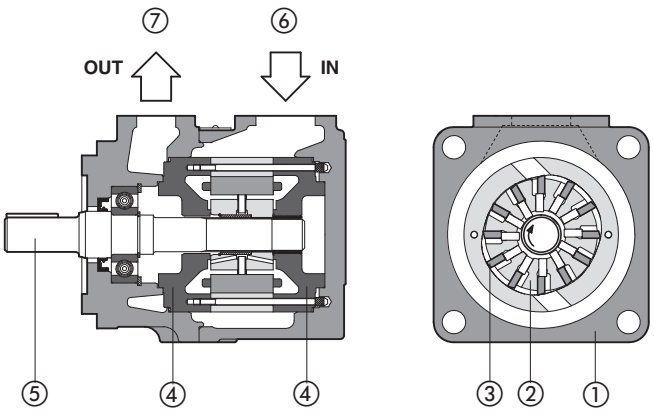
INDEX

PUMPS

Supplementary components range available on **www.atos.com**

Vane pumps type PFE-31, PFE-41, PFE-51

fixed displacement - cartridge design



① body
②③ rotor with vanes
④ balanced plates
⑤ shaft
⑥ inlet port
⑦ outlet port

PFE-41

PFE-*1 are fixed displacement-twelve-vane pumps, ② ③ cartridge design with integral hydraulic balancing ④ for high pressure operation, long service life and low noise level.

They are available in three different sizes with max displacements up to 44, 85 and 150 cm³/rev and single, multiple or with through-shaft configurations.

Mounting flange according to SAE J744 standard.

Inlet and outlet ports can be oriented in four different positions to match any installation requirement.

Simplified maintenance as the pumping cartridge can be easily replaced.

Max pressure 210 bar.

1 MODEL CODE

PFE	X2	-	31	036	/	31028	/	1	D	T	*	/	*

Fixed displacement vane pump

Additional suffix for multiple pumps:
X2 = double pump composed of single vane pumps
X3 = triple pump composed of single vane pumps

Eventual suffix for pumps with through shaft:
XA = for coupling one PFE-31
XB = for coupling one PFE-41 (only for PFE-41 and PFE-51)
XC = for coupling one PFE-51 (only for PFE-51)
XO = with through shaft, without rear flange
Note: mulitple pumps are assembled in decreasing order of size. See also tab. A190.

Size, see section 2:
31, 41, 51

Displacement [cm³/rev], see section 2
for PFE 31: **010, 016, 022, 028, 036, 044**
for PFE 41: **029, 037, 045, 056, 070, 085**
for PFE 51: **090, 110, 129, 150**

Only for multiple pumps PFEX*: type of second (and third) pump

Drive shaft, see section 6 and 7:

cylindrical, keyed for single and multiple pump (only first position)
1 = standard
2 = long version (only for PFE-41 and PFE-51)
3 = for high torque applications

splined
5 = for single and multiple pumps (any position)
6 = for single and multiple pumps (only first position)
7 = for second and third position in multiple pumps
} only for PFE-31 and PFE-41

Direction of rotation (viewed from the shaft end):
D = clockwise (supplied standard if not otherwise specified)
S = counterclockwise
Note: PFE are not reversible

Port orientation, see section 5:
T = standard
U, V, W = on request

Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FPM

2 OPERATING CHARACTERISTICS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

Model	Displacement cm³/rev	Max pressure (1)	Speed range rpm (2)	7 bar (3) l/min	kW	70 bar (3) l/min	kW	140 bar (3) l/min	kW	210 bar (3) l/min	kW
PFE-31010	10,5	160	800-2400	15	0,2	13,5	2	12	5	-	-
PFE-31016	16,5	210 bar	800-2800	23	0,5	21	3	19	5	16	8,3
PFE-31022	21,6			30	0,6	28	4	26	7	23	10,8
PFE-31028	28,1			40	0,8	38	5,5	36	10	33	14
PFE-31036	35,6			51	1	49	7	46	12,5	43	17,8
PFE-31044	43,7		800-2500	63	1,3	61	8	58	15,5	55	22
PFE-41029	29,3			41	0,8	39	5,5	37	10	34	14,7
PFE-41037	36,6			52	1	50	7	48	12,5	45	18,3
PFE-41045	45,0			64	1,3	62	8,5	60	16	57	22,6
PFE-41056	55,8			80	1,6	78	11	75	21	72	28
PFE-41070	69,9			101	2	98	13,5	95	26	91	35
PFE-41085	85,3		800-2000	124	2,4	121	16	118	32	114	43
PFE-51090	90,0		800-2200	128	2,7	124	17	119	33	114	45
PFE-51110	109,6			157	3,2	152	21	147	40	141	55
PFE-51129	129,2			186	3,7	180	25	174	47	168	65
PFE-51150	150,2		800-1800	215	4,2	211	29	204	55	197	75

(1) Max pressure is 160 bar for /PE version and water glycol fluid
(2) Max speed is 1800 rpm for /PE versions; 1500 rpm for water glycol fluid
(3) Flow rate and power consumption are proportional to the rotation speed, see section 4

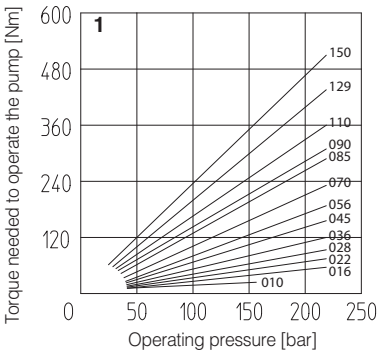
3 MAIN CHARACTERISTICS OF VANE PUMPS TYPE PFE-*1

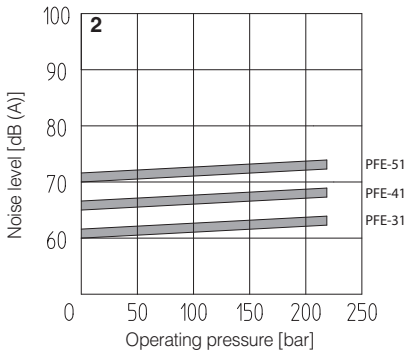
Installation position		Any position	
Loads on the shaft		Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.	
Ambient temperature		**Standard** = -25°C ÷ +80°C **/PE** option -15°C ÷ +80°C	
Fluid		Hydraulic oil as per DIN 51524...535; for other fluids see section 1	
Recommended viscosity		max at cold start: 800 mm²/s; max at full power 100 mm²/s; during operation 24 mm²/s; min at full power 10 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	
Fluid temperature		-20°C +60°C -20°C +50°C (water glycol) -20°C +80°C (/PE seals)	
Recommended pressure on inlet port		from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm	
Compliance		RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006	

4 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

1 = Torque versus pressure diagram

2 = Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm.

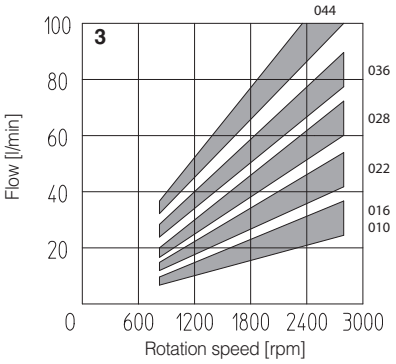


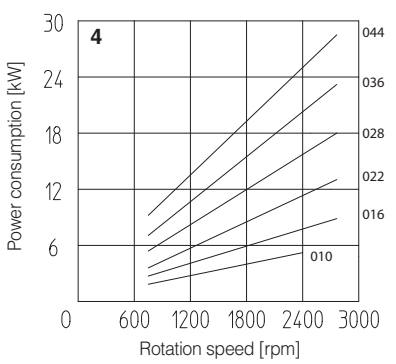


PFE-31:

3 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

4 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

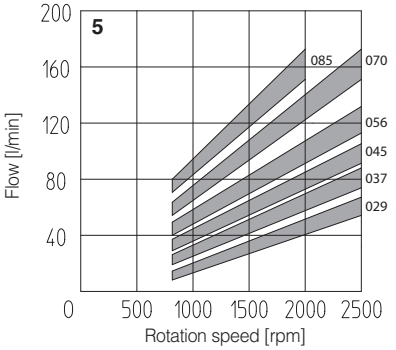


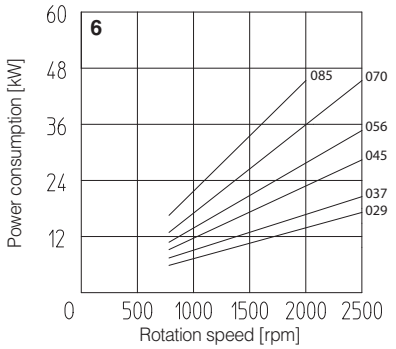


PFE-41:

5 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

6 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

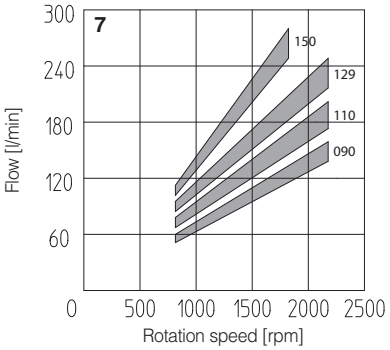


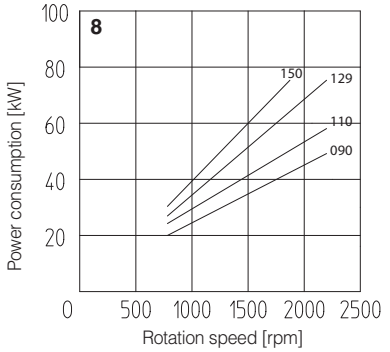


PFE-51:

7 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

8 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.



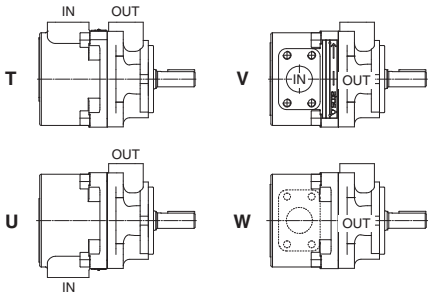


5 PORT ORIENTATION

Single pumps can be supplied with oil ports oriented in different configuration in relation to the drive shaft, as follows (wiewed from the shaft end);

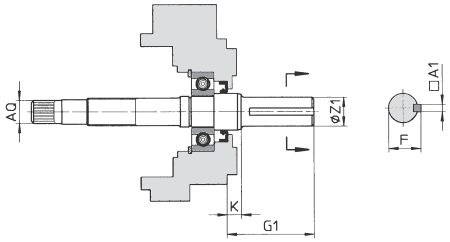
T = inlet and outlet ports on the same axis (standard)
U = outlet orientated 180° with respect to the inlet
V = outlet oriented 90° with respect to the inlet
W = outlet oriented 270° with respect to the inlet

In multiple pumps inlet ports and outlet ports are in line.
Ports orientation can be easily changed by rotating the pump body that carries inlet port.



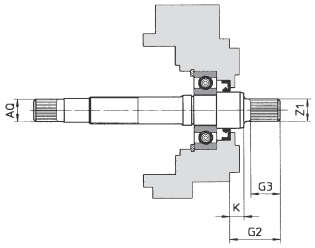
6 DRIVE SHAFT

CYLINDRICAL SHAFT KEYED
1 = for single and multiple pumps (only first position) supplied as standard if not specified in the model code
2 = for single and multiple pumps (only first position) long version (only for PFE-41 and PFE-51)
3 = for single and multiple pumps (only first position) for high torque applications



Model	Keyed shaft type 1 (standard)						Keyed shaft type 2						Keyed shaft type 3					
	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ
PFE-31	4,78	21,11	56,00	8,00	19,05	SAE 16/32-9T	–	–	–	–	–	–	4,78	24,54	56,00	8,00	22,22	SAE 16/32-9T
	4,75	20,94			19,00								4,75	24,41			22,20	
PFE-41	4,78	24,54	59,00	11,40	22,22	SAE 32/64-24T	6,36	25,03	71,00	8,00	22,22	SAE 32/64-24T	6,38	28,30	78,00	11,40	25,38	SAE 32/64-24T
	4,75	24,41			22,20		6,35	24,77			22,20		6,35	28,10			25,36	
PFE-51	7,97	35,33	73,00	14	31,75	SAE 16/32-13T	7,95	35,33	84,00	8,10	31,75	SAE 16/32-13T	7,97	38,58	84,00	14	34,90	SAE 16/32-13T
	7,94	35,07			31,70		7,94	35,07			31,70		7,94	38,46			34,88	

SPLINED SHAFT
5 = for single and multiple pumps (any position)
for PFE-31 according to SAE A 16/32 DP, 9 teeth;
for PFE-41 according to SAE B 16/32 DP, 13 teeth;
for PFE-51 according to SAE C 12/24 DP, 14 teeth;
6 = for single and multiple pumps (only first position)
for PFE-31 and PFEX*-31 according to SAE B 16/32 DP, 13 teeth;
for PFE-41 and PFEX*-41 according to SAE C 12/24 DP, 14 teeth;
7 = for second and third position pump in multiple configuration:
for PFEX*-31 according to SAE B 16/32 DP, 13 teeth;
for PFEX*-41 according to SAE C 12/24 DP, 14 teeth;



Model	Splined shaft type 5					Splined shaft type 6					Splined shaft type 7				
	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ
PFE-31	32,00	19,50	6,50	SAE 16/32-9T	SAE 16/32-9T	41,00	28	8,00	SAE 16/32-13T	SAE 16/32-9T	32,00	19	8,00	SAE 16/32-13T	SAE 16/32-9T
PFE-41	41,25	28	8,00	SAE 16/32-13T	SAE 32/64-24T	55,60	42	8,00	SAE 12/24-14T	SAE 32/64-24T	41,60	28	8,00	SAE 12/24-14T	SAE 32/64-24T
PFE-51	56,00	42	8,10	SAE 12/24-14T	SAE 16/32-13T	–	–	–	–	–	–	–	–	–	–

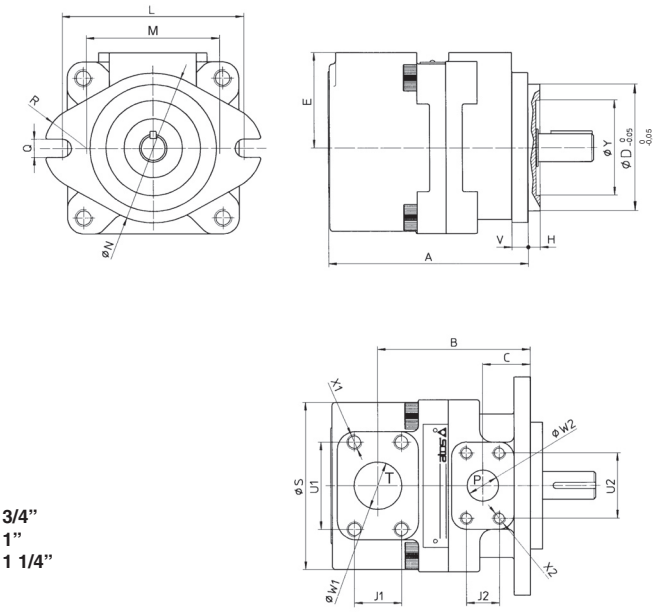
7 LIMITS OF SHAFT TORQUE

Pump model	Maximum driving torque [Nm]						Maximum torque available at the end of the through shaft [Nm]
	Shaft type 1	Shaft type 2	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7	Any type of shaft
PFE-31	160	–	240	110	240	240	130
PFE-41	250	250	400	200	400	400	250
PFE-51	500	500	850	450	–	–	400

The values of torque required to operate the pumps are shown for each type on the “torque versus pressure” diagram at section 4.
In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

8 DIMENSIONS OF SINGLE PUMPS [mm]

T = inlet port
P = outlet port



SAE FLANGES
PFE-31: port **T = 1 1/4"**; port **P = 3/4"**
PFE-41: port **T = 1 1/2"**; port **P = 1"**
PFE-51: port **T = 2**; port **P = 1 1/4"**

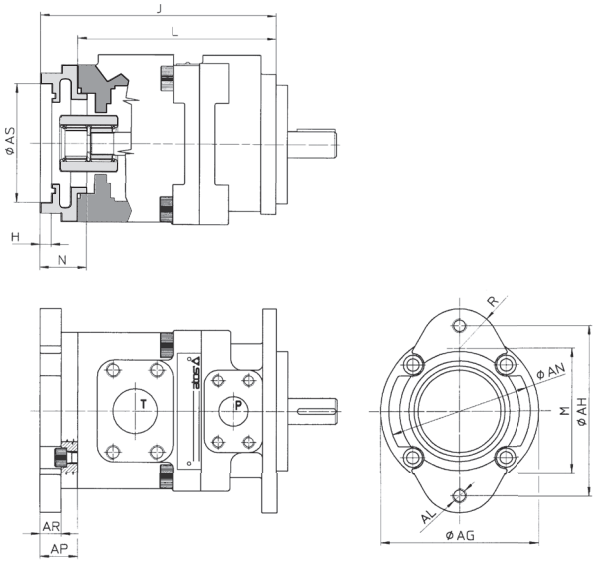
SAE flanges can be supplied with the pump

Mass:
PFE-31 = 9 kg
PFE-41 = 14 kg
PFE-51 = 25,5 kg

Model	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFE-31	136	100	28	82,55	70	6,4	106	73	95	11,1	28,5
PFE-41	160	120	38	101,6	76,2	9,7	146	107	120	14,3	34
PFE-51	186,5	125	38	127	82,6	12,7	181	143,5	148	17,5	35
Model	**ØS**	**U1**	**U2**	**V**	**ØW1**	**ØW2**	**J1**	**J2**	**X1**	**X2**	**ØY**
PFE-31	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFE-41	134	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFE-51	160	77,8	58	15	51	32	42,9	30,2	M12X20	M10X20	76

9 DIMENSIONS OF PUMPS WITH THROUGH-SHAFT (FOR MULTIPLE PUMPS) [mm]

T = inlet port
P = outlet port



SAE FLANGES
PFEX-31: port **T = 1 1/4"**; port **P = 3/4"**
PFEX-41: port **T = 1 1/2"**; port **P = 1"**
PFEX-51: port **T = 2**; port **P = 1 1/4"**

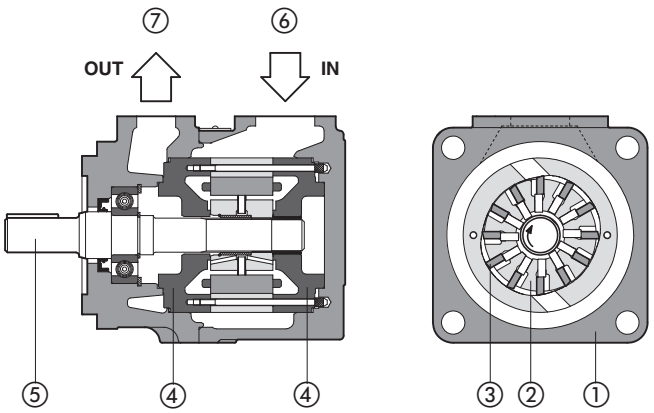
For other dimensions, see section 8

Model	Ø AG	Ø AH	AL	Tightening torque (Nm)(1)	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEXA-31	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	165,5	132,5	79	32	28,5
PFEXA-41	134	106	M10X17	70	95	23	11	82,57 82,63	6,42 6,47	194	171	73	32	28,5
PFEXB-41	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	41	34
PFEXA-51	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	32	28,5
PFEXB-51	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	41	34
PFEXC-51	134	181	M16	300	148	46,5	30,7	127,02 127,02	12,73 12,78	230	183,5	143,5	56	35

(1) Tightening torque for screw class 12.9

Vane pumps type PFE-32, PFE-42, PFE-52

fixed displacement - cartridge design - high pressure and low noise level execution



① body
②③ rotor with vanes
④ balanced plates
⑤ shaft
⑥ inlet port
⑦ outlet port

PFE-42

New PFE-*2 are fixed displacement -twelve-vanes pumps ②③, cartridge design with integral hydraulic balancing ④ for high pressure operation and long service life with further reduction of noise level compared with PFE-*1.

These pumps are available as single, multiple or with through-shaft configuration.
Mounting flange according to SAE J744 standard.
Easy installation as inlet and outlet ports can be assembled in any of four relative positions.
Easy maintenance as the pumping cartridge can be replaced in a few minutes.

Three different sizes with max displacements up to 36, 85 and 150 cm³/rev.
Max pressures up to 300 bar.

1 MODEL CODE

PFE	X2	-	42	045	/	31028	/	3	D	T	*	/	*

PFE: Fixed displacement vane pump

X2: Additional suffix for multiple pumps:
X2 = double pump composed of single vane pumps
X3 = triple pump composed of single vane pumps
Additional suffix for pumps with through shaft:
XA = for coupling one PFE-31
XB = for coupling one PFE-41 (only for PFE-42 and PFE-52)
XC = for coupling one PFE-51 (only for PFE-52)
XO = with through shaft, without rear flange
Note: mulitple pumps are assembled in decreasing order of size. See also tab. A190.

42: Size, see section 2:
32, 42, 52

045: Displacement [cm³/rev], see section 2
for PFE 32: **016, 022, 028, 036**
for PFE 42: **045, 056, 070, 085**
for PFE 52: **090, 110, 129, 150**

31028: Only for multiple pumps PFEX*: type of second (and third) pump

3: Drive shaft, see section 6 and 7:
cylindrical, keyed for single and multiple pump (only first position)
3 = for high torque applications
splined
5 = for single and multiple pumps (any position)
6 = for single and multiple pumps (only first position)
7 = for second and third position in multiple pumps
} only for PFE-32 and PFE-42

D: Direction of rotation (viewed from the shaft end):
D = clockwise (supplied standard if not otherwise specified)
S = counterclockwise
Note: PFE are not reversible and it is therefore necessary to specify the desired direction of rotation

T: Port orientation, see section 5:
T = standard
U, V, W = on request

*****: Series number

*****: Seals material:
omit for NBR (mineral oil & water glycol)
PE = FPM

2 OPERATING CHARACTERISTICS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

Model	Displacement cm³/rev	Max pressure (1)	Speed range rpm (2)	7 bar (3)		140 bar (3)		at max. pressure (3)	
				l/min	kW	l/min	kW	l/min	kW
PFE-32016	16,5	210 bar	1000-2500	23	0,35	20	6	16	10
PFE-32022	21,6	300 bar	1200-2500	30	0,6	26	7	20	16
PFE-32028	28,1			40	0,8	36	10	30	20
PFE-32036	35,6			51	1	46	12,5	40	26
PFE-42045	45	280 bar	1000-2200	64	1,3	60	16	56	31
PFE-42056	55,8			80	1,6	75	21	70	40
PFE-42070	69,9	250 bar		101	2	95	26	90	42
PFE-42085	85,3	210 bar	800-2000	124	2,4	118	32	114	43
PFE-52090	90	250 bar	1000-2000	128	2,7	119	33	111	54
PFE-52110	109,6			157	3,2	147	40	138	66
PFE-52129	129,2			186	3,7	174	47	163	78
PFE-52150	150,2	210 bar	800-1800	215	4,2	204	55	197	80

(1) Max pressure is 160 bar for /PE version and water glycol fluid
(2) Max speed is 1800 rpm for /PE versions; 1500 rpm for water glycol fluid
(3) Flow rate and power consumption are proportional to the rotation speed

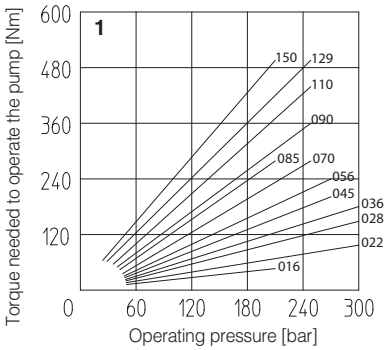
3 MAIN CHARACTERISTICS OF VANE PUMPS TYPE PFE-*2

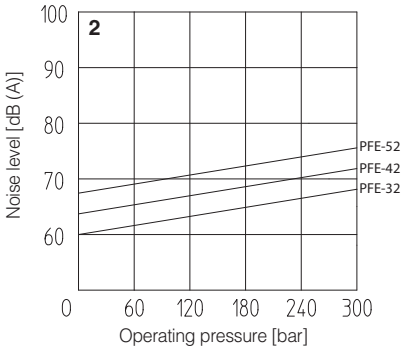
Installation position		Any position	
Loads on the shaft		Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.	
Ambient temperature		**Standard** = -25°C ÷ +80°C **/PE** option -15°C ÷ +80°C	
Fluid		Hydraulic oil as per DIN 51524...535; for other fluids see section 1	
Recommended viscosity		max at cold start: 800 mm²/s; max at full power 100 mm²/s; during operation 24 mm²/s; min at full power 10 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	
Fluid temperature		-20°C +60°C -20°C +50°C (water glycol) -20°C +80°C (/PE seals)	
Recommended pressure on inlet port		from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm	
Compliance		RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006	

4 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

1 = Torque versus pressure diagram

2 = Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm.

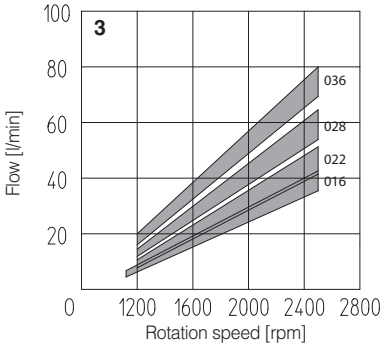


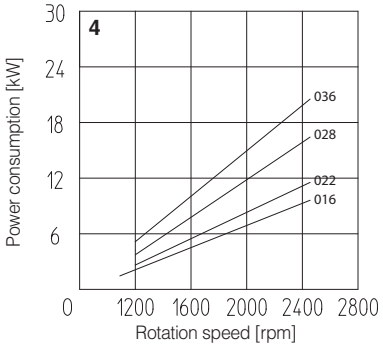


PFE-32:

3 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

4 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

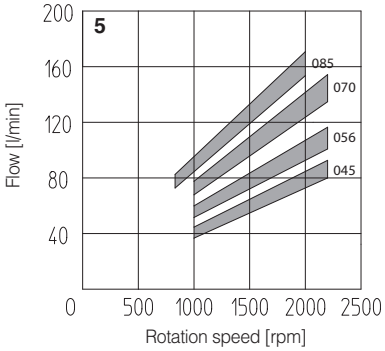


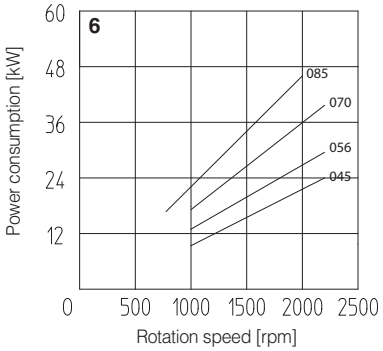


PFE-42:

5 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

6 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

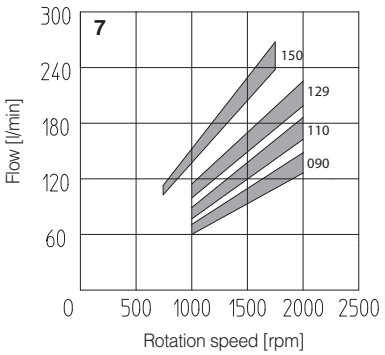


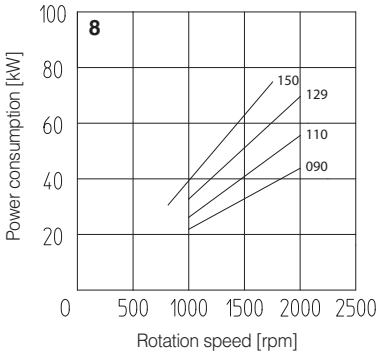


PFE-52:

7 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

8 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.



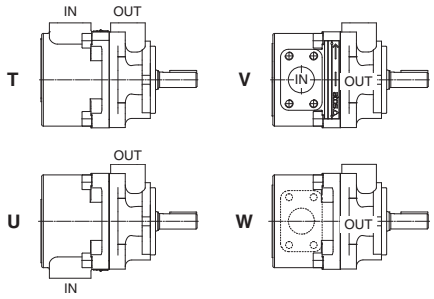


5 PORT ORIENTATION

Single pumps can be supplied with oil ports oriented in different configuration in relation to the drive shaft, as follows (wiewed from the shaft end);

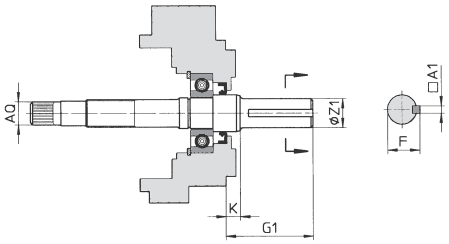
T = inlet and outlet ports on the same axis (standard)
U = outlet orientated 180° with respect to the inlet
V = outlet oriented 90° with respect to the inlet
W = outlet oriented 270° with respect to the inlet

In multiple pumps inlet ports and outlet ports are in line.
Ports orientation can be easily changed by rotating the pump body that carries inlet port.



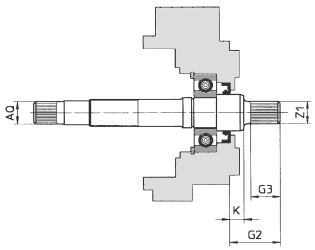
6 DRIVE SHAFT

CYLINDRICAL KEYED SHAFT
3 = for single and multiple pumps (only first position)
for high torque applications



Model	Keyed shaft type 3					
	A1	F	G1	K	ØZ1	Only for through shaft execution Ø AQ
PFE-32	4,78	24,54	56,00	8,00	22,22	SAE 16/32-9T
	4,75	24,41			22,20	
PFE-42	6,38	28,30	78,00	11,40	25,38	SAE 32/64-24T
	6,35	28,10			25,35	
PFE-52	7,97	38,58	84,00	14	34,90	SAE 16/32-13T
	7,94	38,46			34,88	

SPLINED SHAFT
5 = for single and multiple pumps (any position)
for PFE-32 according to SAE A 16/32 DP, 9 teeth;
for PFE-42 according to SAE B 16/32 DP, 13 teeth;
for PFE-52 according to SAE C 12/24 DP, 14 teeth;
6 = for single and multiple pumps (only first position)
for PFE-32 and PFEX*-32 according to SAE B 16/32 DP, 13 teeth;
for PFE-42 and PFEX*-42 according to SAE C 12/24 DP, 14 teeth;
7 = for second and third position pump in multiple configuration:
for PFEX*-32 according to SAE B 16/32 DP, 13 teeth;
for PFEX*-42 according to SAE C 12/24 DP, 14 teeth;



Model	Splined shaft type 5					Splined shaft type 6					Splined shaft type 7				
	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ	G2	G3	K	Z1	Only for through shaft execution Ø AQ
PFE-32	32,00	19,50	6,50	SAE 16/32-9T	SAE 16/32-9T	41,00	28	8,00	SAE 16/32-13T	SAE 16/32-9T	32,00	19	8,00	SAE 16/32-13T	SAE 16/32-9T
PFE-42	41,25	28	8,00	SAE 16/32-13T	SAE 32/64-24T	55,60	42	8,00	SAE 12/24-14T	SAE 32/64-24T	41,60	28	8,00	SAE 12/24-14T	SAE 32/64-24T
PFE-52	55,60	42	8,10	SAE 12/24-14T	SAE 16/32-13T	–	–	–	–	–	–	–	–	–	–

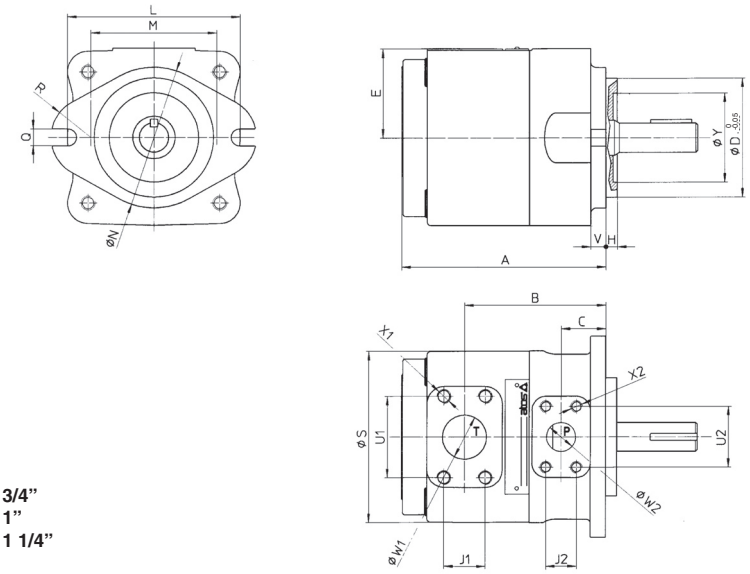
7 LIMITS OF SHAFT TORQUE

Pump model	Maximum driving torque [Nm]				Maximum torque available at the end of the through shaft [Nm]
	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7	Any type of shaft
PFE-32	240	110	240	240	130
PFE-42	400	200	400	400	250
PFE-52	850	450	–	–	400

The values of torque required to operate the pumps are shown for each type on the “torque versus pressure diagram” at section 4.
In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

8 DIMENSIONS OF SINGLE PUMPS [mm]

T = inlet port
P = outlet port



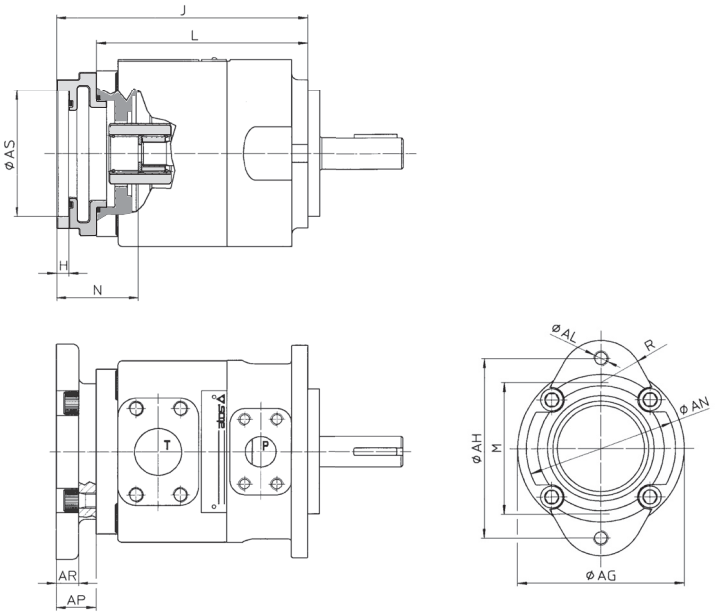
SAE FLANGES
PFE-32: port **T = 1 1/4”**; port **P = 3/4”**
PFE-42: port **T = 1 1/2”**; port **P = 1”**
PFE-52: port **T = 2**; port **P = 1 1/4”**

Mass:
PFE-32 = 9 kg
PFE-42 = 20,5 kg
PFE-52 = 32,1 kg

Model	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFE-32	136	100	28	82,5	70	6,4	106	73	95	11	28,5
PFE-42	175,5	121	38	101,6	78	9,7	146	107	121	14,3	34
PFE-52	189	125	38	127	89	12,7	181	143,5	148	17,5	35
Model	**ØS**	**U1**	**U2**	**V**	**ØW1**	**ØW2**	**J1**	**J2**	**X1**	**X2**	**ØY**
PFE-32	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFE-42	148	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFE-52	174	77,8	58,7	16,3	50	50	42,9	30,2	M12X20	M10X20	76

9 DIMENSIONS OF PUMPS WITH THROUGH-SHAFT (FOR MULTIPLE PUMPS) [mm]

T = inlet port
P = outlet port



SAE FLANGES
PFEX-32: port **T = 1 1/4”**; port **P = 3/4”**
PFEX-42: port **T = 1 1/2”**; port **P = 1”**
PFEX-52: port **T = 2**; port **P = 1 1/4”**

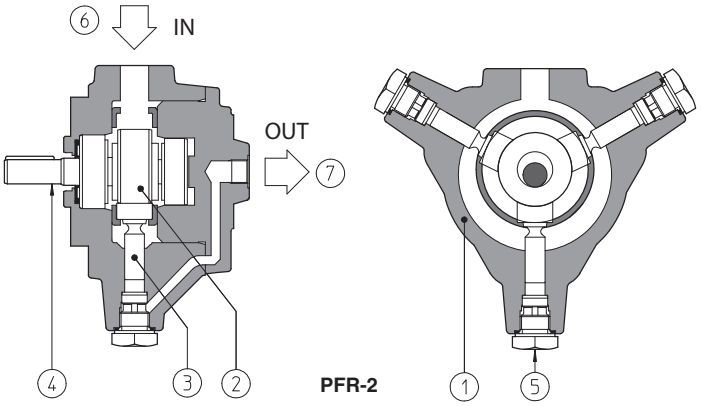
For other dimensions, see section 8

Model	Ø AG	Ø AH	AL	Tightening torque (Nm)(1)	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEXA-32	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	193,7	132,5	79	32	28,5
PFEXA-42	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	194	171	73	34	28,5
PFEXB-42	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	43	34
PFEXA-52	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	34,5	28,5
PFEXB-52	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	43,8	34
PFEXC-52	134	181	M16	300	148	46,7	30,7	127,02 127,02	12,73 12,78	230,2	183,5	143,5	58,5	35

(1) Tightening torque for screw class 12.9

Radial piston pumps type PFR

fixed displacement



① body
② central bearing and return plates
③ radial pistons
④ shaft
⑤ seat of delivery valve
⑥ inlet port
⑦ outlet port

PFR are fixed displacement radial piston pumps with positive drive construction of the pistons ③ (without return spring) for high performance and low noise level.
Suitable for hydraulic oils according to DIN 51524... 535 or synthetic fluids having similar lubricating characteristics.

These pumps are available as single or with through-shaft configuration in order to be coupled to PFE vane pumps, see table A190.

Wide range of displacements from 1,7 up to 25,4 cm³/rev.
Max pressure up to 350/500 bar.

1 MODEL CODE

PFR	XA	-	3	08	**	-	*

PFR: Fixed displacement radial piston pump

XA: Additional suffix for pumps provided to be coupled with vane pump type PFE (tab. A005), see section 9
Only for PFR-3 and PFR-5:
XA = provided (throughgoing shaft, flange and joint) to be coupled with PFE-31
XB = provided (throughgoing shaft, flange and joint) to be coupled with PFE-41
XC = provided (throughgoing shaft, flange and joint) to be coupled with PFE-51
See table A190 for codes of complete multiple pumps: PFR +PFE = PFRX*E

3: Conventional size, see section 2: **2, 3, 5**

08: Displacement [cm³/rev], see section 2
for PFR-2: **02, 03**
for PFR-3: **08, 11, 15**
for PFR-5: **18, 25**

******: Series number

*****: Seals material: omit for NBR (mineral oil & water glycol) **PE** = FPM

2 OPERATING CHARACTERISTICS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

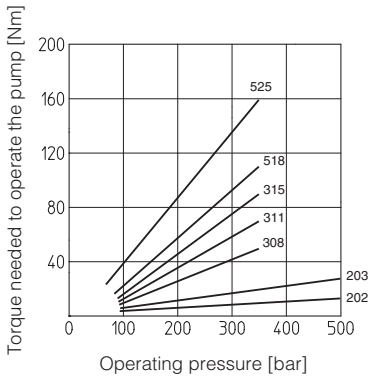
Model	Displacement cm³/rev	Max pressure bar	Speed range rpm	150 bar (3) l/min	kW	250 bar (3) l/min	kW	350 bar (3) l/min	kW	500 bar (3) l/min	kW
PFR-202	1,7	500 (1)	600-1800 (2)	2,4	0,7	2,4	1,1	2,4	1,6	2,4	2,1
PFR-203	3,5			5,0	1,4	5,0	2,2	4,9	3,0	4,9	4,2
PFR-308	8,2	350 (1)		11,8	3,2	11,5	5,6	11,5	7,5	-	-
PFR-311	11,4			16,5	4,5	16,4	7,8	16,2	10	-	-
PFR-315	14,7			21,3	6,3	21,3	10,0	20,9	12,5	-	-
PFR-518	18,1			26	7,7	25,8	12,3	25,6	15,2	-	-
PFR-525	25,4			36,5	11	36	17,3	35,5	21,6	-	-

(1) Max pressure is 250 bar for /PE versions; max pressure is 175 bar for water glycol fluid
(2) Max speed is 1000 rpm for /PE version and for water glycol fluid
(3) Flow rate and power consumption are proportional to rotation speed

3 MAIN CHARACTERISTICS OF FIXED DISPLACEMENT RADIAL PISTON PUMP TYPE PFR

Installation position		Any position. It is advisable to install on the outlet pipe a proper valve for air bleeding. The installation under oil level is recommended. The installation above oil level should be avoided. The shaft of the pump has an eccentric cam which rotates with the shaft generating the stroke of the pistons and thus generating the flow rate. For best functioning a balanced coupling should be provided between the shaft of the motor and the shaft of the pump. See section 10
Commisioning		PFR pumps can be reversed without changing the flow direction. Therefore both directions of rotation are permitted. It is recommend to start the pump by short impulses, with pump case filled and air bleed plugs unlocked. Pumps type PFR-3 and PFR-5 have 2 air bleeds, normally plugged, ports located near to the P ports. To help filling and air bleeding, it could be advisable to install a vertical pipe connected on the intake line, just before the inlet port flange.
Loads on the shaft		Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the developed peak horsepower.
Ambient temperature		**Standard** = -25°C ÷ +80°C **/PE** option -15°C ÷ +80°C
Fluid		Hydraulic oil as per DIN 51524...535; for other fluids see section 1
Recommended viscosity		max at cold start: 800 mm²/s; max at full power 100 mm²/s; during operation 24 mm²/s; min at full power 10 mm²/s
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10 — see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8
Fluid temperature		-20°C +60°C -20°C +50°C (water glycol) -20°C +80°C (/PE seals)
Recommended pressure on inlet port		from -0,1 to 1,5 bar for speed up to 1800 rpm
Compliance		RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

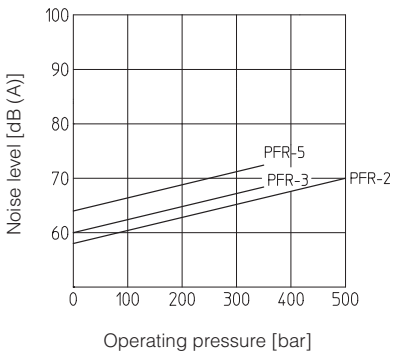
4 TORQUE VERSUS PRESSURE DIAGRAM



5 NOISE LEVEL

Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps

Shaft speed: 1450 rpm. Mineral oil ISO VG 46 at 50°C.



6 LIMIT OF SHAFT TORQUE

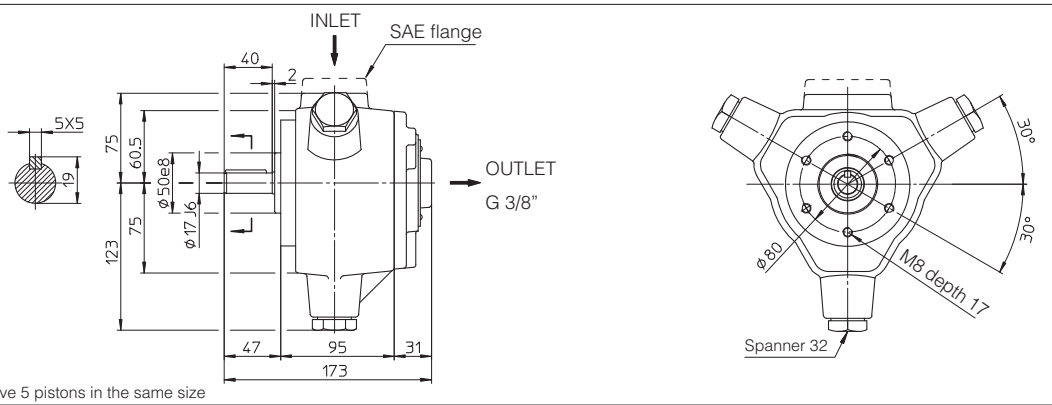
Pump model	Maximum driving torque [Nm]	Maximum torque available on the end of the through shaft [Nm]
PFR-2	200	=
PFR-3	600	320
PFR-5	800	320

The values of torque needed to operate the pumps are shown for each type on the "torque versus pressure diagram" at section 4.
In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

7 DIMENSIONS OF SINGLE PUMPS [mm]

PFR-2

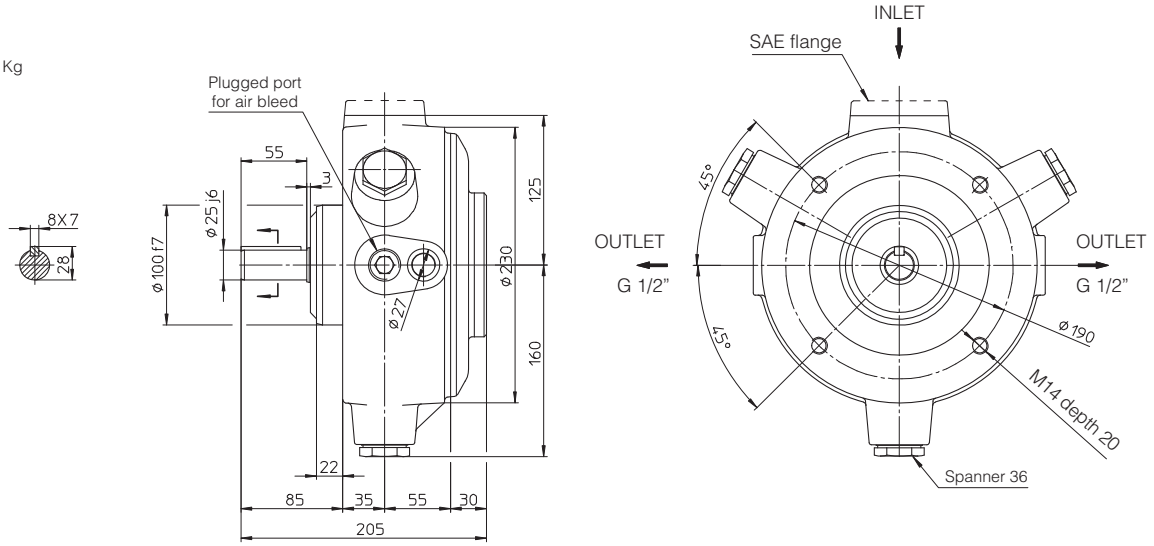
Mass: 12 Kg



Note: PFR-206 have 5 pistons in the same size

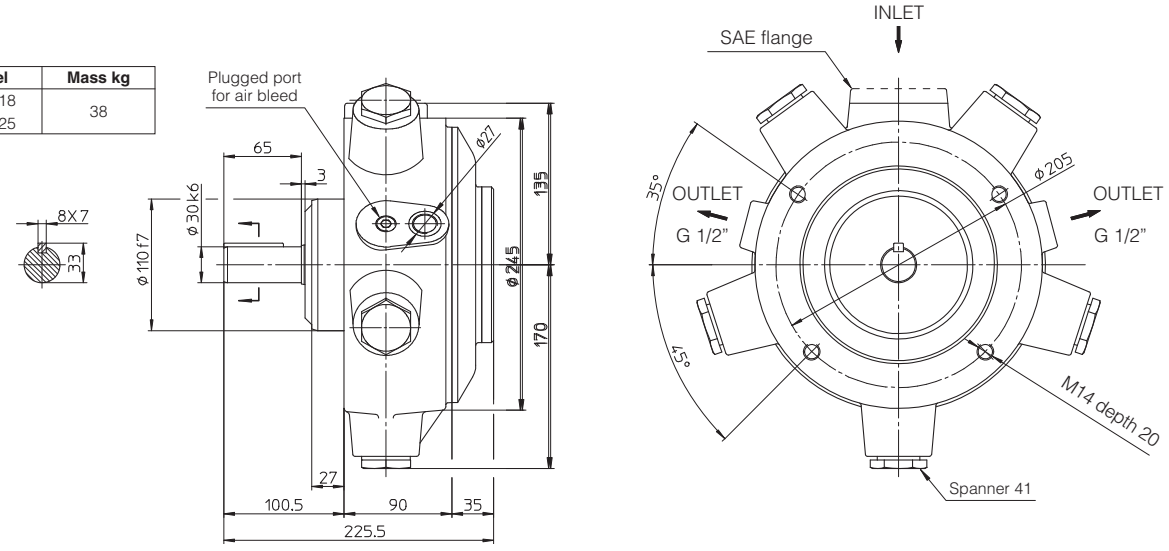
PFR-3

Mass: 31 Kg



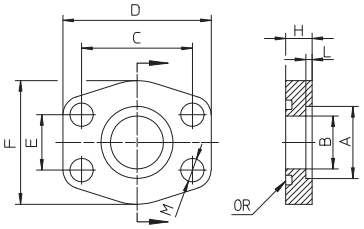
PFR-5

Model	Mass kg
PFR-518 PFR-525	38



(•) **SAE flanges are supplied with the pump**

8 SAE-3000 FLANGES supplied with the pump [mm]

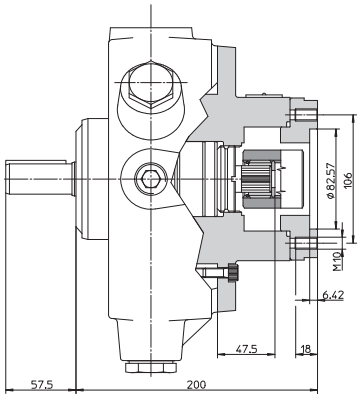


Flanges are supplied with seal and screws M10 class 12.9
Tightening torque = 70 Nm

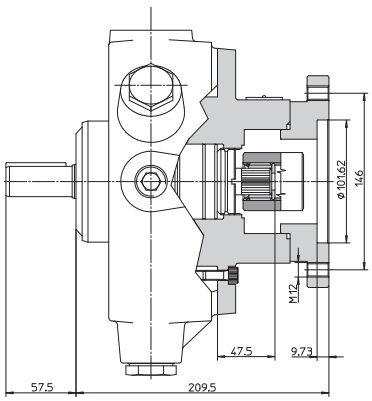
Pump model	Flange code	A	B	C	D	E	F	H	L	M	OR	Screws
PFR - 2	WFA-25	35,5	29	52,37	70	26,19	55	12	4	ø 11	4131	M10x30
PFR - 3 PFR - 5	WFA-32	42,5	34	58,72	79	30,18	68	12	4	ø 11,5	4150	M10x35

9 DIMENSIONS OF PUMPS PROVIDED TO BE COUPLED WITH VANE PUMPS [mm]

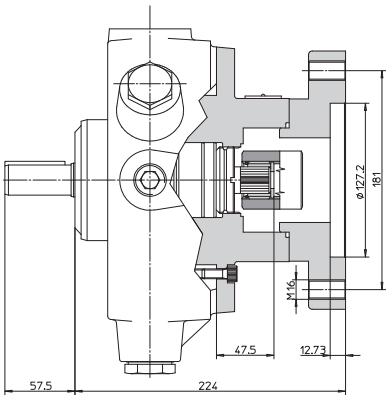
PFRXA-3



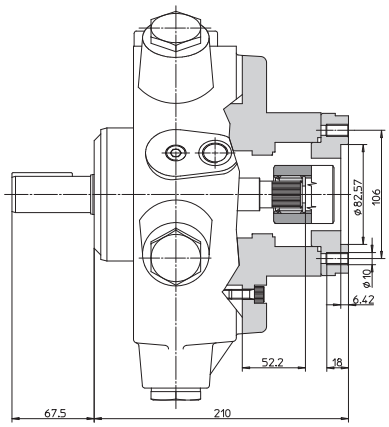
PFRXB-3



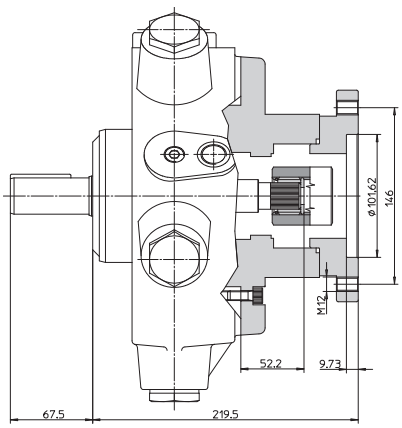
PFRXC-3



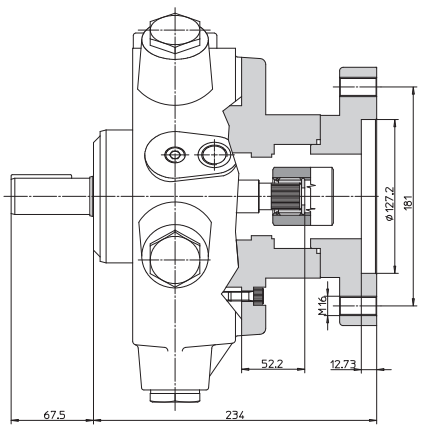
PFRXA-5



PFRXB-5



PFRXC-5



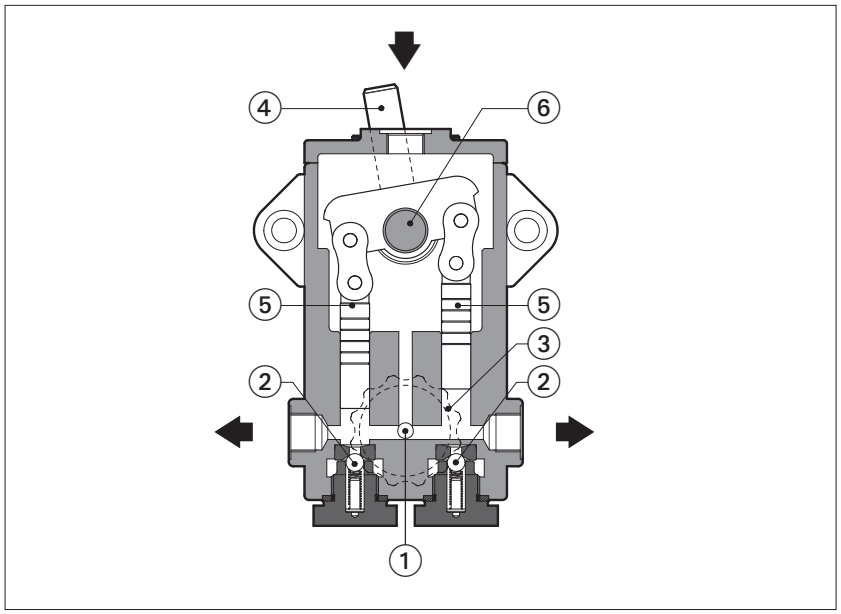
10 BALANCED COUPLING

The balanced couplings permit to minimize the vibrations caused by the unbalanced mass during the pump rotation.
The couplings listed in the table, supplied by Atos, must be used together with the relevant bell housing (supplied by Scoda). The table lists the codes of the Atos balanced couplings and the Scoda bell housing, available for the several pumps and for the standardized sizes of the electrical motors.

PUMP MODEL	ELECTRICAL MOTOR	BALANCED COUPLING	BELL HOUSING
PFR-202	UNEL-MEC 100-112	Y-GB-82/02	Y-LS4P2
	UNEL-MEC 132	Y-GB-122/02	Y-LS6P2
PFR-203	UNEL-MEC 100-112	Y-GB-82/03	Y-LS4P2
	UNEL-MEC 132	Y-GB-122/03	Y-LS6P2
PFR-308	UNEL-MEC 100-112	Y-GB-83/08	Y-LS4P3
	UNEL-MEC 132	Y-GB-123/08	Y-LS6P3
	UNEL-MEC 160	Y-GB-303/08	Y-LS7P3
PFR-311	UNEL-MEC 100-112	Y-GB-83/11	Y-LS4P3
	UNEL-MEC 132	Y-GB-123/11	Y-LS6P3
	UNEL-MEC 160	Y-GB-303/11	Y-LS7P3
PFR-315	UNEL-MEC 100-112	Y-GB-83/15	Y-LS4P3
	UNEL-MEC 132	Y-GB-123/15	Y-LS6P3
	UNEL-MEC 160	Y-GB-303/15	Y-LS7P3
PFR-518	UNEL-MEC 132	Y-GB-125/18	Y-LS6P5
	UNEL-MEC 160	Y-GB-305/18	Y-LS7P5
	UNEL-MEC 180	Y-GB-605/18	
PFR-525	UNEL-MEC 132	Y-GB-125/25	Y-LS6P5
	UNEL-MEC 160	Y-GB-305/25	Y-LS7P5
	UNEL-MEC 180	Y-GB-605/25	

Hand pumps type PM

2-plunger

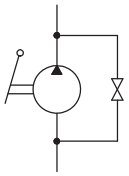


PM are double alternate-acting hand pumps with simple and rugged construction for minimum service and long operating life.
They are provided with one by-pass valve ① which connects directly the delivery ports with the inlet port through the delivery valves ②. The by-pass valve is operated by a handwheel ③.
Pumping operation is made by alternative movement of the lever ④ and consequently movement of plungers ⑤, after having locked the by-pass valve by means of the handwheel.
The splined shaft attachment ⑥ permits to turn the lever shaft in the best position.
On the pump body are available two outlet ports (one supplied plugged).
Suitable for hydraulic oils according to DIN 51524...535 or synthetic fluids having similar lubricating characteristics.
Displacements: from 12 to 20 cm³ for double stroke.
Max pressure 250 bar

1 MODEL CODE

PM	-	112	*	/	*
2-plunger hand pump		Displacement, see section 2 **112**= 12 cm³/double stroke **120**= 20 cm³/double stroke	Series number		Seals material: omit for NBR (mineral oil & water glycol) **PE** = FPM

2 OPERATING CHARACTERISTICS with hydraulic fluid having a viscosity of 24 mm²/s and 40°C

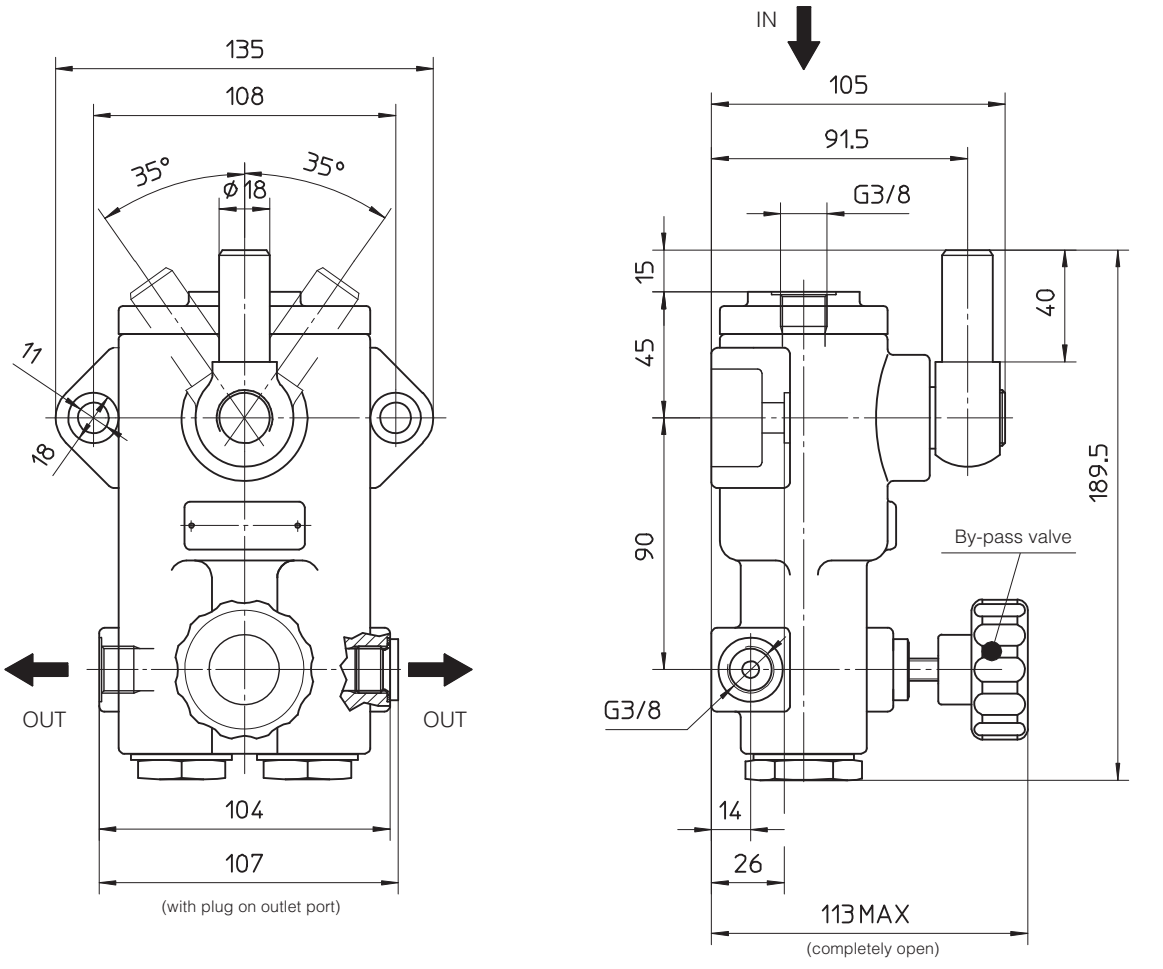


Model	Displacement for double stroke [cm³]	Max pressure [bar]	Shaft rotation angle [degree]	Maximum torque required [Nm]
PM-112	12	250	± 35°	133
PM-120	20	120	± 35°	116

3 MAIN CHARACTERISTICS OF HAND PUMP TYPE PM

Installation position		Vertical position, with inlet port facing upward to ensure complete case filling	
Commissioning		Pumping operation is made by alternative movement of the lever after closing by-pass valve. **Note:** the by-pass valve connects the delivery ports with inlet port and when locked it could allow some leakage from outlet ports. Two opposite outlet ports are available for pump delivery: one of these is supplied plugged. The pumps are supplied without lever harm that could made by a simple tube with Ø 18 mm inside diameter. Usually a lenght of 500 to 600 mm is appropriate. Lever position can be selected by proper assembling of lever on splined shaft.	
Ambient temperature		**Standard** = -25°C ÷ +80°C **/PE** option -15°C ÷ +80°C	
Fluid		Hydraulic oil as per DIN 51524...535; for other fluids see section 1	
Recommended viscosity		10 ÷ 100 mm²/sec at 40°C (ISO VG 15 - 100)	
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	
Fluid temperature		-20°C +60°C -20°C +50°C (water glycol) -20°C +80°C (/PE seals)	
Compliance		RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006	

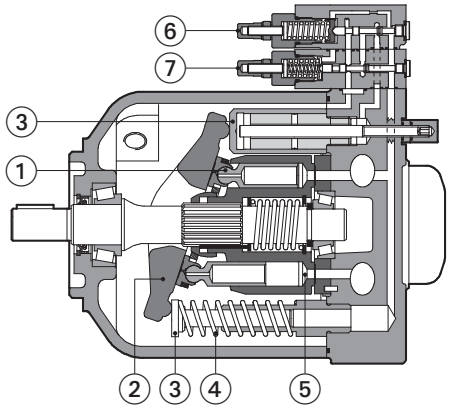
4 DIMENSIONS [mm]



Mass: 4,6 Kg

Axial piston pumps

variable displacement, mechanical controls



① Pistons
② Swash plate
③ Servo piston
④ Spring
⑤ Rotating barrel
⑥ Max pressure compensator
⑦ Load sensing compensator
⑧ Remote pressure transducer

PVPC-L-4046

PVPC

Variable displacement axial piston pumps with swash plate design suited for high pressure open circuits.
They are characterized by low noise emission, short response time and flexible operation thanks to the wilde range of mechanical controls, see section 11.

For PVPC pumps with electrohydraulic proportional controls, see tech table AS170.

SAE J744 mounting flange and shaft.

Max displacement (cm³/rev)	Max pressure working (bar)	Max pressure peak (bar)
29, 46, 73, 140	280	350
88	250	315

1 MODEL CODE

PVPC	X2E	-	C	-	4046	/	1	D	-	X	24DC	*	/	*

PVPC
Variable displacement axial piston pump

X2E
Option for pumps with through shaft (1):
XA = intermediate flange SAE A
XB = intermediate flange SAE B
XC = intermediate flange SAE C (only for size 5073 and 90)
Additional suffix for double pumps:
X2E = with a fixed displacement pump type PFE (see tech table A005)

C
Type of control, see section 11:
C = manual pressure compensator
CH = manual pressure compensator, with venting
R = remote pressure compensator
L = load sensing (pressure & flow)
LW = constant power (combined pressure & flow)
For electrohydraulic proportional controls, see tech table AS170

4046
Size and max displacement (2):
3029 = size 3 - displacement 029 cm³/rev
4046 = size 4 - displacement 046 cm³/rev
5073 = size 5 - displacement 073 cm³/rev
5090 = size 5 - displacement 090 cm³/rev
6140 = size 6 - displacement 140 cm³/rev

1
Shaft, SAE Standard **(3)**:
1 = keyed
5 = splined

D
Direction of rotation, viewed at the shaft end:
D = clockwise
S = counterclockwise

X
X = without connector (only for CH version)
See section 4 for available connectors, to be ordered separately

24DC
Coil voltage, see section 4
(only for CH version)

*****
Series number

*****
Seals material, see section 5 :
- = NBR
PE = FKM

(1) Not available for PVPC-*-6140
(2) Optional intermediate displacements 35 and 53 cm³/rev are available on request
(3) Pumps with ISO 3019/2 mounting flange and shaft (option /M) are available on request

2 GENERAL CHARACTERISTICS

Assembly position - see section 6	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line lenght is 3 m.
Ambient temperature range	**Standard** = -25°C ÷ +80°C **/PE** option -15°C ÷ +80°C
Storage temperature	**Standard** = -40°C ÷ +50°C **/PE** option -20°C ÷ +50°C
Surface protection (pump body)	Black painting RAL9005

3 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

PVPC size		**3029**		**4046**		**5073**		**5090**		**6140**	
Max displacement	(cm^3/rev)	29		46		73		88		140	
Theoretical max flow at 1450 rpm	(l/min)	42		66,7		105,8		127,6		203	
Max working pressure / Peak	(bar)	280/350		280/350		280/350		250/315		280/350 **(1)**	
Min/Max inlet pressure	(bar abs.)	0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25	
Max pressure on drain port	(bar abs.)	1,5		1,5		1,5		1,5		1,5	
Power consumption at 1450 rpm and at max pressure and displacement	(Kw)	19,9		31,6		50,1		54,1		122	
Max torque on the shaft	(shaft type)	Type 1	Type 5	Type 1	Type 5	Type 1	Type 5	Type 1	Type 5	Type 1	Type 5
	(Nm)	210	270	350	440	670	810	670	810	1000	2340
Max torque at max working pressure	(Nm)	128		203		328		350		780	
Speed rating	(rpm)	500 ÷ 3000		500 ÷ 2600		500 ÷ 2600		500 ÷ 2200		500 ÷ 2200	
Body volume	(l)	0,7		0,9		1,5		1,5		2,8	

(1) The maximum pressure can be increased to 350 bar (working) and 420 (peak) after detailed analysis of the application and of the pump working cycle

4 ELECTRICAL CHARACTERISTICS - for PVPC-CH

Insulation class	H
Connector protection degree	IP 65
Relative duty factor	100%
Supply voltage tolerance	± 10%

4.1 COIL VOLTAGE - only for CH version

Average values based ambient/coil temperature of 20°C.

External supply nominal voltage ±10%		**Voltage code**	Power consumption	Nominal courrent	Coil characteristics
DIRECT CURRENT	12 DC 24 DC	**12DC** **24DC**	19,2 W	1,61 A 0,80 A	Insulation Class: **H**
ALTERNATE CURRENT	24 / 50 / 60 AC 110 / 50 / 60 AC 220 / 50 / 60 AC	**24/50/60AC** **110/50/60AC** **220/50/60AC**	19,0 W	0,89 A 0,19 A 0,09 A	Protection degree: **IP65**

4.2 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - to be ordered separately

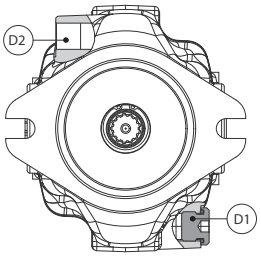
Code of connector	Function
SP-666	Connector IP-65
SP-667	Connector IP-65 but with built-in signal led

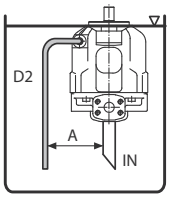
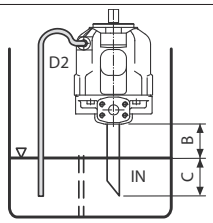
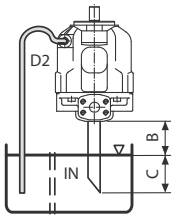
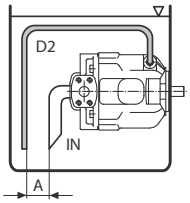
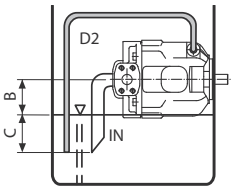
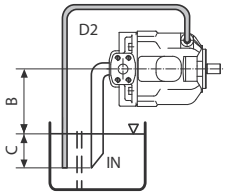
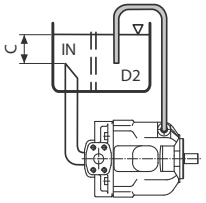
5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -25°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		15÷35 mm^2/s - max allowed range: min 10 cSt (at 80°C) - max 1500 cSt at cold startup (-25°C)		
Max fluid contamination level	normal operation	ISO4406 class 20/18/13 NAS1638 class 9		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 18/16/11 NAS1638 class 7		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR **(1)**	ISO 12922
Flame resistant with water		NBR, HNBR	HFC **(1)**	

(1) Max working pressure must be reduced to: 180 bar (working) / 210 bar (peak) for HFC fluid
200 bar (working) / 240 bar (peak) for HFDU and HFDR fluid

6 INSTALLATION POSITION

<table>
<tr><td rowspan="2"> 

The pump is supplyed whit drain D2 open, and D1 plugged. Before installation fill the pump with hydraulic oil for at least 3/4 of its volume, keeping it in horizontal position. With exception of pump mounted below the oil level, we recomend to interpose a baffle plate between inlet and drain line.</td><td colspan="3">VERTICAL INSTALLATION</td></tr>
<tr><td> 
</td><td> 
</td><td> 
</td></tr>
<tr><td></td><td>INSIDE THE TANK
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm</td><td>INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm</td><td>OUTSIDE THE TANK, above oil level
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm</td></tr>
<tr><td colspan="4">HORIZONTAL INSTALLATION</td></tr>
<tr><td> 
</td><td> 
</td><td> 
</td><td> 
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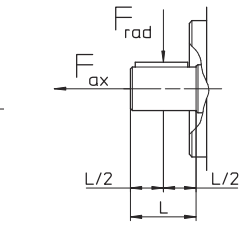
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm</td><td>INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm</td><td>OUTSIDE THE TANK, above oil level
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm</td><td>OUTSIDE THE TANK, below oil level
C= 200mm</td></tr>
</table>

IN: inlet line - **D1:** drain line - **A:** minimum distance between inlet and drain line - **B+C:** permissible suction height - **C:** inlet line immersion dept

7 MAX PERMESSIBLE LOAD ON DRIVE SHAFT

PVPC size			**3029**	**4046**	**5073**	**5090**	**6140**
Fax = axial load		N	1000	1500	2000	2000	2000
Frad = radial load		N	1500	1500	3000	3000	3000

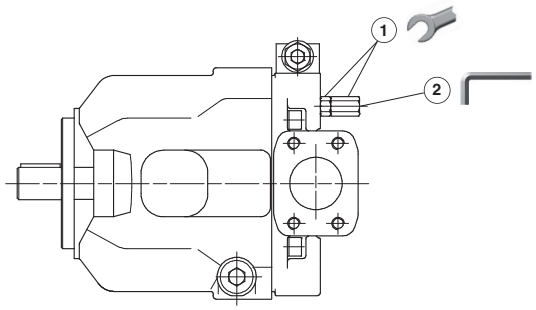
Notes: For speeds over 1800 rpm the inlet port must be under oil level with adequate pipes.
Maximum pressure for all models with water glycol fluid is 160 bar, with option /PE is 190 bar.
Max speed with options /PE and for water glycol fluid is 2000/1900/1600/1500 rpm respectively for the four sizes.

8 VARIATION OF MAX SPEED VS INLET PRESSURE

Inlet pressure	**Displacement %**					
bar abs.	65	70	80	90	100	
0,8	120	115	105	97	90	**% variation of the max. speed**
0,9	120	120	110	103	95	
1,0	120	120	115	107	100	
1,2	120	120	120	113	106	
1,4	120	120	120	120	112	
1,6	120	120	120	120	117	
2,0	120	120	120	120	120	

Example
Displacement: 80% - Inlet pressure: 1,0 bar - Speed: 115%

9 MAX DISPLACEMENT SETTING



(1) Locking displacement limiter screw

(2) Displacement setting

PVPC size		**3029**	**4046**	**5073**	**5090**	**6140**
Max displacement setting range	from ÷ to	20,1 ÷ 28,7	31,8 ÷ 45,4	36,8 ÷ 73,6	44,0 ÷ 87,9	70 ÷ 140
One turn of screw changes pump displacement by approximately	cm^3/rev	1,5	2,2	3,2	3,2	6,0
For locking displacement limiter screw	mm	14	14	17	17	19
For displacement setting	mm	4	4	5	5	6
Tightening torque	Nm	15 ± 1	15 ± 1	15 ± 1	15 ± 1	20 ± 1

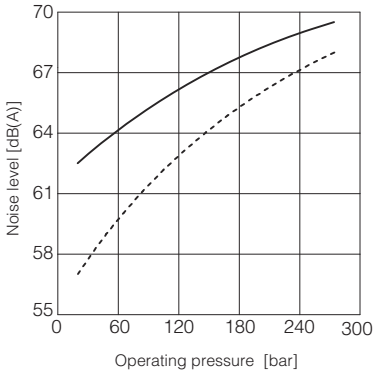
10 DIAGRAMS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

10.1 Noise level curves

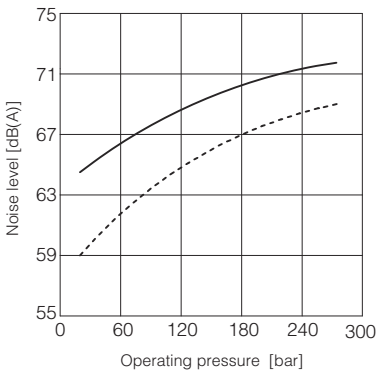
Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps Shaft speed: 1450 rpm.

—— = Qmax ---- = Qmin

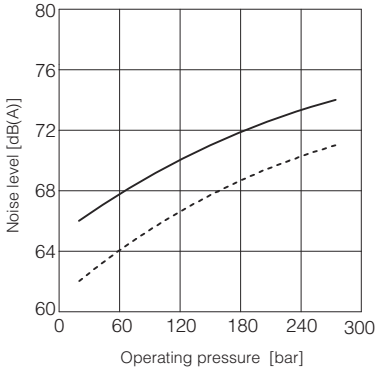
PVPC-*-3029



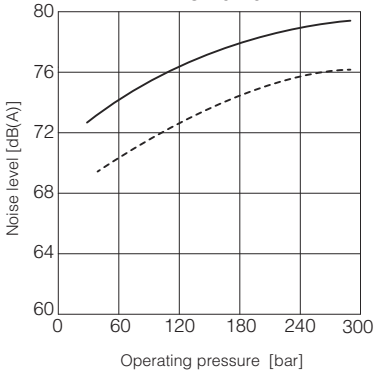
PVPC-*-4046



PVPC-*-5073 and PVPC-*-5090



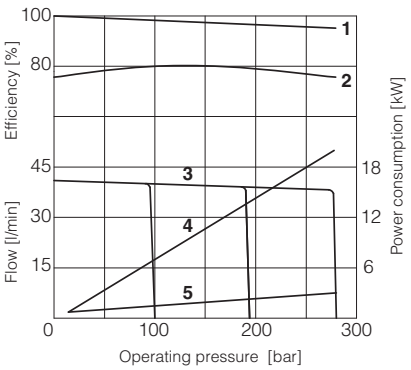
PVPC-*-6140



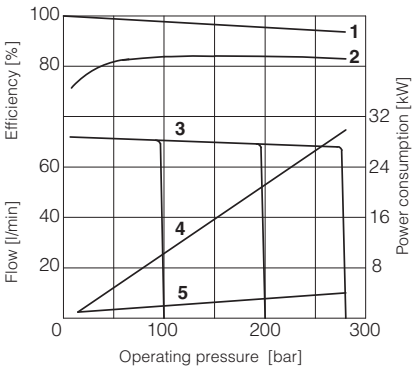
10.2 Operating limits

1 = Volumetric efficiency
2 = Overall efficiency
3 = Flow versus pressure curve
4 = Power consumption with full flow
5 = Power consumption at null flow

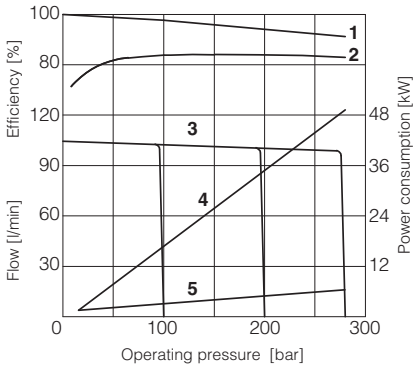
PVPC-*-3029



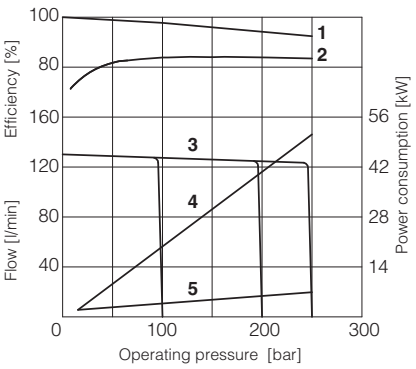
PVPC-*-4046



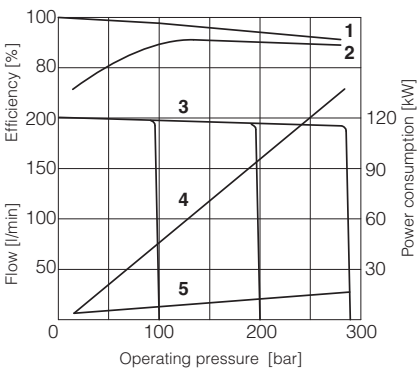
PVPC-*-5073



PVPC-*-5090



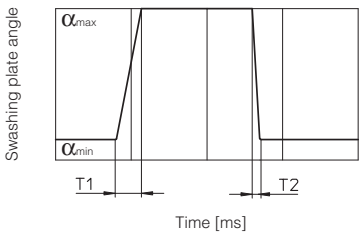
PVPC-*-6140

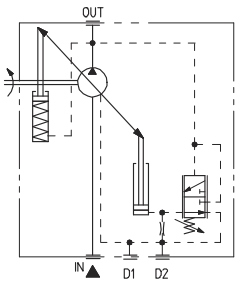


10.3 Response times

Response times and pressure peack due to variation 0% to 100% and 100% to 0% of the pump displacement, obtained with an istantaneously opening and shut-off of the delivery line.

Pump type	**T1** (ms)	**T2** (ms)
PVPC-*-3029	140	36
PVPC-*-4046	140	42
PVPC-*-5073	160	44
PVPC-*-5090	160	44
PVPC-*-6140	220	150





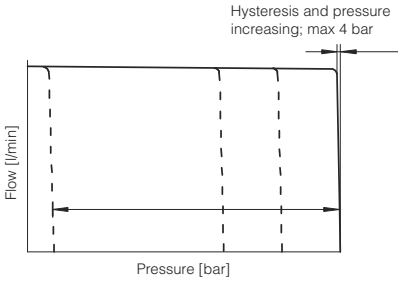
C

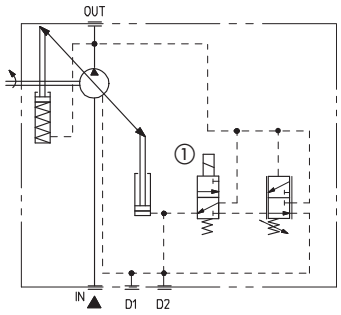
Manual pressure compensator

The pump displacement is zeroed when the line pressure approaches the setting pressure of the compensator.

Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073, 6140
20 ÷ 250 bar for 5090

Compensator standard setting:
280 bar for 3029, 4046, 5073, 6140
250 bar for 5090





① solenoid venting valve

CH

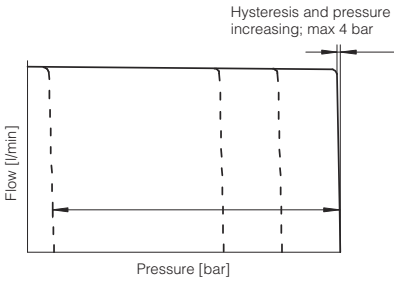
Manual pressure compensator with venting

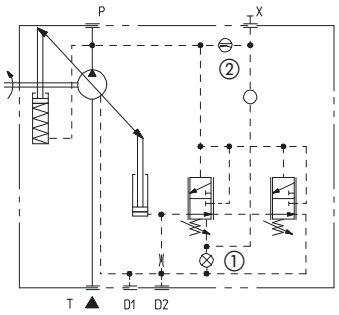
As C plus venting function, when a long unloading time is required and heat generation and noise have to be kept at lowest level.

Venting valve solenoid voltage, see section 4
Venting valve OFF = null displacement
Venting valve ON = max displacement

Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090, 6140

Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090, 6140





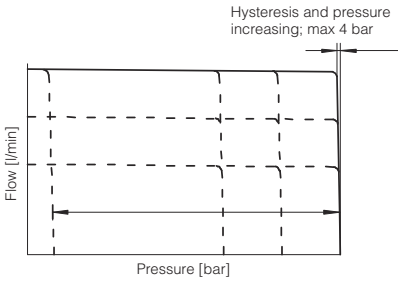
R

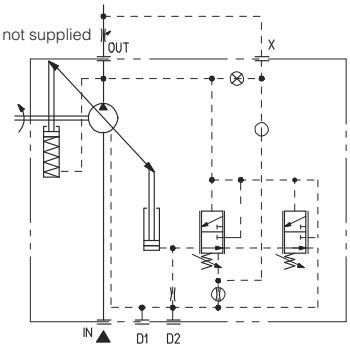
Remote pressure compensator

As C, but predisposed with X piloting port for connection of a remote pilot relief valve.

Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090, 6140

Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090, 6140





L

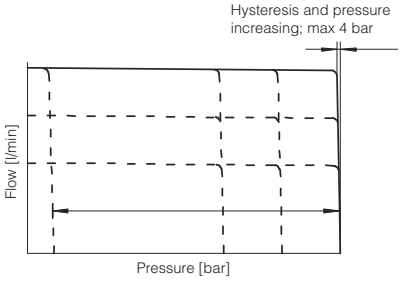
Load sensing

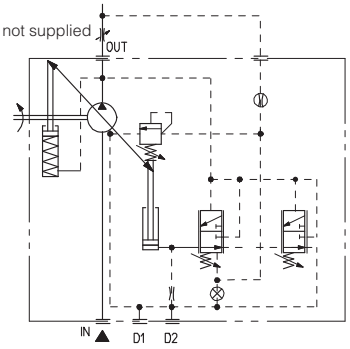
The pump displacement is automatically adjusted to maintain a constant (load indipendent) pressure drop across an external throttle. Changing the throttle regulation, the pump flow is consequently adjusted.
Load sensing control always incorporates an hydraulic compensator to limit the maximum pressure.

Compensator setting range:
20 ÷ 280 bar for 3029, 4046, 5073
20 ÷ 250 bar for 5090, 6140

Compensator standard setting:
280 bar for 3029, 4046, 5073
250 bar for 5090, 6140

Differential pressure setting range: 10 ÷ 40 bar
Differential pressure standard setting: 14 bar

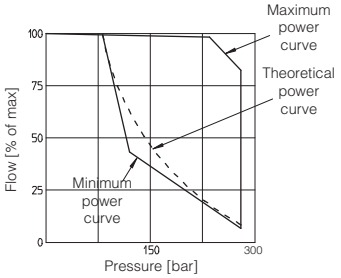




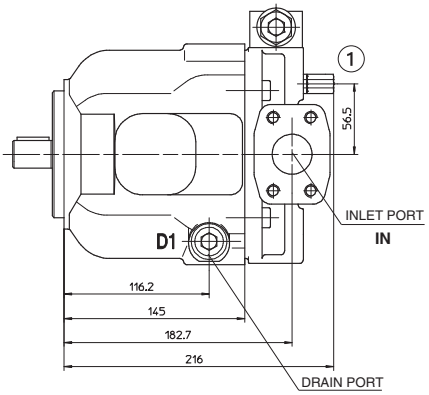
LW

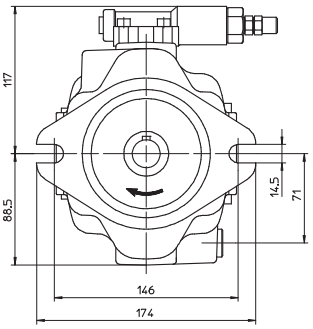
Constant power

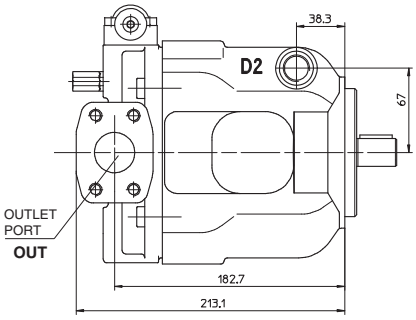
In order to achieve a constant drive torque with varying operating pressure. The swashing angle and therefore the outlet flow is varied so that the product of flow and pressure remains constant.
For the best regulation, minimum working pressure is 80 bar.
While selecting LW control, the required value of power must be communicated with the order (ex. 10 kW at 1450 rpm).



12 INSTALLATION DIMENSIONS OF PVPC-*-3029: BASIC VERSION “C” CONTROL







PORTS DIMENSION

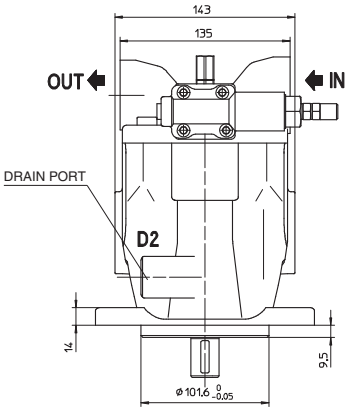
IN = Flange SAE 3000 1 1/4”

OUT = Flange SAE 6000 3/4”

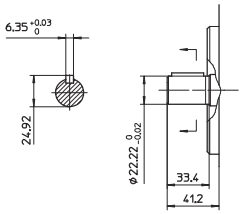
D1, D2 = 1/2” BSPP

① = Screw for max displacement setting.
In case of double pumps, the screw is not available for version XB

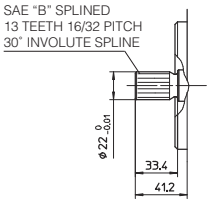
Mass [kg]	
PVPC-*-3029	18



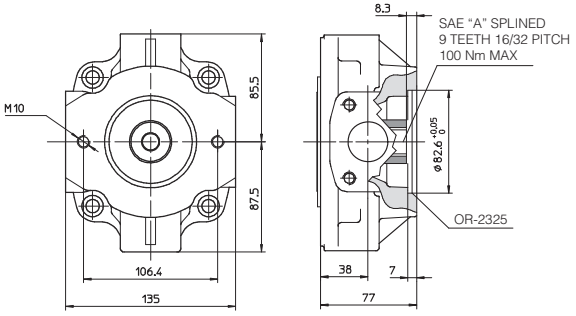
SHAFT TYPE “1”



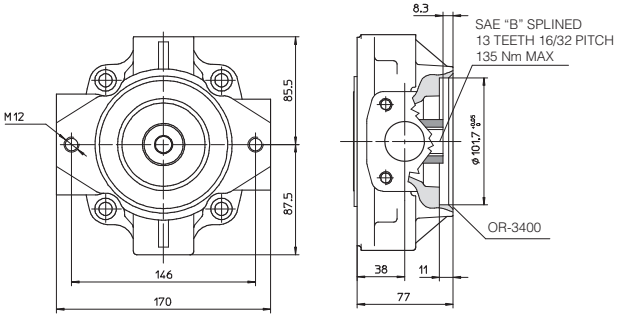
SHAFT TYPE “5”



CODE XA - INTERMEDIATE FLANGE SAE “A” FOR PFE-31

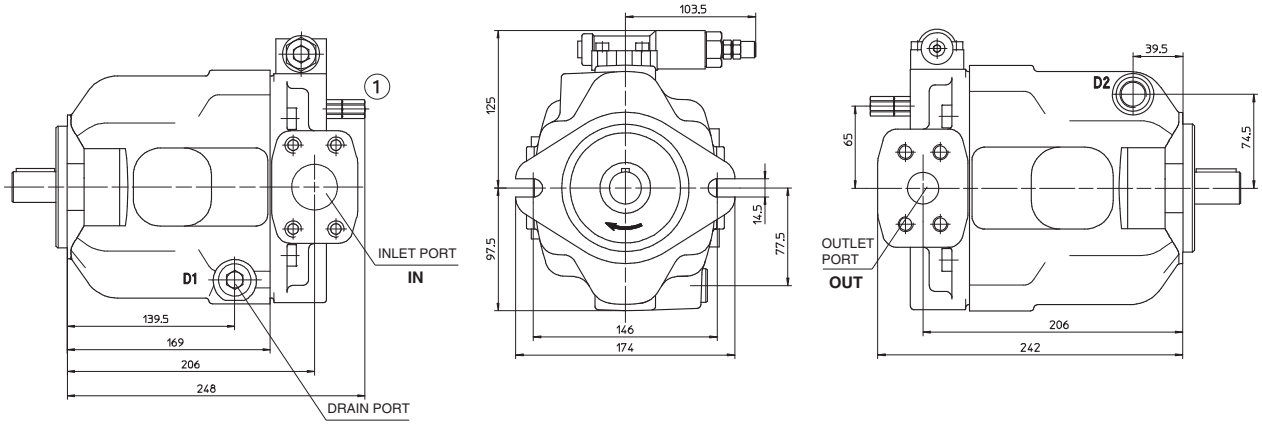


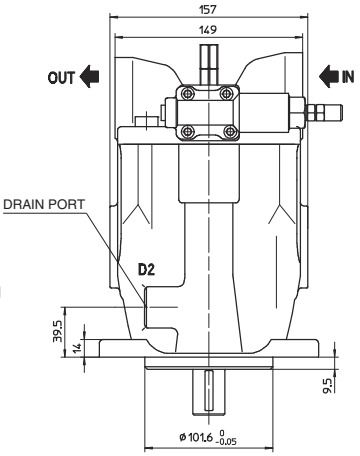
CODE XB - INTERMEDIATE FLANGE SAE “B” FOR PFE-41
screw for max displacement setting not available



Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

13 INSTALLATION DIMENSIONS OF PVPC-*-4046: BASIC VERSION “C” CONTROL



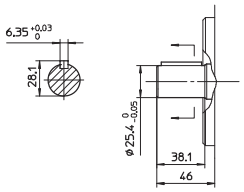


PORTS DIMENSION

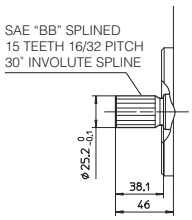
IN = Flange SAE 3000 1 1/2”
OUT = Flange SAE 6000 1”
D1, D2 = 1/2” BSPP
① = Screw for max displacement setting

Mass [kg]	
PVPC-*-4046	24

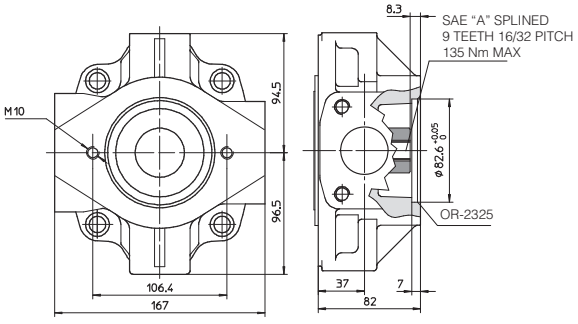
SHAFT TYPE “1”



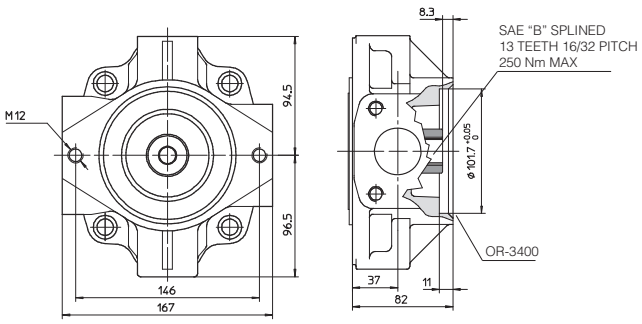
SHAFT TYPE “5”



CODE XA - INTERMEDIATE FLANGE SAE “A” FOR PFE-31

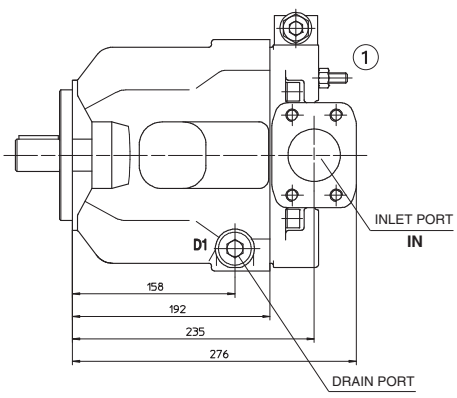


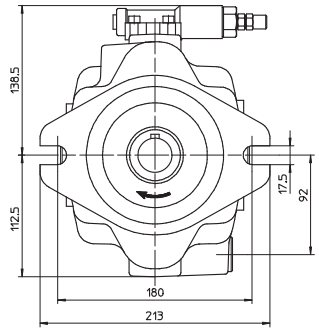
CODE XB - INTERMEDIATE FLANGE SAE “B” FOR PFE-41

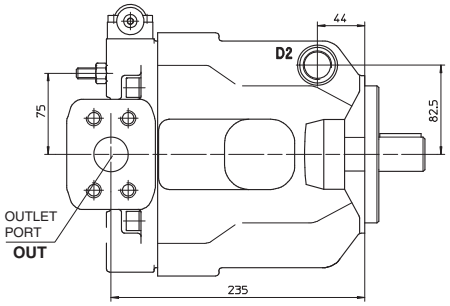


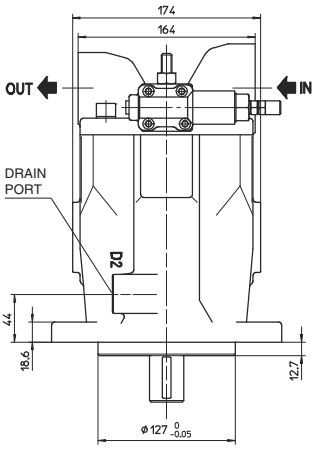
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

14 INSTALLATION DIMENSIONS OF PVPC-*-5073 and PVPC-*-5090: BASIC VERSION "C" CONTROL







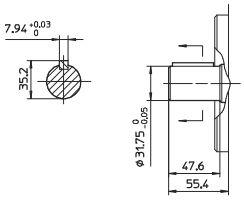


PORTS DIMENSION

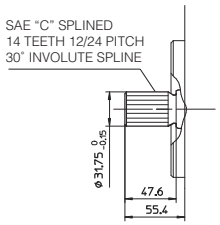
IN = Flange SAE 3000 2"
OUT = Flange SAE 6000 1 1/4"
D1, D2 = 3/4" BSPP
① = Screw for max displacement setting.
In case of double pump the screw is not available for version XC

Mass [kg]	
PVPC-*-5073	33
PVPC-*-5090	

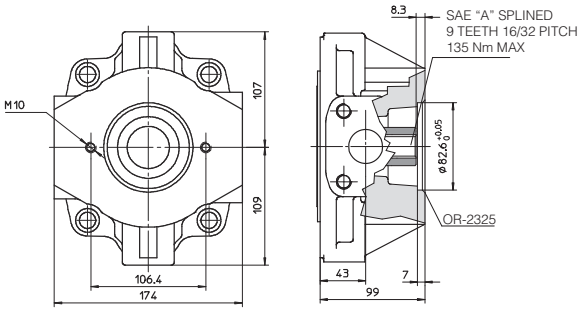
SHAFT TYPE "1"



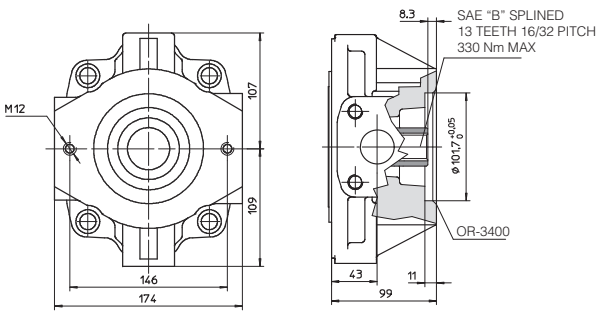
SHAFT TYPE "5"



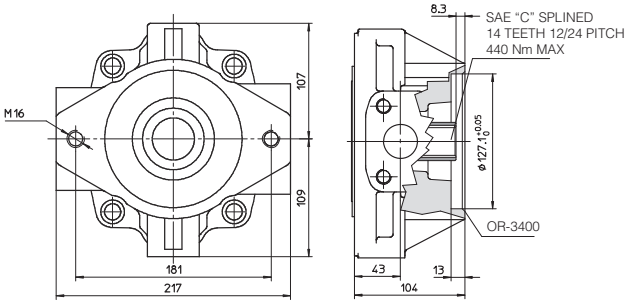
CODE XA - INTERMEDIATE FLANGE SAE "A" FOR PFE-31



CODE XB - INTERMEDIATE FLANGE SAE "B" FOR PFE-41

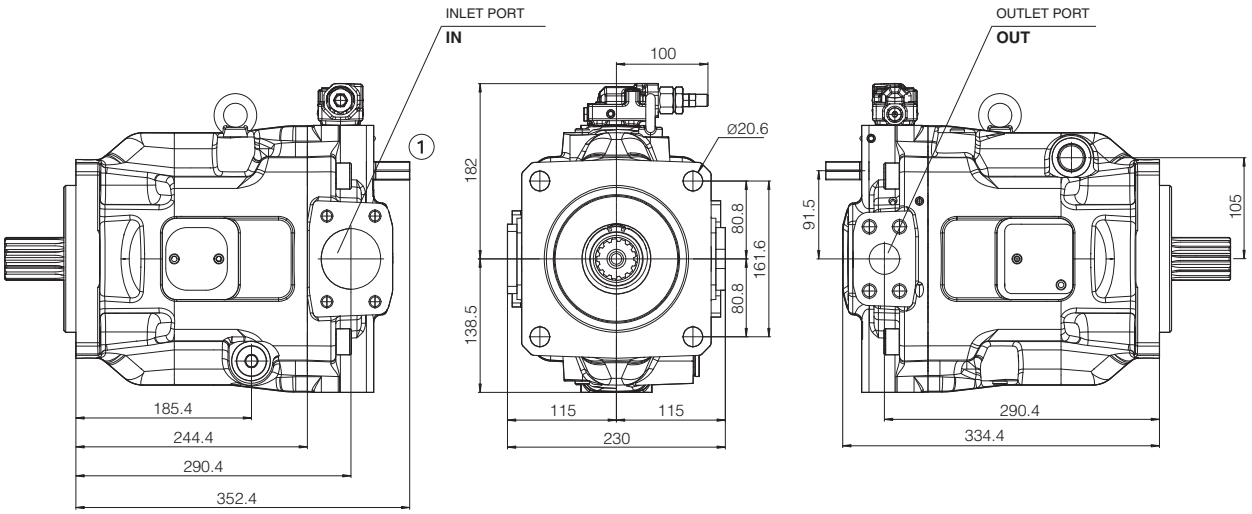


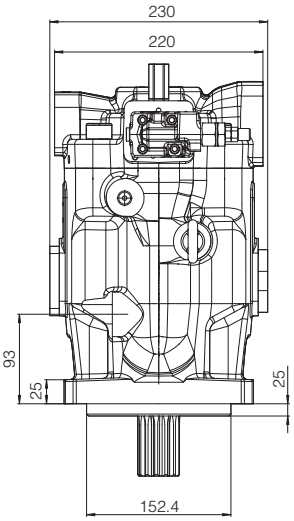
CODE XC - INTERMEDIATE FLANGE SAE "C" FOR PFE-51



Drawing show pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

15 INSTALLATION DIMENSIONS OF PVPC-*-6140: BASIC VERSION “C” CONTROL



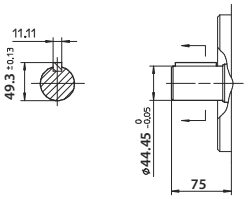


PORTS DIMENSION

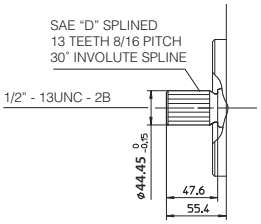
IN = Flange SAE 3000 2 1/2”
OUT = Flange SAE 6000 1 1/4”
D1, D2= 3/4” BSPP
① = Regulation screw for max displacement setting.

Mass [kg]	
PVPC-*-6140	69

SHAFT TYPE “1”



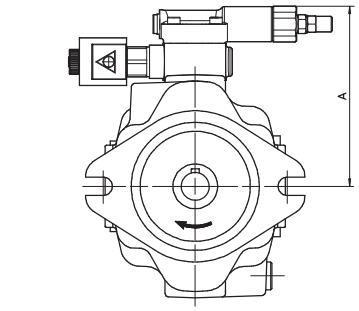
SHAFT TYPE “5”



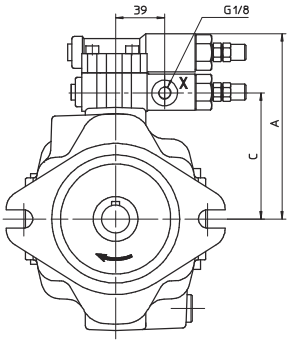
16 INSTALLATION DIMENSIONS OF OTHER CONTROLS

16.1 PVPC size 3, 4 and 5

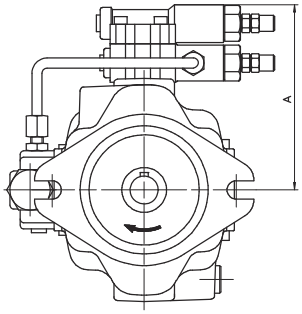
VERSION CH

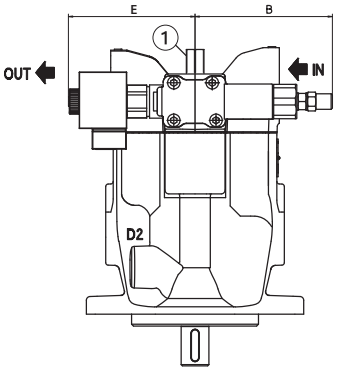


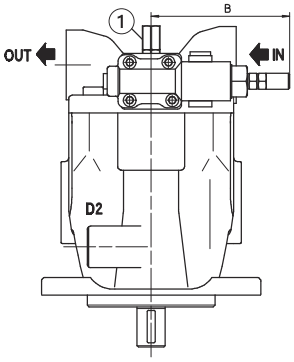
VERSIONS L, R

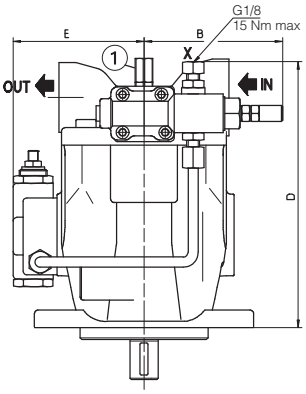


VERSION LW









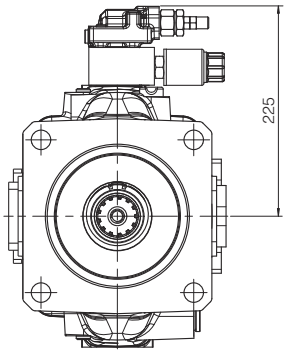
① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement).
In case of double pump the regulation screw is not always available, please contact our technical office.

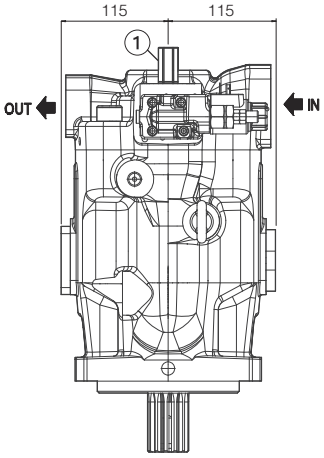
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups

Pump type	Version	A	B	C	D	E	Mass (kg)
PVPC-*-3029	**CH**	144	111	-	-	102	22
	L -R	144	111	100	-	-	19,2
	LW	144	111	-	211	104	20
PVPC-*-4046	**CH**	153	111	-	-	102	28
	L -R	153	111	109	-	-	25,2
	LW	153	111	-	235	111	26
PVPC-*-5073 PVPC-*-5090	**CH**	166	111	-	-	102	36,9
	L -R	166	111	122	-	-	34,2
	LW	166	111	-	258	120	35

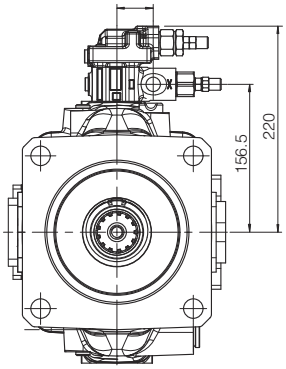
16.2 PVPC size 6

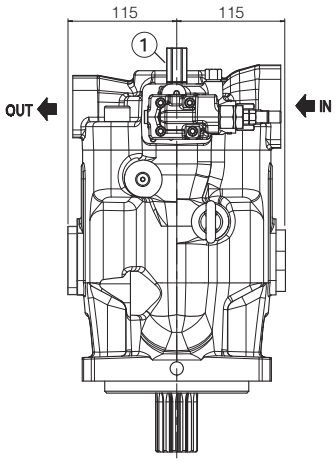
VERSION CH



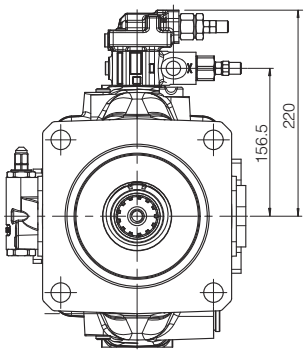


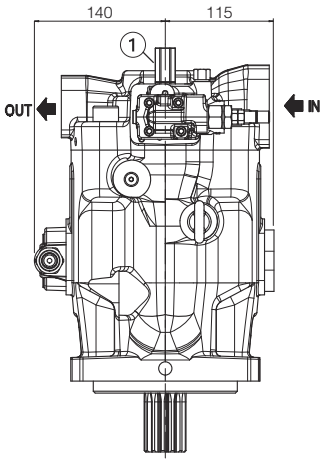
VERSIONS L, R





VERSION LW





① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement).
In case of double pump the regulation screw is not always available, please contact our technical office.

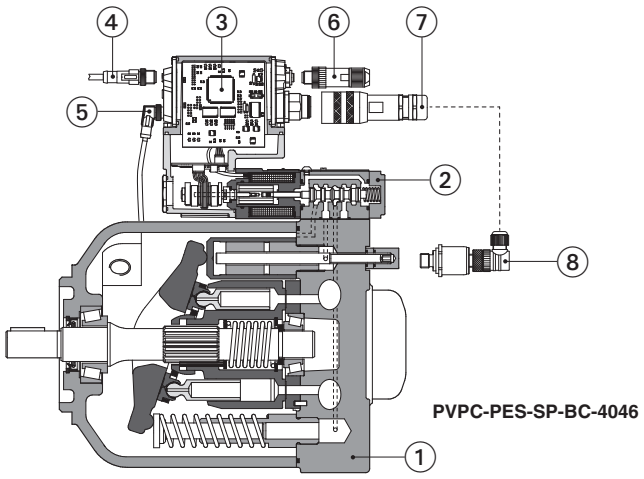
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups

17 RELATED DOCUMENTATION

A900	Operating and maintenance information for pumps
K800	Electric and electronic connectors

Proportional controls for axial piston pumps

pressure, flow or P/Q controls



PVPC-PES-SP-BC-4046

① Pump body
② Proportional valve
③ On-board driver with P/Q control
④ USB connector
⑤ Swash plates transducer connection
⑥ Fieldbus connector
⑦ Main connector
⑧ Remote pressure transducer

PVPC

Variable displacement axial piston pumps with swash plate design suited for high pressure open circuits, they are provided with advanced electrohydraulic proportional controls:

- **CZ** open loop pressure control
- **LQZ** open loop flow control (load sensing)
- **PES** closed loop P/Q control

PES performs alternate closed loop controls of pressure, flow and max power limitation. It is also available with optional sequence module (PERS versions) that allows to reduce close to zero the pressure to the delivery line.

SAE J744 mounting flange and shaft.

Max displacement (cm³/rev)	Max pressure working (bar)	Max pressure peak (bar)
29, 46, 73, 140	280	350
88	250	315

For technical characteristics and features, see tech table A160.

1 **MODEL CODE**

PVPC	X2E	-	PERS-SP	-	BC	-	4046	/	*	/	1	D	/	*	*	/	*

PVPC
Variable displacement axial piston pump

Option for pumps with through shaft (1):
XA = intermediate flange SAE A
XB = intermediate flange SAE B
XC = intermediate flange SAE C (only for size 5073 and 5090)

Additional suffix for double pumps:
X2E = with a fixed displacement pump type PFE (see tech table A005)

Type of control, see section 10 and 11:
CZ = proportional pressure control **(1)**
LQZ = proportional flow control (load sensing) **(1)**
PES-SP = closed loop integral digital P/Q driver
PERS-SP = as PES plus sequence module

Fieldbus interfaces, USB port always present **(2)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Size and max displacement (3):
3029 = size 3 - displacement 029 cm³/rev
4046 = size 4 - displacement 046 cm³/rev
5073 = size 5 - displacement 073 cm³/rev
5090 = size 5 - displacement 090 cm³/rev
6140 = size 6 - displacement 140 cm³/rev

Pressure setting, only for PERS: **200** = 200 bar **250** = 250 bar **280** = 280 bar

Shaft, SAE Standard **(5)**:
1 = keyed **5** = splined

Direction of rotation, viewed at the shaft end:
D = clockwise **S** = counterclockwise

Electronics options, for PES and PERS **(4):**
C = current feedback for pressure transducer 4÷20 mA (omit for std voltage ±10VDC)
I = current reference input and monitor 4÷20 mA (omit for std voltage ±10VDC)
X = on-board pressure transducer with pre-configured pressure settings (only for PERS)
S = with 2 on-off inputs for multiple pressure PID selection for NP execution or double power supply for fieldbus execution, plus dedicated connector for remote pressure transducer

Coil voltage, for CZ, LQZ - see section 15:
18 = optional coil for low current drivers

Series number

Seals material, see section 9:
- = NBR
PE = FKM

(1) Not available for PVPC-*-6140
(2) Only for PES and PERS
(3) Optional intermediate displacements 35 and 53 cm³/rev are available on request
(4) For possible combined options, see section 14
(5) Pumps with ISO 3019/2 mounting flange and shaft (option /M) are available on request

2 OFF-BOARD ELECTRONIC DRIVERS - only for **CZ**, **LQZ**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Data sheet	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals pumps are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 PUMP SETTINGS AND PROGRAMMING TOOLS

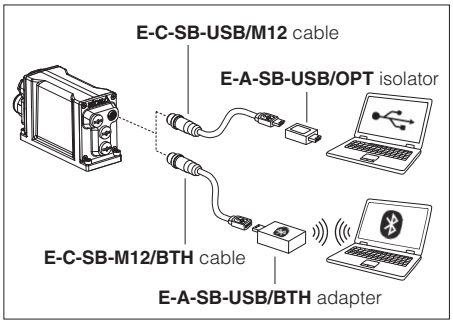
Pump's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits pump's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

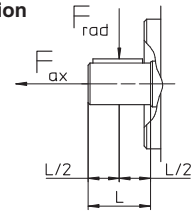
Assembly position	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line lenght is 3 m.
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**CZ,LQZ:** **Standard** = -25°C ÷ +60°C **/PE** option = -15°C ÷ +80°C **PES, PERS:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C
Storage temperature range	**CZ,LQZ:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **PES, PERS:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Surface protection (pump body)	Black painting RAL 9005
Surface protection (pilot valve)	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance (pilot valve)	Salt spray test (EN ISO 9227) > 200 h
Compliance (proportional pilot valve)	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

PVPC size		**3029**		**4046**		**5073**		**5090**		**6140**	
Max displacement	(cm^3/rev)	29		46		73		88		140	
Theoretical max flow at 1450 rpm	(l/min)	42		66,7		105,8		127,6		203	
Max working pressure / Peak	(bar)	280/350		280/350		280/350		250/315		280/350 **(1)**	
Min/Max inlet pressure	(bar abs.)	0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25	
Max pressure on drain port	(bar abs.)	1,5		1,5		1,5		1,5		1,5	
Power consumption at 1450 rpm and at max pressure and displacement	(Kw)	19,9		31,6		50,1		54,1		122	
Max torque on the first shaft	(Nm)	Type 1 210	Type 5 270	Type 1 350	Type 5 440	Type 1 670	Type 5 810	Type 1 670	Type 5 810	Type 1 1000	Type 5 2340
Max torque at max working pressure	(Nm)	128		203		328		350		780	
Speed rating	(rpm)	500 ÷ 3000		500 ÷ 2600		500 ÷ 2600		500 ÷ 2200		500 ÷ 2200	
Body volume	(l)	0,7		0,9		1,5		1,5		2,8	

(1) The maximum pressure can be increased to 350 bar (working) and 420 (peak) after detailed analysis of the application and of the pump working cycle

External load position



F_{ax} = axial load
F_{rad} = radial load

Notes:
For speeds over 1800 rpm the inlet port must be under oil level with adequate pipes.
Maximum pressure for all models with water glycol fluid is 160 bar, with /PE options is 190 bar.
Max speed with /PE options and water glycol fluid is 2000/1900/1600/1500 rpm respectively for the four sizes.

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**CZ**, **LQZ** = 35 Watt; **PES**, **PERS** = 50 Watt			
Max. solenoid current	2,6 A for standard **12 VDC** coil; 1,5 A for standard **18 VDC** coil (only for CZ, LQZ)			
Coil resistance R at 20°C	**Size 3**: 3 ÷ 3,3 Ω for standard **12 VDC** coil; 13 ÷ 13,4 Ω for **18 VDC** coil (only for version CZ, LQZ)			
	Size 4, 5: 3,8 ÷ 4,1 Ω for standard **12 VDC** coil; 12 ÷ 12,5 Ω for **18 VDC** coil (only for version CZ, LQZ)			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**CZ, LQZ** = IP65; **PES, PERS** = IP66/67 with mating connector			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

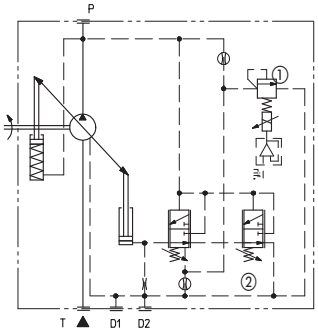
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR **(1)**	ISO 12922
Flame resistant with water		NBR, HNBR	HFC **(1)**	

(1) Max working pressure must be reduced to: 180 bar (working) / 210 bar (peak) for HFC fluid
200 bar (working) / 240 bar (peak) for HFDU and HFDR fluid

10 OPEN LOOP ELECTROHYDRAULIC CONTROLS

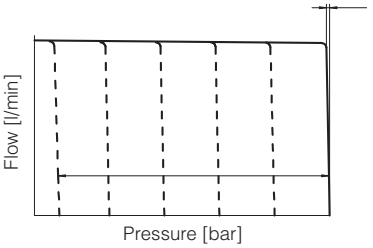


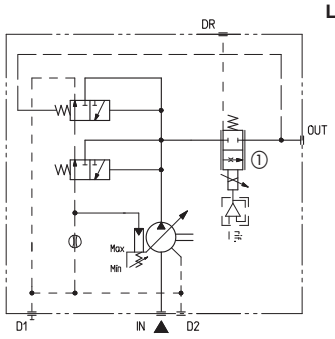
CZ

Proportional pressure control

Open loop control of the pump max pressure
The pumps displacement, and thus the flow, remains constant as far the pressure in the circuit reaches the value set on the proportional pilot valve ①, then the flow is reduced to maintain the circuit pressure to the value set by the electronic reference signal to the proportional valve. In this conditions the pressure in the circuit can be continuosly modulated by means of the reference signal.
Proportional pressure setting range: see below pressure control diagram.
Compensator setting range ②: 20÷350 bar (315 bar for 090)
Compensator factory setting ②: 280 bar (250 bar for 090)

Hysteresis and pressure increase: max 4 bar

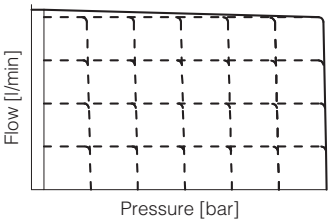




LQZ

Proportional flow (load-sensing)

Open loop control of the pump flow independent to the cyrcuit load. The pump displacement is self adjusted to maintain a costant pressure drop across the proportional flow control valve ①.
The pump flow can be continuosly regulated by modulating the proportional valve ①.

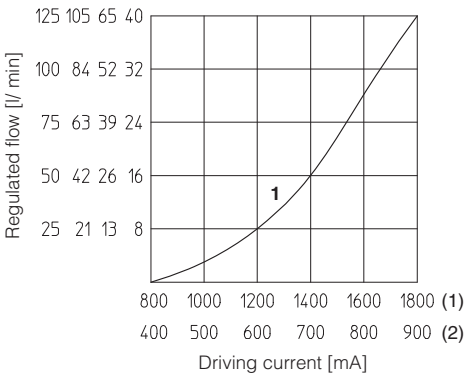


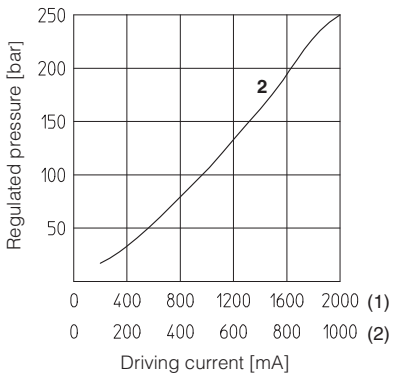
Diagrams for CZ, LQZ

Regulation diagrams
1 = Flow control
2 = Pressure control

(1) for standard 12 VDC coil
(2) for 18 VDC coil

Pump size
88 73 46 29 cm³/rev

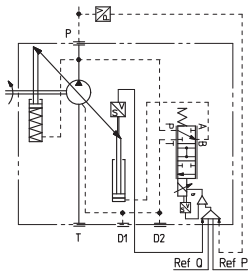




11 P/Q CONTROL

Pressure transducer not included

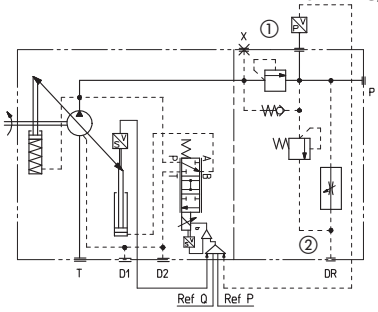
PES



Pressure transducer included only for PERS/X

PERS

PERS/X



P/Q control integrates the alternate pressure and flow regulation with the electronic max power limitation.
A remote pressure transducer must be installed on the system and its feedback has to be interfaced to the pump on-board digital driver.
Flow control is active when the actual system pressure is lower than the pressure reference input signal: the pump flow is regulated according to the flow reference input.
Pressure control is activated when the actual pressure grows up to the pressure reference input signal: the pump flow is then reduced in order to regulate and limit the max system pressure (if the pressure tends to decrease under its command value, the flow control returns active). This option allows to realize accurate dynamic pressure profiles.
Following fieldbus interfaces are available:

- BC - CANopen interface
- BP - PROFIBUS DP interface
- EH - EtherCAT interface
- EW - POWRELINK interface
- EI - EtherNet/IP interface
- EP - PROFINET RT/IRT interface

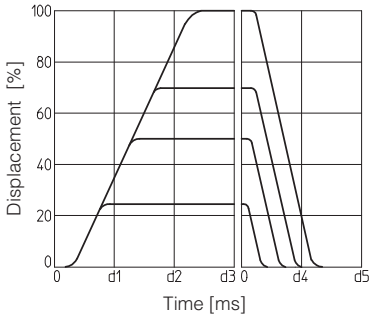
The pumps with BC, BP, EH, EW, EI and EP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.
The digital control ensures high performances as flow and pressure linearity (see diagram 1), better flow knee (see diagram 2), internal leakage compensation (controlled flow independent to the load variations).

PVPC-PES basic version, without sequence module and without pressure transducer, which has to be installed on the main line and wired to the 12 poles connector of the pump on-board digital driver.

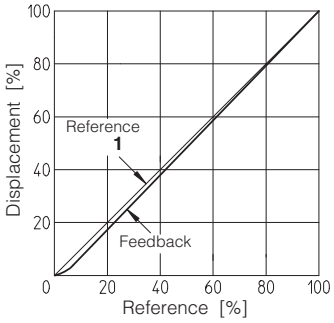
PVPC-PERS version with sequence module RESC ② which grant a minimum piloting pressure (18 bar) when the actual pressure falls below that value. Without pressure transducer.

PVPC-PERS/X as PERS version plus integral pressure transducer, with output signal 4÷20 mA, factory wired to the pump on-board digital driver through a cable gland.

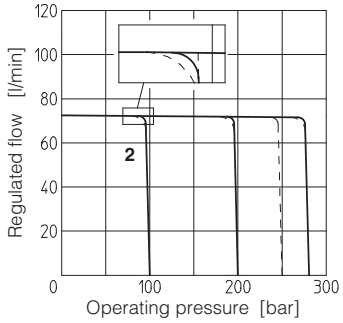
Response time



Regulated flow



P/Q control



Type pump	d1	d2	d3	d4	d5
	[ms]				
PVPC-PE(R)S-3029	30	60	90	30	60
PVPC-PE(R)S-4046	40	80	120	40	80
PVPC-PE(R)S-5073	50	100	150	50	100
PVPC-PE(R)S-5090	60	120	170	60	120
PVPC-PE(R)S-6140	90	180	200	90	180

Response time of displacement variation for a step change of the electronic reference signal.

12 PRESSURE TRANSDUCER SELECTION

The pressure transducer type E-ATR-8 must be ordered separately (see tech table **GS465**)
For /X option the pressure transducer with output signal 4 ÷ 20 mA is on-board to the pump.

Pump code:	Pressure transducer code:
PVPC-PE(R)S-*/200	E-ATR-8/250
PVPC-PE(R)S-*/250	E-ATR-8/400
PVPC-PE(R)S-*/280	E-ATR-8/400
PVPC-PE(R)S-*/200/*/C	E-ATR-8/250/I
PVPC-PE(R)S-*/250/*/C	E-ATR-8/400/I
PVPC-PE(R)S-*/280/*/C	E-ATR-8/400/I

13 ELECTRONICS OPTIONS - only for **PES** and **PERS**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

X = This option providing the presence of the pressure transducer, with output signal 4÷20 mA, integral to the pump and factory wired to the PES electronics through a cable gland (see 16.10).

S = Two on-off input signals are available on the main connector to select one of the four pressure PID parameters setting, stored into the driver (see 16.11).

14 POSSIBLE COMBINED OPTIONS

for **PES**:	for **PERS**:
/CI, /CS, /IS, /CIS	/CI, /CS, /IS, /IX, /SX, /CIS, /ISX

15 COIL VOLTAGE OPTION - only for **CZ** and **LQZ**

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **PES** and **PERS**

Generic electrical output signals of the pump (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/S** and **/SX** options for fieldbus executions

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (Q_INPUT+)

Functionality of Q_INPUT+ signal, is used as reference for the pump's flow.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Pressure reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal, is used as reference for the driver pressure closed loop.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual pump swashplate position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected pump code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.6 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected pump code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE) - only for **/S** and **/SX** options

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

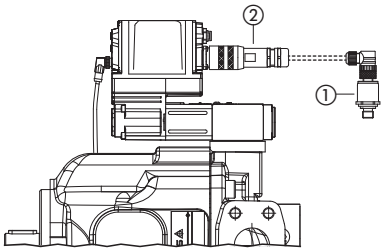
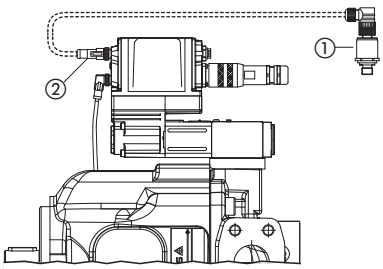
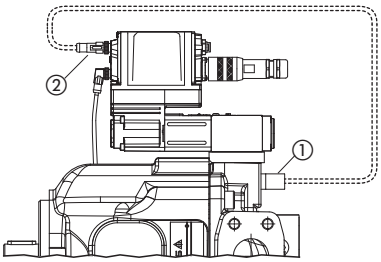
16.9 Pressure transducer input signal

Analog pressure transducers can be directly connected to the driver.
Analog input signal is factory preset according to selected pump code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to the pump technical table to transducer characteristics to select the transducer's maximum pressure.

Standard:
Remote pressure transducer can be directly connected to the main connector on the driver (see 17.1)

/S option
Remote pressure transducer can be directly connected to a dedicated M12 connector (see 17.4)

/X and /SX options
Integral-to-pump transducer is directly connected with a dedicated M12 connector and no remote transducer is required;
current input signal (4 ÷ 20 mA) of the integral transducer allows cable break detection functionality

Standard	/S option	/X and /SX options
		
① = **remote transducer** ② = **main connector** Note: ① and ② to be ordered separately	① = **remote transducer** ② = **M12 connector** Note: ① and ② to be ordered separately	① = **integral transducer** ② = **M12 connector** Note: ① and ② included

16.10 Logic Input Signal (D_IN) - only for **standard** and **standard** with **/X** option

D_IN on-off input signal can be software set to perform one of the following functions:
- enable and disable the driver functioning; apply 0 VDC to disable and 24 VDC to enable the driver - see 16.7
- switch between two pressure PID settings; apply 0 VDC to select SET1 pressure PID and 24 VDC to select SET2 - see 16.11
- enable and disable the power limitation function; default setting, apply 0V to disable and 24VDC to enable the power limitation - see 16.13

16.11 Multiple PID selection (D_IN0 and D_IN1) - only for **/S** and **/SX** options in **NP** execution

Two on-off input signals are available on the main connector to select one of the four pressure PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

16.12 Multiple pressure PID (1)

Four sets for pressure PID parameters are stored into the driver: switching in real-time the active pressure PID parameters during machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
The available commands to switch these PID pressure sets depend on the driver execution:

Fieldbus	Driver	Commands
NP	Standard and Standard with /X option	1 on-off input on main connector allow to switch the 2 PID parameters (SET1 and SET2, see 4.10)
	/S and /SX options	2 on-off inputs allow to switch the 4 PID parameters set (SET1.. SET4 - see 4.11)
BC, BP, EH, EW, EI, EP	All versions	real-time fieldbus communication can switch between the 4 PID parameters set (SET1 - SET4 - see driver manuals)

16.13 Hydraulic Power Limitation (1)

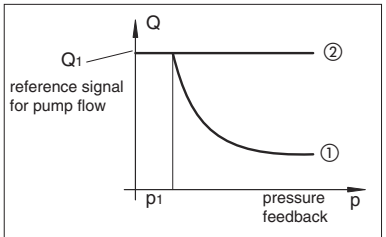
A limit to the maximum pump's hydraulic power can be software set into the driver thus limiting the electric power consumption of the motor coupled to the pump: when the actual requested hydraulic power **p**x**Q** (pressure transducer feeback x flow reference value) reaches the max power limit (p1xQ1), the driver automatically reduces the flow pump regulation.

The higher is the pressure feedback the lower is the pumps's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [kW]}}{\text{Pressure Feedback [bar]}} \times \frac{1}{\text{Flow Full Scale [l/min]}} ; \text{Flow Reference}\right)$$

The hydraulic power limitation, disabled as default, can be enabled using the Atos pc software or the fieldbus communication (fieldbus executions).
Standard and standard with /X option allow also to enable and disable this function during the machine cycle, using the D_IN on-off input available on the main connector (see 16.11).

16.12 - Hydraulic Power Limitation



regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

(1) The sections 16.12 and 16.13 are a brief description of the settings and features of digital drivers with alternated P/Q control. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:
E-MAN-RI-PES - user manual for **PES-S** digital drivers

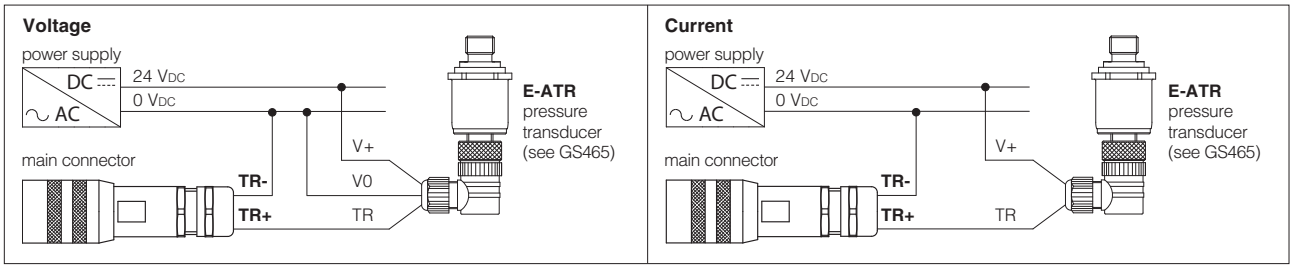
17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 12 pin (A) **Standard** and **Standard** with **/X** option - for **PES** and **PERS**

PIN	Standard	/X	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to V0	Output - on/off signal
4	**INPUT-**		Negative reference input signal for Q_INPUT+ and P_INPUT+	Gnd - analog signal
5	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
6	**Q_MONITOR**		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option. Referred to V0	Output - analog signal **Software selectable**
7	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**P_MONITOR**		Pressure monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option. Referred to V0	Output - analog signal **Software selectable**
9	**D_IN**		Function software selectable between: power limitation enable (default), multiple pressure PID selection or pump enable (24 VDC) / disable (0 VDC). Referred to V0	Input - on/off signal
10	**TR+**		Remote pressure transducer input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /C option	Input - analog signal **Software selectable**
		NC	Do not connect	
11	**TR-**		Negative pressure transducer input signal for TR+	Input - analog signal
		NC	Do not connect	
PE	**EARTH**		Internally connected to driver housing	

Note: these connections are the same of Rexroth A10VSO axial piston pumps, model SYDFEE and SYDFEC

Remote pressure transducer connections - only for **Standard**



17.2 Main connector signals - 12 pin (A) **/S** and **/SX** option - for **PES** and **PERS**

PIN	/S and /SX		TECHNICAL SPECIFICATIONS	NOTES
	NP	Fieldbus		
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	Enable (24 VDC) or disable (0 VDC) the pump	Input - on/off signal
4	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for Q_INPUT+ and P_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: V0	VL0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**P_MONITOR** referred to: V0	VL0	Pressure monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0÷+10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**D_IN0**		Function software selectable between: multiple pressure PID 0 selection (default) or power limitation enable. Referred to V0	Input - on/off signal
		VL+	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**D_IN1**		Function software selectable between: multiple pressure PID 1 selection (default) or power limitation enable. Referred to V0	Input - on/off supply
		VL0	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT** referred to: V0	VL0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

Notes: these connections are the same of Moog radial piston pumps, model RKP-D;
do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communications connectors - for **PES** and **PERS** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(1) Shield connection on connector's housing is recommended

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

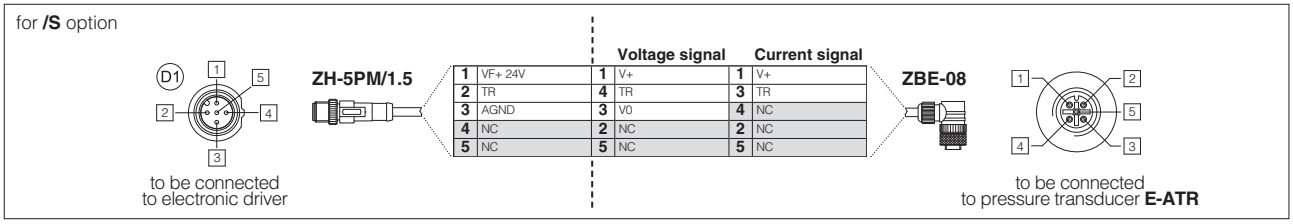
(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(2) Pin 2 can be fed with external +5V supply of CAN interface

17.4 Remote pressure/force transducer connector - M12 - 5 pin - for **PES** and **PERS** with for **/S, /X, /SX** options (D1) - (D2)

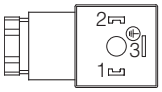
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect
2	**TR1**	Signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/
4	**NC**	Not connect		/	/
5	**NC**	Not connect		/	/

Remote pressure transducer connection - example



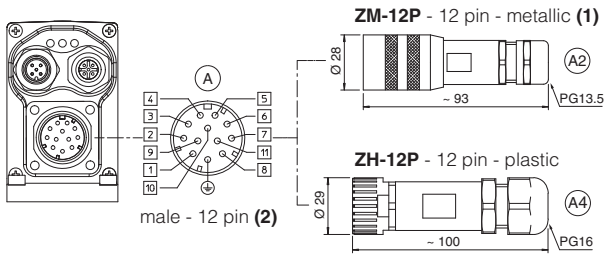
Note: connectors front view

17.5 Solenoid connection - for **CZ** and **LQZ**

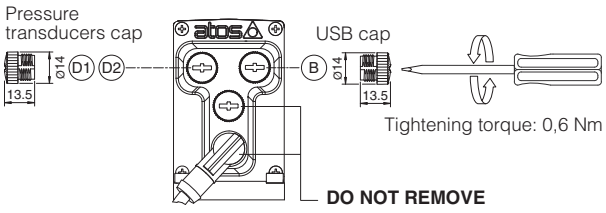
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.6 PES and PERS connections layout

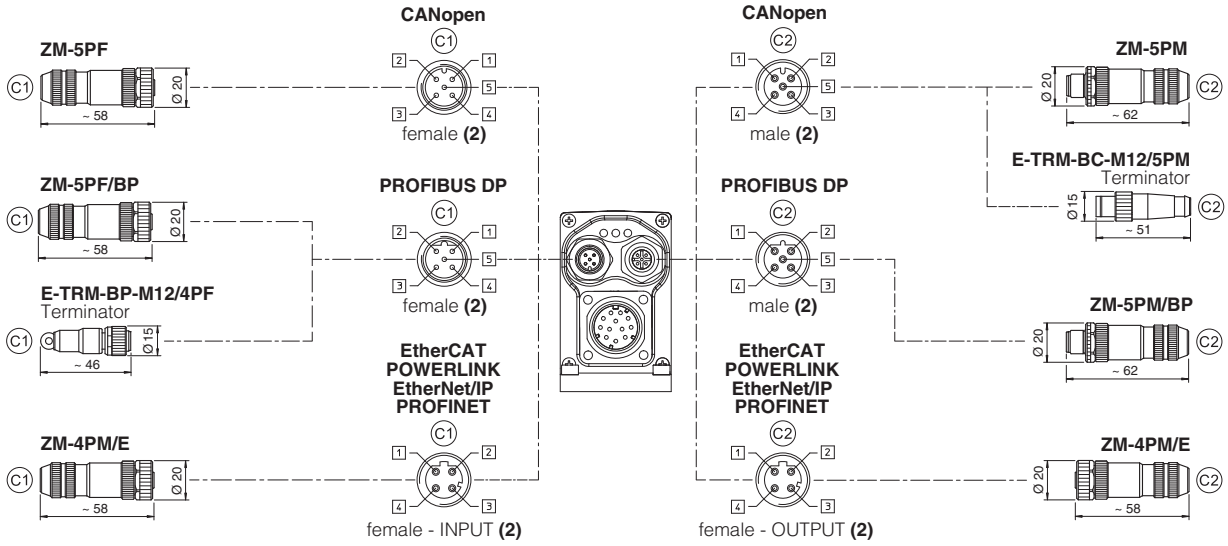
MAIN CONNECTORS



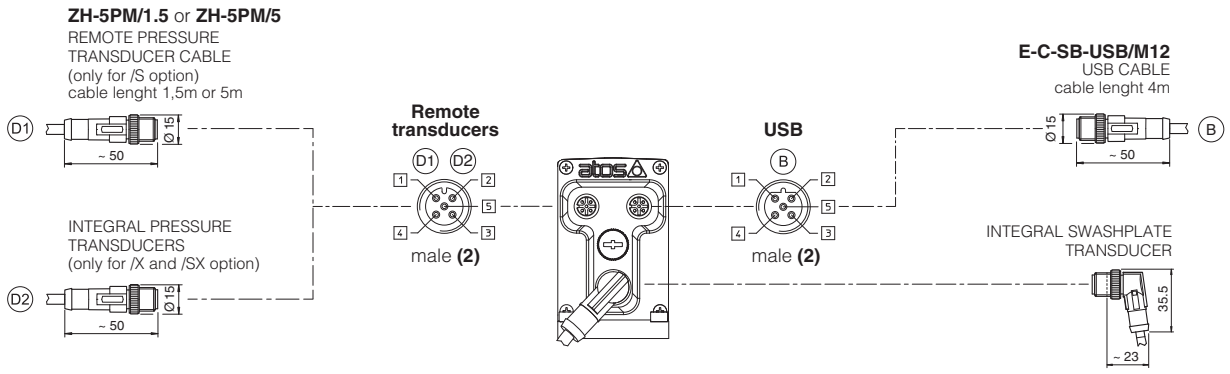
PLASTIC PROTECTION CAPS - supplied with the valves



FIELDBUS CONNECTORS



TRANSDUCERS AND USB CONNECTORS

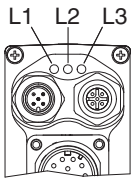


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.7 Diagnostic LEDs (L)

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

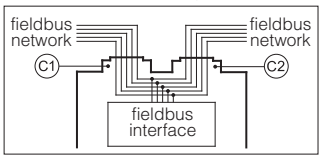
FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET
L1	VALVE STATUS			LINK/ACT			
L2	NETWORK STATUS			NETWORK STATUS			
L3	SOLENOID STATUS			LINK/ACT			



18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital driver executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-12P**	(A2) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately, see tech table **GS500** **(2)** Internally terminated

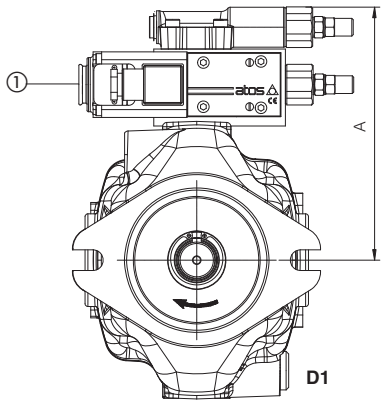
19.3 Remote pressure transducer connectors

CONNECTOR TYPE	PRESSURE TRANSDUCER		SF - Double transducers
CODE	(D1) (D2) **ZH-5PM/1.5**	(D1) (D2) **ZH-5PM/5**	(D2) **ZH-5PM-2/2**
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm²		3 x 0,25 mm² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

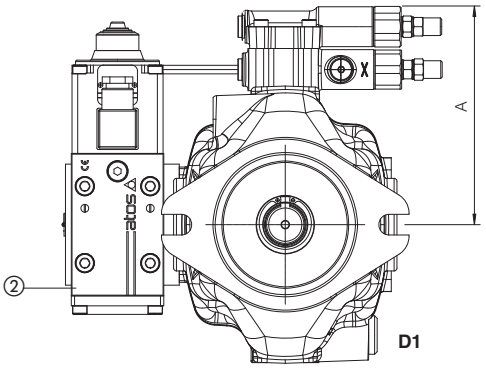
20 INSTALLATION DIMENSION [mm]

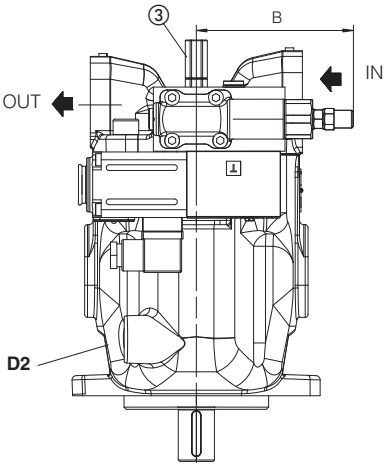
DIMENSIONS OF PVPC size 3, 4 and 5

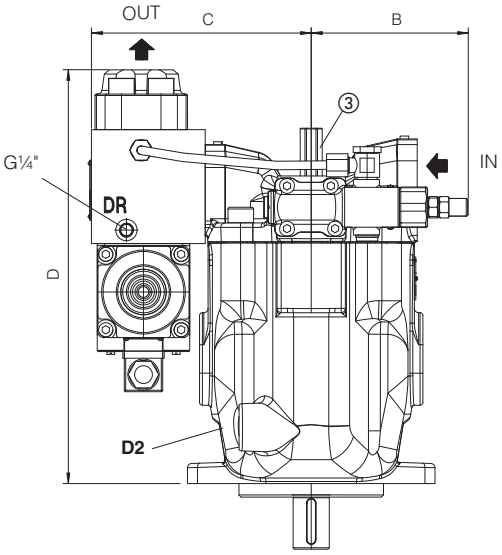
PVPC-CZ



PVPC-LQZ







① = Proportional pressure control valve

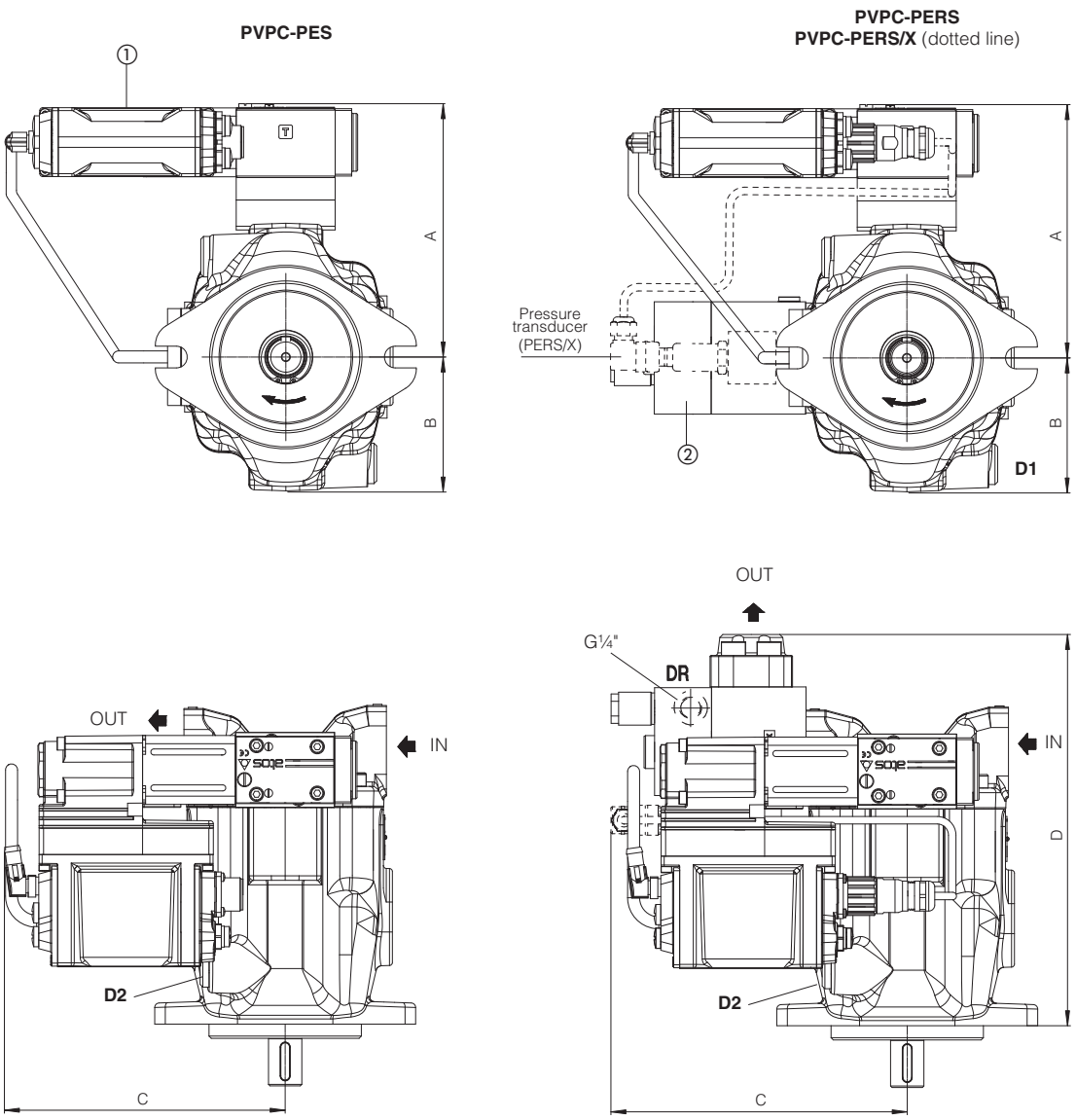
② = Proportional flow control valve

③ = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement (not available for versions PES, PERS and PERS/X). In case of double pump the regulation screw is not always available, please contact our technical office.

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

Pump type	Version	A	B	C	D	IN	OUT	D1, D2	Mass (kg)
PVPC-*-3029	**CZ**	168	111	-	-	Flange SAE 3000 1 1/4”	Flange SAE 6000 3/4”	1/2” BSPP	22
	LQZ	144	111	132	257				24
PVPC-*-4046	**CZ**	177	111	-	-	Flange SAE 3000 1 1/2”	Flange SAE 6000 1”	1/2” BSPP	28
	LQZ	153	111	156	293				33,6
PVPC-*-5073 PVPC-*-5090	**CZ**	190	111	-	-	Flange SAE 3000 2”	Flange SAE 6000 1 1/4”	3/4” BSPP	36,9
	LQZ	166	111	163	328				44

DIMENSIONS OF PVPC size 3, 4 and 5



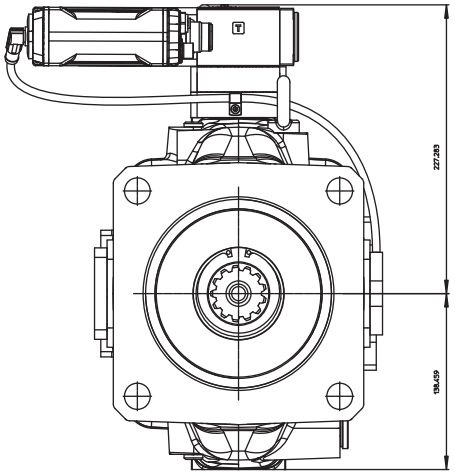
① = Proportional valve with on-board driver with P/Q control
② = Sequence module

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

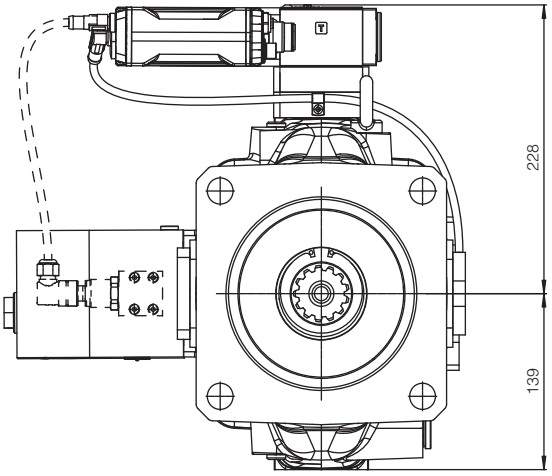
Pump type	Version	A	B	C	D	IN	OUT	D1, D2	Mass (kg)
PVPC-*-3029	**PES**	170	103,5	190	-	Flange SAE 3000 1 1/4”	Flange SAE 6000 3/4”	1/2” BSPP	21,6
	PERS	170	103,5	200	262,5				26
	PERS/X	190	103,5	200	262,5				26,4
PVPC-*-4046	**PES**	178	103,5	190	-	Flange SAE 3000 1 1/2”	Flange SAE 6000 1”	1/2” BSPP	27,6
	PERS	178	103,5	220	299				33,7
	PERS/X	178	103,5	220	299				34,1
PVPC-*-5073 PVPC-*-5090	**PES**	190	103,5	190	-	Flange SAE 3000 2”	Flange SAE 6000 1 1/4”	3/4” BSPP	36,6
	PERS	190	103,5	230	337				46,7
	PERS/X	190	103,5	230	337				47,1

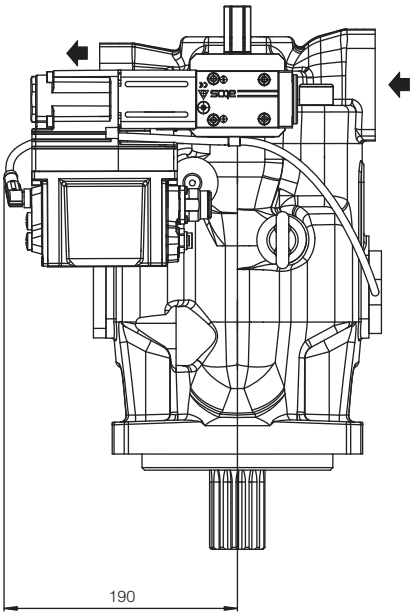
DIMENSIONS OF PVPC size 6

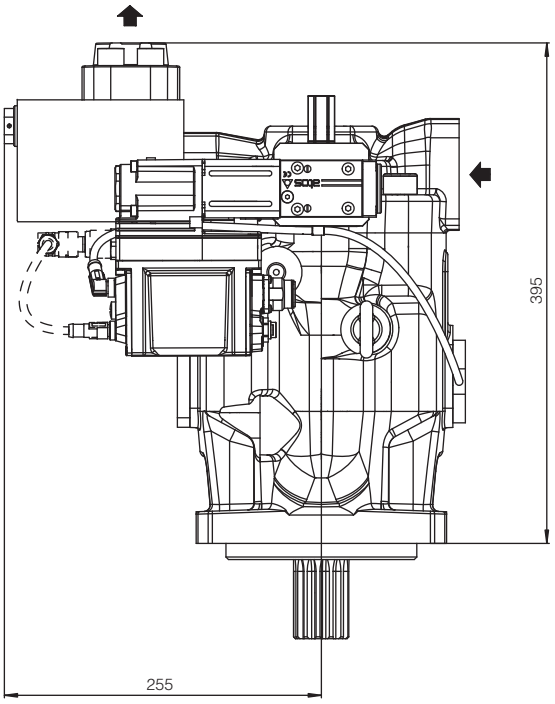
PVPC-PES



PVPC-PERS
PVPC-PERS/X (dotted line)







① = Proportional valve with on-board driver with P/Q control
② = Sequence module

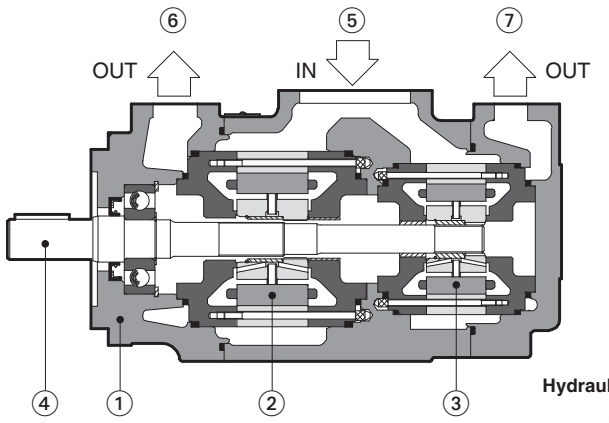
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

21 RELATED DOCUMENTATION

A900	Operating and maintenance information for pumps	**G030**	E-BM-AS digital driver
FS001	Basics for digital electrohydraulics	**GS050**	E-BM-AES digital driver
FS500	Digital proportional valves with P/Q control	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves

Double vane pumps type PFED

fixed displacement



① body
② first cartridge: stator, rotor, vanes, balanced plates
③ second cartridge: as above
④ shaft
⑤ inlet port
⑥ first outlet port
⑦ second outlet port

PFED-43

PFED are fixed displacement double vane pumps ②③ composed by two cartridges of pumps type PFE (see tab. A005) assembled in a main body having one inlet port ⑤ and two outlet ports ⑥⑦.

PFED-43 are composed by one cartridge of PFE-41 and one cartridge of PFE-31.
PFED-54 are composed by one cartridge of PFE-51 and one cartridge of PFE-41.

Suitable for hydraulic oils according to DIN 51524...535 or synthetic fluids having similar lubricating characteristics.

These pumps can be assembled, as second element, with PFE-4 and PFE-5 to obtain triple pumps, see tab A190.

Mounting according to SAE J744.
Easy installation as inlet and outlet ports can be assembled in any of four relative positions.
Easy maintenance as pumping cartridge can be replaced in a few minutes.

Wide variety of displacements: from 29+16 up to 150+85 cm³/rev.
Max pressure up to 210 bar.

1 MODEL CODE

PFED	-	42	045	/	022	/	1	D	TA	*	/	*

PFED: Fixed displacement double vane pump

42: Size of cartridges:
43 = composed by: one cartridge of PFE-41 + one cartridge of PFE-31
54 = composed by: one cartridge of PFE-51 + one cartridge of PFE-41

045: Displacement of first element [cm³/rev], see sec. 3

022: Displacement of second element [cm³/rev], see sec. 3

1: Drive shaft, see section 6 and 7:
cylindrical, keyed
1 = supplied standard if not otherwise specified
2 = according to ISO/DIN 3019
3 = for high torque applications
splined
5 = for PFED-43: according to SAE B 13T 16/32 DP (13 teeth)
for PFED-54: according to SAE C 14T 12/24 DP (14 teeth)
6 = (only for PFED-43) = according to SAE C 14T 12/24 DP (14 teeth)
7 = (only for PFED-43) = similar to shaft type 6. It is used when PFED-43 is the last element of a multiple pump

D: Direction of rotation (as viewed at the shaft end):
D = clockwise (supplied standard if not otherwise specified)
S = counterclockwise
Note: PFED are not reversible

TA: Ports orientation, see section 4

*****: Series number

*****: Seals material:
omit for NBR (mineral oil & water glycol)
PE = FPM

2 MAIN CHARACTERISTICS OF DOUBLE VANE PUMPS TYPE PFED

Installation position		Any position.	
Loads on the shaft		Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the peak horsepower developed.	
Ambient temperature		**Standard** = -25°C ÷ +80°C **/PE** option -15°C ÷ +80°C	
Fluid		Hydraulic oil as per DIN 51524...535; for other fluids see section 1	
Recommended viscosity		max at cold start: 800 mm²/s; max at full power 100 mm²/s; during operation 24 mm²/s; min at full power 10 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	
Fluid contamination class		ISO 4401 class 21/19/16 NAS 1638 class 10 (filters at 25 µm value with ß25 ≥ 75 recommended)	
Fluid temperature		-20°C +60°C -20°C +50°C (water glycol) -20°C +80°C (/PE seals)	
Recommended suction line pressure		from -0,5 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm	
Compliance		RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006	

3 OPERATING CHARACTERISTICS at 1450 rpm with hydraulic oil having viscosity of 24 mm²/sec and 40°C

Model	7 bar				70 bar				140 bar				210 bar				Speed range min/max rpm
	1°flow		2°flow		1°flow		2°flow		1°flow		2°flow		1°flow		2°flow		
PFED-43	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	
PFED-43 029/016	41	0,8	23	0,5	39	5,5	21	3	37	10	19	5	34	14	16	6,5	800Ø2500
PFED-43 029/022	41	0,8	30	0,6	39	5,5	28	4	37	10	26	7	34	14	23	10	
PFED-43 029/028	41	0,8	40	0,8	39	5,5	38	5,5	37	10	36	10	34	14	33	14	
PFED-43 037/016	52	1	23	0,5	50	7	21	3	48	12,5	19	5	45	18	16	6,5	
PFED-43 037/022	52	1	30	0,6	50	7	28	4	48	12,5	26	7	45	18	23	10	
PFED-43 037/028	52	1	40	0,8	50	7	38	5,5	48	12,5	36	10	45	18	33	14	
PFED-43 037/036	52	1	51	1	50	7	49	7	48	12,5	46	12,5	45	18	43	18	
PFED-43 045/016	64	1,3	23	0,5	62	8,5	21	3	60	16	19	5	57	24	16	6,5	
PFED-43 045/022	64	1,3	30	0,6	62	8,5	28	4	60	16	26	7	57	24	23	10	
PFED-43 045/028	64	1,3	40	0,8	62	8,5	38	5,5	60	16	36	10	57	24	33	14	
PFED-43 045/036	64	1,3	51	1	62	8,5	49	7	60	16	46	12,5	57	24	43	18	
PFED-43 045/044	64	1,3	63	1,3	62	8,5	61	8	60	16	58	15,5	57	24	55	23	
PFED-43 056/016	80	1,6	23	0,5	78	11	21	3	75	21	19	5	72	30	16	6,5	
PFED-43 056/022	80	1,6	30	0,6	78	11	28	4	75	21	26	7	72	30	23	10	
PFED-43 056/028	80	1,6	40	0,8	78	11	38	5,5	75	21	36	10	72	30	33	14	
PFED-43 056/036	80	1,6	51	1	78	11	49	7	75	21	46	12,5	72	30	43	18	
PFED-43 056/044	80	1,7	63	1,3	78	11	61	8	75	21	58	15,5	72	30	55	23	
PFED-43 070/016	101	2	23	0,5	98	13,5	21	3	95	26	19	5	91	37	16	6,5	
PFED-43 070/022	101	2	30	0,6	98	13,5	28	4	95	26	26	7	91	37	25	10	
PFED-43 070/028	101	2	40	0,8	98	13,5	38	5,5	95	26	36	10	91	37	33	14	
PFED-43 070/036	101	2	51	1	98	13,5	49	7	95	26	46	12,5	91	37	43	18	
PFED-43 070/044	101	2	63	1,3	98	13,5	61	8	95	26	58	15,5	91	37	55	23	
PFED-43 085/016	124	2,4	23	0,5	121	16	21	3	118	32	19	5	114	46	16	6,5	800Ø2000
PFED-43 085/022	124	2,4	30	1,6	121	16	28	4	118	32	26	7	114	46	23	10	
PFED-43 085/028	124	2,4	40	0,8	121	16	38	5,5	118	32	36	10	114	46	33	14	
PFED-43 085/036	124	2,4	51	1	121	16	49	7	118	32	46	12,5	114	46	43	18	
PFED-43 085/044	124	2,4	63	1,3	121	16	61	8	118	32	58	15,5	114	46	55	23	
PFED-54																	
PFED-54 090/029	128	2,7	41	0,8	124	17	39	5,5	119	33	37	10	114	48	34	14	700Ø2200
PFED-54 090/037	128	2,7	52	1	124	17	50	7	119	33	48	12,5	114	48	45	18	
PFED-54 090/045	128	2,7	64	1,3	124	17	62	8,5	119	33	60	16	114	48	57	24	
PFED-54 090/056	128	2,7	80	1,6	124	17	78	11	119	33	75	21	114	48	72	30	
PFED-54 090/070	128	2,7	101	2	124	17	98	13,5	119	33	95	26	114	48	91	37	
PFED-54 090/085	128	2,7	124	2,4	124	17	121	16	119	33	118	32	114	48	114	46	700Ø2000
PFED-54 110/029	157	3,2	41	0,8	152	21	39	5,5	147	40	37	10	141	58	34	14	700Ø2200
PFED-54 110/037	157	3,2	52	1	152	21	50	7	147	40	48	12,5	141	58	45	18	
PFED-54 110/045	157	3,2	64	1,3	152	21	62	8,5	147	40	60	16	141	58	57	24	
PFED-54 110/056	157	3,2	80	1,6	152	21	78	11	147	40	75	21	141	58	72	30	
PFED-54 110/070	157	3,2	101	2	152	21	98	13,5	147	40	95	26	141	58	91	37	
PFED-54 110/085	157	3,2	124	2,4	152	21	121	16	147	40	118	32	141	58	114	46	700Ø2000
PFED-54 129/029	186	3,7	41	0,8	180	25	39	5,5	174	47	37	10	168	69	34	14	700Ø2200
PFED-54 129/037	186	3,7	52	1	180	25	50	7	174	47	48	12,5	168	69	45	18	
PFED-54 129/045	186	3,7	64	1,3	180	25	62	8,5	174	47	60	16	168	69	57	24	
PFED-54 129/056	186	3,7	80	1,6	180	25	78	11	174	47	75	21	168	69	72	30	
PFED-54 129/070	186	3,7	101	2	180	25	98	13,5	174	47	95	26	168	69	91	37	
PFED-54 129/085	186	3,7	124	2,4	180	25	121	16	174	47	118	32	168	69	114	46	700Ø2000
PFED-54 150/029	215	4,2	41	0,8	211	29	39	5,5	204	55	37	10	197	80	34	14	700Ø1800
PFED-54 150/037	215	4,2	52	1	211	29	50	7	204	55	48	12,5	197	80	45	18	
PFED-54 150/045	215	4,2	64	1,3	211	29	62	8,5	204	55	60	16	197	80	57	24	
PFED-54 150/056	215	4,2	80	1,6	211	29	78	11	204	55	75	21	197	80	72	30	
PFED-54 150/070	215	4,2	101	2	211	29	98	13,5	204	55	95	26	197	80	91	37	
PFED-54 150/085	215	4,2	124	2,4	211	29	121	16	204	55	118	32	197	80	114	46	

(1) Max pressure is 160 bar for /PE and /WG versions (2) Max speed is 1800 rpm for /PE versions; 1500 rpm for /WG versions

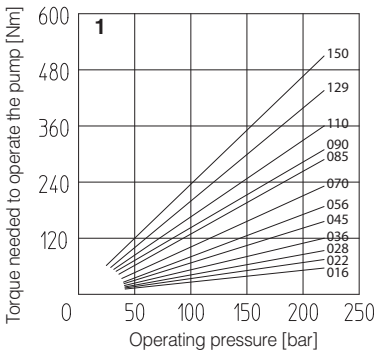
4 PORT ORIENTATION (pumps viewed from the shaf end)

Pumps can be supplied with the oil ports oriented in different configuration in relation to the drive shaft. Port orientation of the first element is designated as follows (as wiewed at the shaft end);
T = inlet and outlet ports on the same axis (standard)
U = outlet orientated 180° with respect to the inlet
V = outlet oriented 90° with respect to the inlet
W = outlet oriented 270° with respect to the inlet
Outlet port of second element can be orientated, relative to the inlet port, in 8 positions at 45° **(O, A, B, C, D, E, F, G)**
Ports orientation can be easily changed by rotating the pump body that carries inlet port.

TO P1-T-P2	**TA** P1-T P2	**TB** P1-T P2	**TC** P1-T P2	**TD** P1-T P2	**TE** P1-T P2	**TF** P1-T P2	**TG** P1-T P2
WO P1-P2 T	**WA** P1 P2 T	**WB** P1 T P2	**WC** P1 T P2	**WD** P1 T P2	**WE** P1 T P2	**WF** P1 P2-T	**WG** P1 P2 T
UO P1-P2 T	**UA** P1 P2 T	**UB** P1 T P2	**UC** P1 T P2	**UD** P1 P2-T	**UE** P1 P2 T	**UF** P1 P2 T	**UG** P1 P2 T
VO P1-P2 T	**VA** P1 P2 T	**VB** P1 P2-T	**VC** P1 T P2	**VD** P1 T P2	**VE** P1 P2 T	**VF** P1 P2 T	**VG** P1 P2 T

5 DIAGRAMS

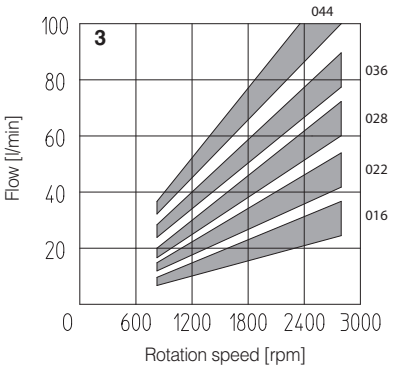
1 = Torque versus pressure diagram

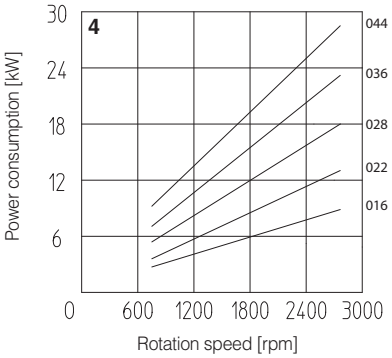


PFED-43: Second element (cartridge SC-PFED-31)**

2 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

3 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

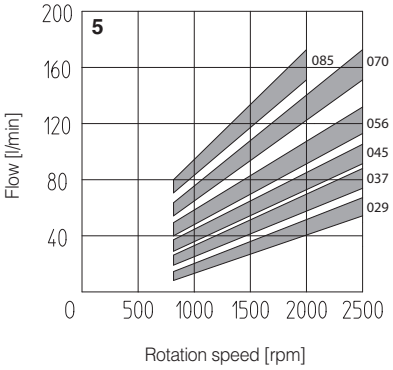


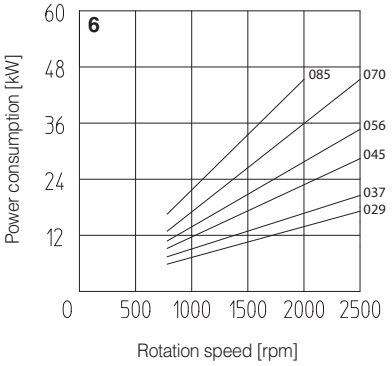


PFED-43: First element (cartridge SC-PFE-41)**
PFED-54: Second element (cartridge SC-PFED-41)**

4 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

5 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

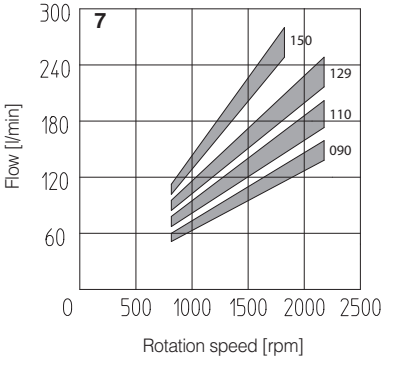


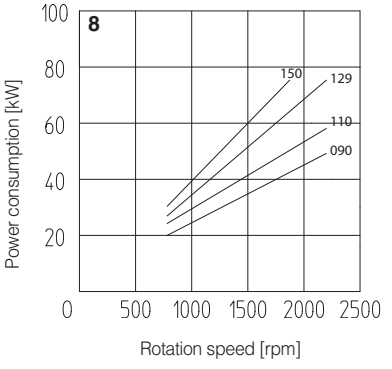


PFED-54: First element (cartridge SC-PFE-51)**

6 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

7 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.





6 LIMITS OF SHAFT TORQUE

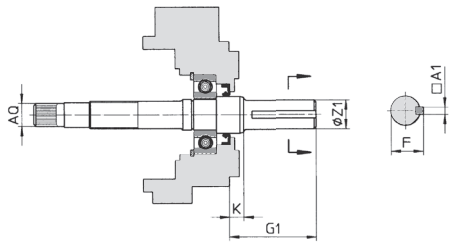
Pump model	Maximum driving torque [Nm]					
	Shaft type 1	Shaft type 2	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7
PFED-43	250	250	400	200	400	400
PFED-54	500	500	850	450	–	–

The values of torque needed to operate each single cartridge are shown on the "torque versus pressure diagram" at section 5.
The total torque applied to the shaft of the pump is the sum of the single torque needed for operating each single cartridge and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

7 DRIVE SHAFT

CYLINDRICAL SHAFT KEYED

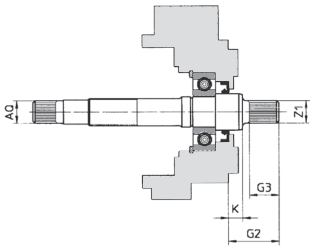
1 = supplied as standard if not specified in the model code
2 = according to ISO/DIN 3019 standards
3 = for high torque applications



Model	Keyed shaft type 1 (standard)					Keyed shaft type 2					Keyed shaft type 3				
	A1	F	G1	K	ØZ1	A1	F	G1	K	ØZ1	A1	F	G1	K	ØZ1
PFED-43	4,78	24,54	59,00	11,40	22,22	6,38	25,03	71,00	8,00	22,22	6,38	28,30	78,00	11,40	25,38
	4,75	24,41			22,20	6,35	24,77			22,20	6,35	28,10			25,35
PFED-54	7,97	35,33	74,25	14	31,75	7,97	35,33	84,25	8,1	31,75	7,97	38,58	84,25	14	34,90
	7,94	35,07			31,70	7,94	35,07			31,70	7,94	38,46			34,88

SPLINED SHAFT

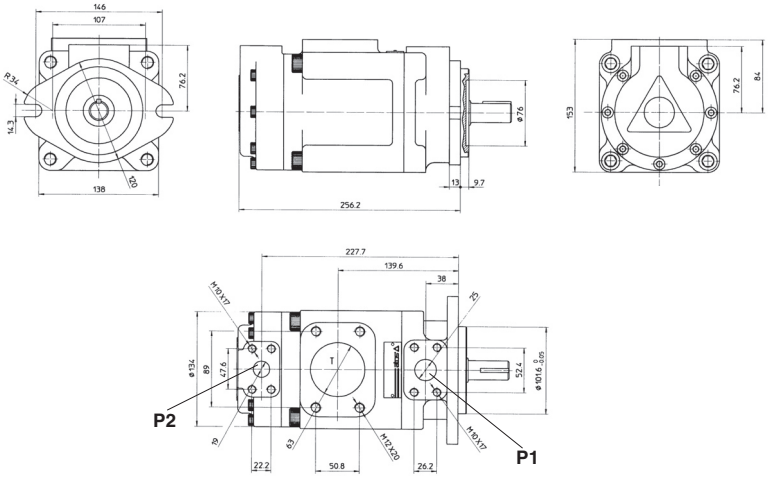
5 = for PFED-43 according to SAE B 16/32 DP, 13 teeth;
for PFED-54 according to SAE C 12/24 DP, 14 teeth;
6 = (only for PFED-43) according to SAE C 12/24 DP, 14 teeth;
7 = only for PFED-43 when used as the last element of a multiple pump: similar to shaft type 6.



Model	Splined shaft type 5				Splined shaft type 6				Splined shaft type 7			
	G2	G3	K	Z2	G2	G3	K	Z2	G2	G3	K	Z2
PFED-43	41,25	28	8,00	SAE 16/32-13T	55,60	42	8,00	SAE 12/24-14T	41,60	28	8,00	SAE 12/24-14T
PFED-54	55,7	42	8,1	SAE 12/24-14T	—	—	—	—	—	—	—	—

8 DIMENSIONS [mm]

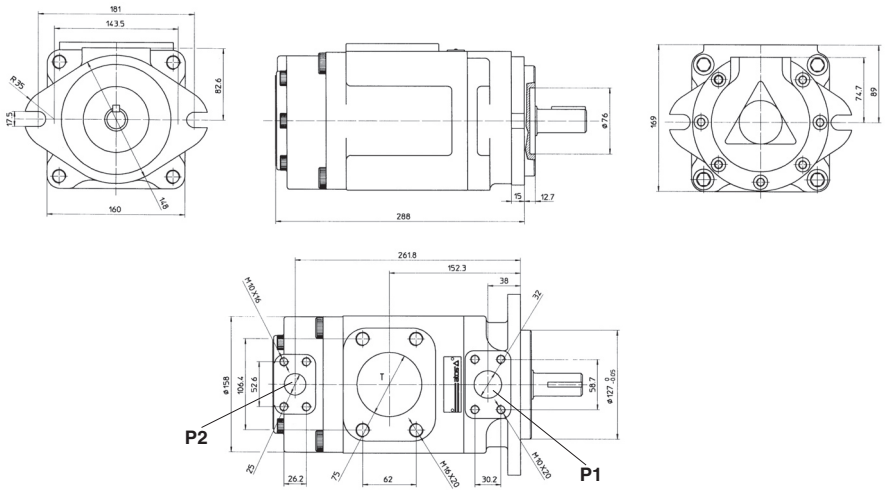
PFED-43



SAE FLANGES:
port P1 = 1";
port P2 = 3/4";
port T = 2 ½"

Weight: 24,5 kg

PFED-54



SAE FLANGES:
port P1 = 1 ¼";
port P2 = 1";
port T = 3"

Weight: 36 kg

Multiple pumps type PFEX, PFRX, PVPCX2E

vane, piston, fixed or variable displacement

Multiple pumps are composed by various vane, radial piston or axial piston pumps modularly assembled:
PFEX, see section 1, are composed by vane pumps PFE (table A005 and A007) or PFED (table A180);
PFRX, see section 2, are composed by radial piston pumps PFR (table A045) and vane pumps PFE (table A005 and A007)
PVPCX2E, see section 3, are composed by axial piston pumps PVPC (table A160) and vane pumps PFE (table A005 and A007)

For multiple pumps must be verified that the max torques applied on each single drive shaft and on each single through shaft are not higher than the max allowed limits. In particular, must be considered that the total torque applied to the drive shaft of the first element is the sum of the single torque needed for operating each single pump.

In the figure are shown:

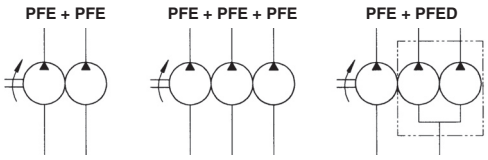
M1, M2, M3, = torque needed to operate each single pump (obtainable from “torque versus pressure diagram” of each single pump).
L_{DS1}, L_{DS2}, L_{DS3} = limits of torque for drive shafts;
L_{TS1}, L_{TS2} = limits of torque at the end of through shafts.

The values of torque needed to operate each single pump and the allowed limit torque values for drive shafts and through shafts are shown on technical tables of individual basic pumps.

For multiple pumps, the following verifications must be executed:
a) $M3 \le L_{TS2}$
b) $M3 + M2 \le L_{DS2}$
c) $M3 + M2 \le L_{TS1}$
d) $M3 + M2 + M1 \le L_{DS1}$

1 PFEX2, PFEX3, PFEXD MULTIPLE VANE PUMPS

PFEX* are fixed displacement multiple vane pumps. They can be double (composed by two pumps type PFE) or triple pumps (composed by three PFE or by one PFE and one PFED).



For technical characteristics of PFE-*1 pumps, see tab. A005; for technical characteristics of PFE-*2 see tab. A007; for technical characteristics of PFED pumps, see tab. A180.

1.1 MODEL CODE FOR PFEX*

PFEX	2	-	42	045	/	31028	/	3	D	T	*	/	*

Fixed displacement multiple vane pump

2 = double pump composed of two pumps type PFE
3 = triple pump composed of three pumps type PFE
D = triple pump composed of one pump type PFE and one pump type PFED
Pumps are assembled in decreasing order of size

Size of first pump:
31, **41**, **51**, **32**, **42**, **52**

Displacement of first pump [cm³/rev]
for PFE 31: 010, 016, 022, 028, 036, 044
for PFE 41: 029, 037, 045, 056, 070,085
for PFE 51: 090, 110, 129, 150
for PFE 32: 016, 022, 028, 036,
for PFE 42: 045, 056, 070, 085
for PFE 52: 090, 110, 129, 150

Size and displacement [cm³/rev] of second (and third) pump

Drive shaft
cylindrical keyed:
1 = (only for PFE-31, 41, 51) standard
2 = (only for PFE-41 and PFE-51) according to ISO/DIN 3019
3 = for high torque applications

splined
5 = standard
6 = for high torque applications
for PFEX*-3 according to SAE B 16/32 DP, 13 teeth;
for PFEX*-4 according to SAE C 12/24 DP, 14 teeth;

Direction of rotation (as viewed at the shaft end):
D = clockwise (supplied standard if not otherwise specified)
S = counterclockwise
Note: PFE are not reversible

Port orientation, see section 1.2

Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FPM

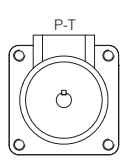
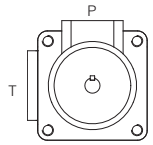
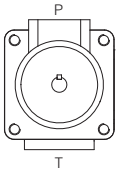
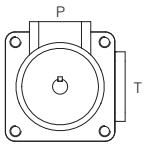
Note:
multiple pumps are supplied with inlet and outlet ports in line. Ports orientation can be easily changed by rotating the pump body that carries inlet port.

1.2 PORT ORIENTATION

-PFEX2, PFEX3

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated.
In PFEX2 and PFEX3 multiple pumps, the port orientation is the same for first, second (third) pumps.

Model code example: PFEX2-42045/41037/5D**T**

T  orientation of all pumps	**V**  orientation of all pumps	**U**  orientation of all pumps	**W**  orientation of all pumps

P1 outlet port ; **T1** inlet port

-PFEXD

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated..
In PFEXD, the ports orientation of second / third pump (PFED), can be selected according following table.
The ports orientation of first pump depends to the selected orientation of second / third pumps.

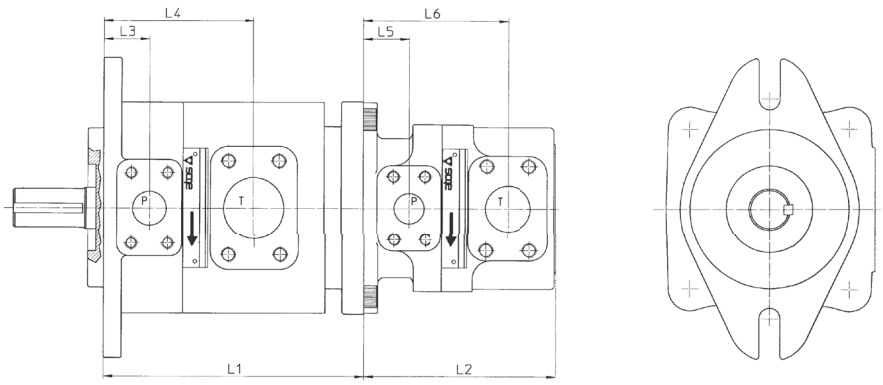
Model code example: PFEXD-42045/43037/016/5D**TO**

1st PUMP PFEX*	**2nd / 3th PUMP PFED***							
	**TO** 	**TA** 	**TB** 	**TC** 	**TD** 	**TE** 	**TF** 	**TG** 
	**WO** 	**WA** 	**WB** 	**WC** 	**WD** 	**WE** 	**WF** 	**WG** 
	**UO** 	**UA** 	**UB** 	**UC** 	**UD** 	**UE** 	**UF** 	**UG** 
	**VO** 	**VA** 	**VB** 	**VC** 	**VD** 	**VE** 	**VF** 	**VG** 

P1 outlet port of first element; **P2** outlet port of second element; **P3** outlet port of third element; **T1** inlet port of first element; **T2** inlet port of second element

1.3 DIMENSIONS OF MULTIPLE PUMPS TYPE PFEX2, PFEX3, PFEXD [mm]

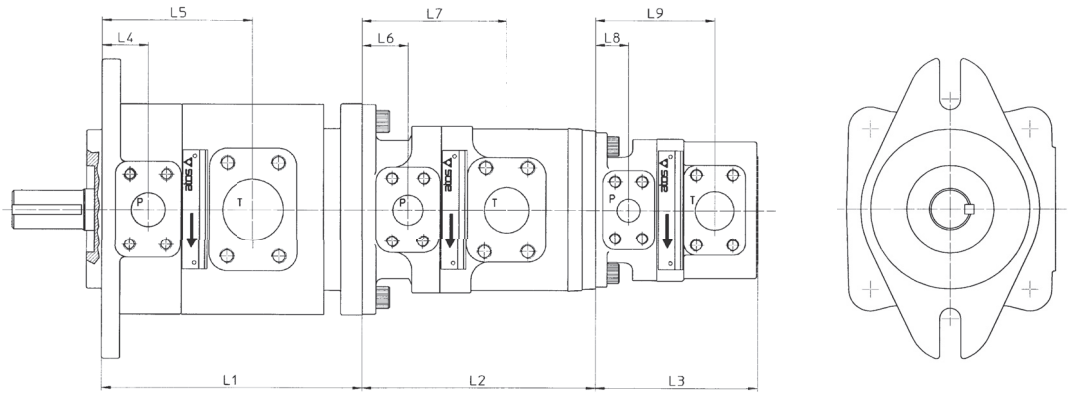
PFEX2



For missing details see tab. A005 and A007

Composed pump	First element	Second element	L1	L2	L3	L4	L5	L6
PFEX2-32***/31***/*	PFEXA-32***/*	PFE-31***/5	164	134,5	27,5	98,5	27,5	98,5
PFEX2-42***/31***/*	PFEXA7-42***/*	PFE-31***/7	194	134,5	38	120	27,5	98,5
PFEX2-42***/41***/*	PFEXB7-42***/*	PFE-41***/7	203	160	38	120	38	120
PFEX2-52***/31***/*	PFEXA7-52***/*	PFE-31***/7	206	134,5	38	125	27,5	98,5
PFEX2-52***/41***/*	PFEXB7-52***/*	PFE-41***/7	215,5	160	38	125	38	120
PFEX2-52***/51***/*	PFEXC-52***/*	PFE-51***/5	230	186,5	38	125	38	125

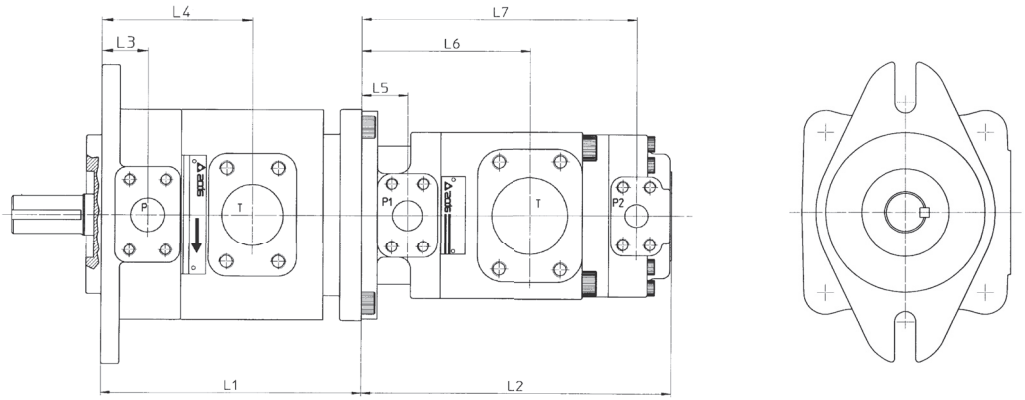
PFEX3



For missing details see tab. A005 and A007

Composed pump	First elem.	Second elem.	Third elem.	L1	L2	L3	L4	L5	L6	L7	L8	L9
PFEX3-32***/31***/31***/*	PFEXA-32***/*	PFEXA-31***/5	PFE-31***/5	164	164	134,5	27,4	98,5	27,4	98,5	24,7	98,5
PFEX3-42***/31***/31***/*	PFEXA7-42***/*	PFEXA-31***/7	PFE-31***/5	203	164	134,5	38	120	27,4	98,5	24,7	98,5
PFEX3-42***/41***/31***/*	PFEXB7-42***/*	PFEXA7-41***/7	PFE-31***/7	203	194	134,5	38	120	38	120	24,7	98,5
PFEX3-42***/41***/41***/*	PFEXB7-42***/*	PFEXB7-41***/7	PFE-41***/7	203	203	160	38	120	38	120	38	120
PFEX3-52***/31***/31***/*	PFEXA7-52***/*	PFEXA-31***/7	PFE-31***/5	206	164	134,5	38	125	24,7	98,5	24,7	98,5
PFEX3-52***/41***/31***/*	PFEXB7-52***/*	PFEXA7-41***/7	PFE-31***/7	215,5	194	134,5	38	125	38	120	24,7	98,5
PFEX3-52***/41***/41***/*	PFEXB7-52***/*	PFEXB7-41***/7	PFE-41***/7	215,5	203	160	38	125	38	120	38	120
PFEX3-52***/51***/31***/*	PFEXC-52***/*	PFEXA7-51***/5	PFE-31***/7	230	206	134,5	38	125	38	125	24,7	98,5
PFEX3-52***/51***/41***/*	PFEXC-52***/*	PFEXB7-51***/5	PFE-41***/7	230	206	160	38	125	38	125	38	120
PFEX3-52***/51***/51***/*	PFEXC-52***/*	PFEXC-51***/5	PFE-51***/5	230	230	186,5	38	125	38	125	38	125

PFEXD

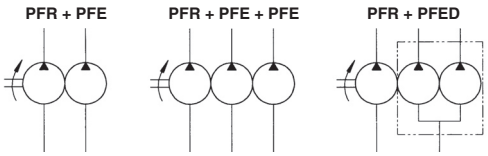


For missing details see tab. A005 and A007, A180

Composed pump	First element	Second element	L1	L2	L3	L4	L5	L6	L7
PFEXD-42***/43***/0**	PFEXB7-42***	PFED-43***/0**/7	203	256	38	120	38	139,6	227,7
PFEXD-52***/43***/0**	PFEXB7-52***	PFED-43***/0**/7	215,5	256	38	125	38	199,6	227,7
PFEXD-52***/54***/0**	PFEXC-52***	PFED-54***/0**/5	230	288	38	125	38	152,3	261,8

2 PFRX2E, PFRX3E, PFRXDE MULTIPLE RADIAL PISTON/VANE PUMPS

PFRX*E are fixed displacement multiple piston/vane pumps. They can be double (composed by one pump type PFR and one pump type PFE) or triple pumps (composed by one pump type PFR and one pump type PFEX2 or by one PFR and one PFED).



For technical characteristics of PFR pumps see tab. A045, for technical characteristics of PFE-1* pumps see tab. A005; for technical characteristics of PFE-*2 see tab. A007, for technical characteristics of PFED pumps, see tab. A180.

2.1 MODEL CODE FOR PFRX*E

PFRX	2E	-	5	25	/	31044	/	D	*	*	/	*

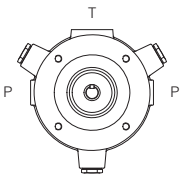
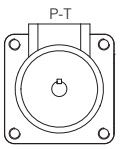
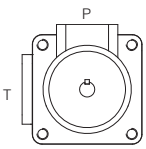
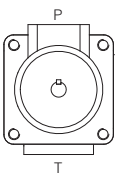
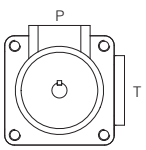
- **PFRX**: Multiple fixed displacement piston/vane pump
- **2E**: Composition: **2E** = double: PFR + PFE; **3E** = triple: PFR + PFEX2; **DE** = triple: PFR + PFED. The pumps are assembled in decreasing order of size.
- **5**: Size of first pump type PFR: **3**, **5**
- **25**: Displacement of first pump type PFR [cm³/rev] for PFR-3: **08**, **11**, **15**; for PFR-5: **18**, **25**
- **31044**: Size and displacement [cm³/rev] of PFE second (and third) pump; for PFE 31: 010, 016, 022, 028, 036, 044; for PFE 41: 029, 037, 045, 056, 070,085; for PFE 51: 090, 110, 129, 150; for PFE 32: 016, 022, 028, 036; for PFE 42: 045, 056, 070, 085; for PFE 52: 090, 110, 129, 150
- **D**: Direction of rotation (as viewed at the shaft end): **D** = clockwise (supplied standard if not otherwise specified); **S** = counter clockwise. Note: PFRX*E are not reversible
- *****: Port orientation, see section 2.2
- *****: Series number
- *****: Seals material: omit for NBR (mineral oil & water glycol); **PE** = FPM

2.2 PORT ORIENTATION

-PFRX2E, PFRX3E

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated.
Referred to the first element (PFRX*), in second / third pumps the ports can be oriented as indicated in the picture. The third element is always oriented as the second element.

Model code example: PFRX2E-525/31044/D**T**

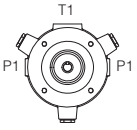
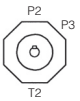
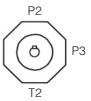
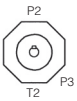
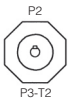
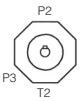
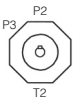
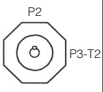
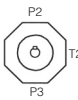
1st PUMP PFRX*	2nd / 3th PUMP PFE			
	**T** 	**V** 	**U** 	**W** 

P1 outlet port ; **T1** inlet port

-PFRXDE

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated.
In PFRXDE, can be select the orientation of second / third pump (PFED)

Model code example: PFRXDE-525/43045/022/D**TO**

1st PUMP PFRX*	2nd / 3th PUMP PFED*							
	**TO** 	**TA** 	**TB** 	**TC** 	**TD** 	**TE** 	**TF** 	**TG** 
	WO 	**WA** 	**WB** 	**WC** 	**WD** 	**WE** 	**WF** 	**WG** 
	UO 	**UA** 	**UB** 	**UC** 	**UD** 	**UE** 	**UF** 	**UG** 
	VO 	**VA** 	**VB** 	**VC** 	**VD** 	**VE** 	**VF** 	**VG** 

P1 outlet port of first element; **P2** outlet port of second element; **P3** outlet port of third element; **T1** inlet port of first element; **T2** inlet port of second element

2.3 OPERATING CHARACTERISTICS OF STANDARD DOUBLE PUMPS TYPE PFRX2E

(at 1450 rpm and based on mineral oil ISO VG46 at 50° C)

Standard model (1)	Speed range [rpm] (2)	RADIAL PISTON PUMP			VANE PUMP			
		Displacement [cm³/rev]	Flow [l/min] (3)	Max pressure [bar] (4)	Displacement [cm³/rev]	Flow [l/min] (3)	Max pressure [bar] (5)	Total flow [l/min]
PFRX2E-308/31010	600-1800	8	12,6	350	10,5	15	160	27,6
PFRX2E-308/31016					16,5	23	210	35,6
PFRX2E-308/31022					21,6	30		42,6
PFRX2E-308/31028					28,1	40		52,6
PFRX2E-308/31036					36,5	51		63,6
PFRX2E-308/31044					43,7	63		75,6
PFRX2E-308/41029					29,3	41		53,6
PFRX2E-308/41037					36,6	52		64,6
PFRX2E-308/41045					45	64		76,6
PFRX2E-308/41056					55,8	80		92,6
PFRX2E-308/41070					69,9	101		113,6
PFRX2E-308/41085					85,3	124		136,6
PFRX2E-308/51090					90	128		140,6
PFRX2E-308/51110					109,6	157		169,6
PFRX2E-308/51129					129,2	186		198,6
PFRX2E-311/31044		11,4	16,5	350	43,7	63		79,5
PFRX2E-311/41070					69,9	101		117,5
PFRX2E-311/41085					85,3	124		140,5
PFRX2E-311/51110					109,6	157		173,5
PFRX2E-311/51129					129,2	186		202,5
PFRX2E-315/41056		14,7	21,5	350	55,8	80		101,5
PFRX2E-315/41070					69,9	101		122,5
PFRX2E-315/51110					109,6	157		178,5
PFRX2E-315/51129					129,2	186		207,5
PFRX2E-518/31044		18,1	26	350	43,7	63		89
PFRX2E-518/41070					69,9	101		127
PFRX2E-518/41085					85,3	124		150
PFRX2E-518/51110					109,6	157		183
PFRX2E-518/51129					129,2	186		212
PFRX2E-525/41070		25,4	37	350	69,9	101		138
PFRX2E-525/51110					109,6	157		194
PFRX2E-525/51129					129,2	186		233

(1) Further composition of PFR and PFE double pumps are available on request. Other composition of PFRX2E must subject to verification of max torque limits allowed by the drive shafts of PFR and PFE and by the through shaft of PFR (320 Nm).
(2) Max speed is 1800 rpm for /PE versions; 1000 rpm for water glycol fluid
(3) Flow rate and power consumption are proportional to revolution speed
(4) Max pressure is 250 bar for /PE versions, 175 bar for water glycol fluid
(5) Max pressure is 160 bar for /PE and water glycol fluid.

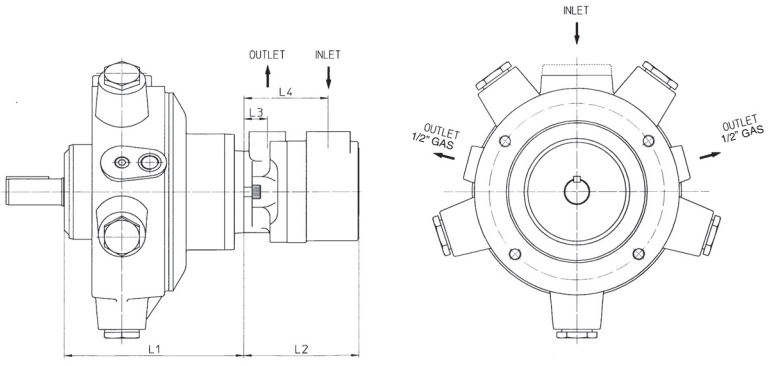
The shaft of the PFR pump has an eccentric cam which rotates with the shaft generating the stroke of the pistons and thus generating the flow rate.
For best functioning a balanced coupling should be provided between the shaft of the motor and the shaft of the pump.
See tab. A045

2.4 TRIPLE PUMPS TYPE PFRX3E AND PFRXDE

Many triple pump compositions PFRX3E = PFR + PFEX2 or PFRXDE = PFR + PFED can be realized but they must be subject to verification of max torque-limits allowed by drive shaft and through shaft of each individual basic pump according to description of first page.

2.5 DIMENSIONS OF MULTIPLE PUMPS TYPE PFRX2, PFRX3, PFRXD [mm]

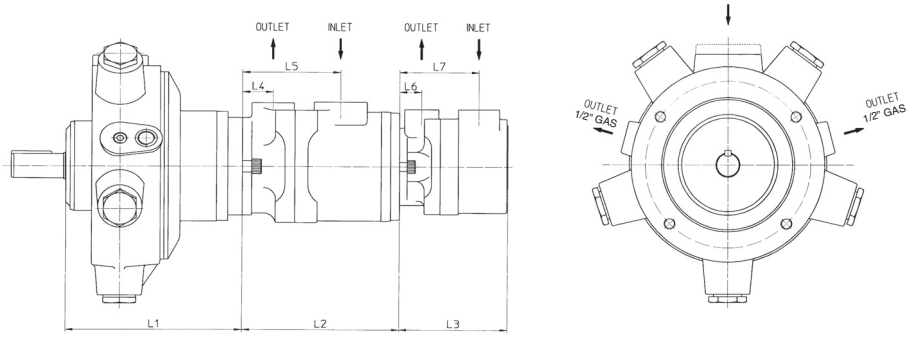
PFRX2E



For missing details see tab. A045, A005 and A007

Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4
PFRX2E-3**/31***	PFRXA-3**	PFE-31***	200	134,5	27,5	98,5
PFRX2E-3**/41***	PFRXB-3**	PFE-41***	209	160	38	120
PFRX2E-3**/51***	PFRXC-3**	PFE-51***	224	186,5	38	125
PFRX2E-5**/31***	PFRXA-5**	PFE-31***	210	134,5	27,5	98,5
PFRX2E-5**/41***	PFRXB-5**	PFE-41***	219,5	160	38	120
PFRX2E-5**/51***	PFRXC-5**	PFE-51***	234	134,5	38	125

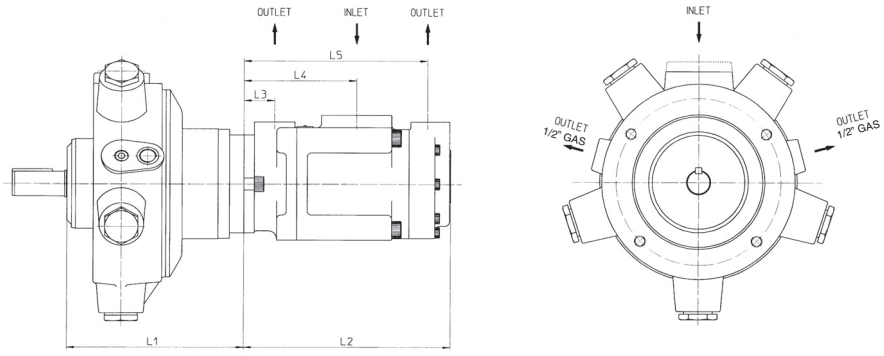
PFRX3E



For missing details see tab. A045, A005 and A007

Composed pump	First element - piston pump -	Second element - vane pump -	Third element - vane pump -	L1	L2	L3	L4	L5	L6	L7
PFRX3E-3**/31**/31***	PFRXA-3**	PFEXA-31***	PFE-31***	200	164	134,5	27,5	98,5	27,5	98,5
PFRX3E-3**/41***/31***	PFRXB-3**	PFEXA-41***	PFE-31***	209	194	134,5	38	120	27,5	98,5
PFRX3E-3**/41***/41***	PFRXB-3**	PFEXB-41***	PFE-41***	209	203	160	38	120	38	120
PFRX3E-3**/51***/31***	PFRXC-3**	PFEXA-51***	PFE-31***	224	206	134,5	38	125	27,5	98,5
PFRX3E-3**/51***/41***	PFRXC-3**	PFEXB-51***	PFE-41***	224	215,5	160	38	125	38	120
PFRX3E-3**/51***/51***	PFRXC-3**	PFEXC-51***	PFE-51***	224	230	186,5	38	125	38	125
PFRX3E-5**/31***/31***	PFRXA-5**	PFEXA-31***	PFE-31***	210	164	134,5	27,5	98,5	27,5	98,5
PFRX3E-5**/41***/31***	PFRXB-5**	PFEXA-41***	PFE-31***	219,5	194	134,5	38	120	27,5	98,5
PFRX3E-5**/41***/41***	PFRXB-5**	PFEXB-41***	PFE-41***	219,5	203	160	38	120	38	120
PFRX3E-5**/51***/31***	PFRXC-5**	PFEXA-51***	PFE-31***	234	206	134,5	38	125	27,5	98,5
PFRX3E-5**/51***/41***	PFRXC-5**	PFEXB-51***	PFE-41***	234	215,5	160	38	125	38	120
PFRX3E-5**/51***/51***	PFRXC-5**	PFEXC-51***	PFE-51***	234	230	186,5	38	125	38	125

PFRXDE



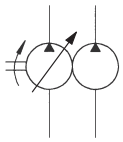
For missing details see tab. A045 and A180

Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PFRXDE-3**/43***/0**	PFRXB-3**	PFED-43***/0**	209	256,5	38	139,6	227,7
PFRXDE-3**/54***/0**	PFRXC-3**	PFED-54***/0**	224	288	38	152,3	261,8
PFRXDE-5**/43***/0**	PFRXB-5**	PFED-43***/0**	219,5	256,5	38	139,6	227,7
PFRXDE-5**/54***/0**	PFRXC-5**	PFED-54***/0**	234	288	38	152,3	261,8

PFRX*E pumps are supplied with WFA-32 inlet flange for PFR, and set of inlet, outlet flanges for PFE or PFED;

3 PVPCX2E MULTIPLE AXIAL PISTON/VANE PUMPS

PVPCX2E are double pumps composed by one variable displacement axial piston pump type PVPC and one vane pump type PFE.
They have two separated inlet ports and two separated outlet ports.



For technical characteristics of PVPC pumps, see tab. A160; for technical characteristics of PFE pumps see tab. A005 and A007.

3.1 MODEL CODE FOR PVPCX2E with standard hydraulic controls

PVPC | **X2E** - **C** - **4** | **046** / **31044** / **1** | **D** | **X** | **24DC** | **10** / | *****

Variable displacement axial piston pump

X2E = coupled with a fixed displacement pump type PFE (see tab. A005)

Type of control:
C = manual pressure compensator
CH = manual pressure compensator, with venting
R = remote pressure compensator
L = load sensing (pressure & flow)
LW = constant power (combined pressure & flow)

Size: **3** = for displacement 029
4 = for displacement 046
5 = for displacement 073 and 090

Max displacement of axial piston pump:
029 = 29 cm³/rev **073** = 73 cm³/rev
046 = 46 cm³/rev **090** = 88 cm³/rev

Size and displacement [cm³/rev] of PFE second (and third) pump
for **PFE 31**: 010, 016, 022, 028, 036, 044 for **PFE 32**: 016, 022, 028, 036
for **PFE 41**: 029, 037, 045, 056, 070, 085 for **PFE 42**: 045, 056, 070, 085
for **PFE 51**: 090, 110, 129, 150 for **PFE 52**: 090, 110, 129, 150

Shaft (SAE Standard):
1 = keyed (7/8" for 029 - 1" for 046 - 1 1/4" for 073 and 090)
5 = splined (13 teeth for 029 - 15 for 046 - 14 for 073 and 090)

Direction of rotation (viewed at the shaft end)
D = clockwise
S = counterclockwise

X = without connector

Supply voltage:
12 DC 24/50 AC
24 DC 110/50 AC
220/50 AC

Series number

Seals material:
– = NBR
PE = FKM
See notes under sect. 2

3.2 MODEL CODE FOR PVPCX2E with electrohydraulic proportional controls

PVPC | **X2E** - **PERS - SP** - **BC** - **4** | **046** / **31044** / ***** / **1** | **D** / **18** | **10** / | *****

Variable displacement axial piston pump

X2E = coupled with a fixed displacement pump type PFE (see tab. A005)

Type of control (see section 5, 6 and 7):
CZ = proportional pressure compensator
LQZ = proportional flow control (load sensing)
LZQZ = proportional pressure & flow control (load sensing)
LZQZR = as LZQZ plus sequence module
PES-SP = closed loop integral digital P/Q driver
PERS-SP = as PES plus sequence module

Fieldbus interfaces for PES and PERS:
USB interface always present
NP = Not present **BP** = PROFIBUS DP
BC = CANopen **EH** = EtherCAT

Size:
3 = for displacement 029 **4** = for displacement 046
5 = for displacement 073 and 090

Max displacement of axial piston pump:
029 = 29 cm³/rev **046** = 46 cm³/rev **073** = 73 cm³/rev **090** = 88 cm³/rev

Size and displacement [cm³/rev] of PFE second (and third) pump
for **PFE 31**: 010, 016, 022, 028, 036, 044 for **PFE 32**: 016, 022, 028, 036
for **PFE 41**: 029, 037, 045, 056, 070, 085 for **PFE 42**: 045, 056, 070, 085
for **PFE 51**: 090, 110, 129, 150 for **PFE 52**: 090, 110, 129, 150

Pressure setting (only for PERS): **200** = 200 bar **250** = 250 bar
280 = 280 bar (not available for 090)

Shaft (SAE Standard):
1 = keyed (7/8" for 029 - 1" for 046 - 1 1/4" for 073 and 090)
5 = splined (13 teeth for 029 - 15 for 046 - 14 for 073 and 090)

Direction of rotation
(viewed at the shaft end)
D = clockwise **S** = counterclockwise

Options, see sections 4 and 7:
18 = with 18 VDC coil instead of standard 12 VDC coil (only for CZ, LQZ, LZQZ)
for versions PES and PERS:
C = current feedback for pressure transducer 4÷20 mA
I = current reference input and monitor 4÷20 mA (omit for standard voltage reference input and monitor ±10 V)
X = with integral pressure transducer (only for PERS)
S = with two on-off inputs for multiple pressure PID selection (NP execution) or double power supply (BC, BP and EH execution).

Series number

Seals material:
– = NBR
PE = FKM
See notes under sect. 2

3.3 OPERATING CHARACTERISTICS OF STANDARD DOUBLE PUMPS TYPE PVPCX2E (with PFE-31, 41 and 51)

(at 1450 rpm and based on mineral oil ISO VG46 at 40° C)

Standard model	Speed range [rpm] (1)	AXIAL PISTON PUMP			VANE PUMP			
		Displacement [cm³/rev]	Flow [l/min] (2)	Max pressure [bar] (3)	Displacement [cm³/rev]	Flow [l/min] (2)	Max pressure [bar] (4)	Total flow [l/min]
PVPCX2E-*-3029/31010	800-2400	29	42	280/350	10,5	15	160	57
PVPCX2E-*-3029/31016	800-2800				16,5	23	210	65
PVPCX2E-*-3029/31022					21,6	30		72
PVPCX2E-*-3029/31028					28,1	40		82
PVPCX2E-*-3029/31036					35,6	51		93
PVPCX2E-*-3029/31044	800-2500				43,7	63		105
PVPCX2E-*-3029/41029					29,3	41		83
PVPCX2E-*-3029/41037					36,6	52		94
PVPCX2E-*-3029/41045					45,0	64		106
PVPCX2E-*-3029/41056					55,8	80		122
PVPCX2E-*-3029/41070					69,9	101		143
PVPCX2E-*-3029/41085	800-2000				85,3	124		166
PVPCX2E-*-4046/31010	800-2400	46	66,7	280/350	10,5	15	160	81,7
PVPCX2E-*-4046/31016	800-2600				16,5	23	210	89,7
PVPCX2E-*-4046/31022					21,6	30		92,7
PVPCX2E-*-4046/31028					28,1	40		102,7
PVPCX2E-*-4046/31036					35,6	51		113,7
PVPCX2E-*-4046/31044	800-2500				43,7	63		129,7
PVPCX2E-*-4046/41029					29,3	41		107,7
PVPCX2E-*-4046/41037					36,6	52		118,7
PVPCX2E-*-4046/41045					45,0	64		130,7
PVPCX2E-*-4046/41056					55,8	80		146.7
PVPCX2E-*-4046/41070					69.9	101		167,7
PVPCX2E-*-4046/41085	800-2000				85,3	124		190,7
PVPCX2E-*-5073/31010	800-2400	73	105,8	280/350	10,5	15	160	120,8
PVPCX2E-*-5073/31016	800-2200				16,5	23	210	128,8
PVPCX2E-*-5073/31022					21,6	30		135,8
PVPCX2E-*-5073/31028					28,1	40		145,8
PVPCX2E-*-5073/31036					35,6	51		156,8
PVPCX2E-*-5073/31044					43,7	63		168,8
PVPCX2E-*-5073/41029					29,3	41		146,8
PVPCX2E-*-5073/41037					36,6	52		157,8
PVPCX2E-*-5073/41045					45,0	64		169,8
PVPCX2E-*-5073/41056					55,8	80		185,8
PVPCX2E-*-5073/41070					69,9	101		206,8
PVPCX2E-*-5073/41085	800-2000				85,3	124		229,8
PVPCX2E-*-5073/51090	800-2200				90,0	128		233,8
PVPCX2E-*-5073/51110					109,6	157		262,8
PVPCX2E-*-5073/51129					129,2	186		291,8
PVPCX2E-*-5073/51150	800-1800				150,2	215		320,8
PVPCX2E-*-5090/31010	800-2400	88	127,6	250/315	10,5	15	160	142,6
PVPCX2E-*-5090/31016	800-2200				16,5	23	210	150,6
PVPCX2E-*-5090/31022					21,6	30		157,6
PVPCX2E-*-5090/31028					28,1	40		167,6
PVPCX2E-*-5090/31036					35,6	51		178,6
PVPCX2E-*-5090/31044					43,7	63		190,6
PVPCX2E-*-5090/41029					29,3	41		168,6
PVPCX2E-*-5090/41037					36,6	52		179,6
PVPCX2E-*-5090/41045					45,0	64		191,6
PVPCX2E-*-5090/41056					55,8	80		207,6
PVPCX2E-*-5090/41070					69,9	101		228,6
PVPCX2E-*-5090/41085	800-2000				85,3	124		251,6
PVPCX2E-*-5090/51090	800-2200				90,0	128		255,6
PVPCX2E-*-5090/51110					109,6	157		284,6
PVPCX2E-*-5090/51129					129,2	186		313,6
PVPCX2E-*-5090/51150	800-1800				150,2	215		342,6

(1) Max speed is 1800 rpm for /PE versions; 1000 rpm for water glycol fluid
(2) Flow rate and power consumption are proportional to revolution speed
(3) Max pressure is 190 bar for /PE versions, 160 bar for water glycol fluid
(4) Max pressure is 160 bar for /PE and water glycol fluid

3.4 OPERATING CHARACTERISTICS OF STANDARD DOUBLE PUMPS TYPE PVPCX2E (with PFE-32, 42 and 52)

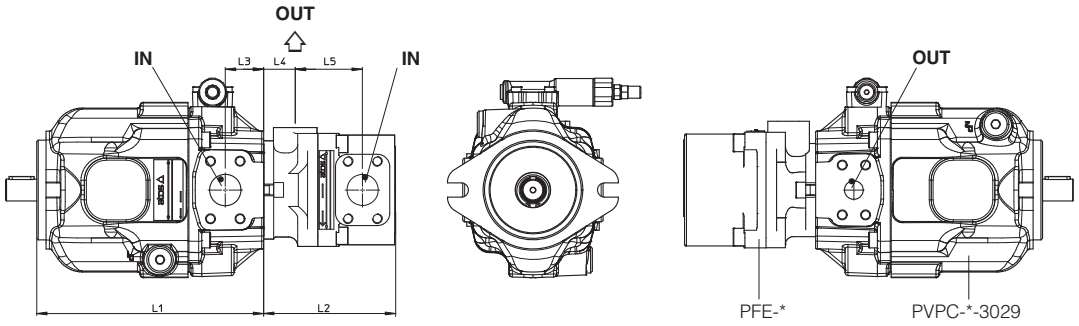
(at 1450 rpm and based on mineral oil ISO VG46 at 40° C)

Standard model	Speed range [rpm] (1)	AXIAL PISTON PUMP			VANE PUMP			
		Displacement [cm³/rev]	Flow [l/min] (2)	Max pressure [bar] (3)	Displacement [cm³/rev]	Flow [l/min] (2)	Max pressure [bar] (4)	Total flow [l/min]
PVPCX2E-*-3029/32016	1200-2500	29	42	280/350	16,5	23	210	65
PVPCX2E-*-3029/32022					21,6	30	300	72
PVPCX2E-*-3029/32028					28,1	40		82
PVPCX2E-*-3029/32036					35,6	51		93
PVPCX2E-*-3029/42045	1000-2200				45,0	64	280	106
PVPCX2E-*-3029/42056					55,8	80		122
PVPCX2E-*-3029/42070					69,9	101		143
PVPCX2E-*-3029/42085	800-2000				85,3	124		166
PVPCX2E-*-4046/32016	1200-2500	46	66,7	280/350	16,5	23	210	89,7
PVPCX2E-*-4046/32022					21,6	30	300	92,7
PVPCX2E-*-4046/32028					28,1	40		102,7
PVPCX2E-*-4046/32036					35,6	51		113,7
PVPCX2E-*-4046/42045	1000-2200				45,0	64	280	130,7
PVPCX2E-*-4046/42056					55,8	80		146,7
PVPCX2E-*-4046/42070					69,9	101		167,7
PVPCX2E-*-4046/42085	800-2000				85,3	124		190,7
PVPCX2E-*-5073/32016	1200-2500	73	105,8	280/350	16,5	23	210	128,8
PVPCX2E-*-5073/32022					21,6	30	300	135,8
PVPCX2E-*-5073/32028					28,1	40		145,8
PVPCX2E-*-5073/32036					35,6	51		156,8
PVPCX2E-*-5073/42045	1000-2200				45,0	64	280	169,8
PVPCX2E-*-5073/42056					55,8	80		185,8
PVPCX2E-*-5073/42070					69,9	101		206,8
PVPCX2E-*-5073/42085	800-2000				85,3	124		229,8
PVPCX2E-*-5073/52090	800-2000				90,0	128	250	233,8
PVPCX2E-*-5073/52110					109,6	157		262,8
PVPCX2E-*-5073/52129					129,2	186		291,8
PVPCX2E-*-5073/52150	800-1800				150,2	215	210	320,8
PVPCX2E-*-5090/32016	1200-1850	88	127,6	280/350	16,5	23	210	150,6
PVPCX2E-*-5090/32022					21,6	30	300	157,6
PVPCX2E-*-5090/32028					28,1	40		167,6
PVPCX2E-*-5090/32036					35,6	51		178,6
PVPCX2E-*-5090/42045	1000-1850				45,0	64	280	191,6
PVPCX2E-*-5090/42056					55,8	80		207,6
PVPCX2E-*-5090/42070					69,9	101		228,6
PVPCX2E-*-5090/42085	800-1850				85,3	124		251,6
PVPCX2E-*-5090/52090	1000-1850				90,0	128	250	255,6
PVPCX2E-*-5090/52110					109,6	157		284,6
PVPCX2E-*-5090/52129					129,2	186		313,6
PVPCX2E-*-5090/52150	800-1800				150,2	215	210	342,6

(1) Max speed is 1800 rpm for /PE versions; 1500 rpm for water glycol fluid
(2) Flow rate and power consumption are proportional to revolution speed
(3) Max pressure is 190 bar for /PE versions, 160 bar for water glycol fluid
(4) Max pressure is 160 bar for /PE and water glycol fluid.

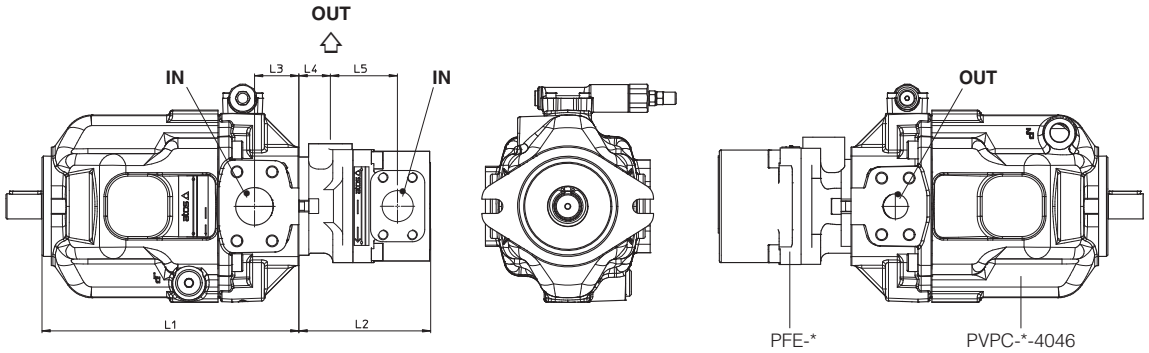
3.5 DIMENSIONS OF MULTIPLE PUMPS TYPE PVPCX2E [mm]

PVPCX2E-*-3029



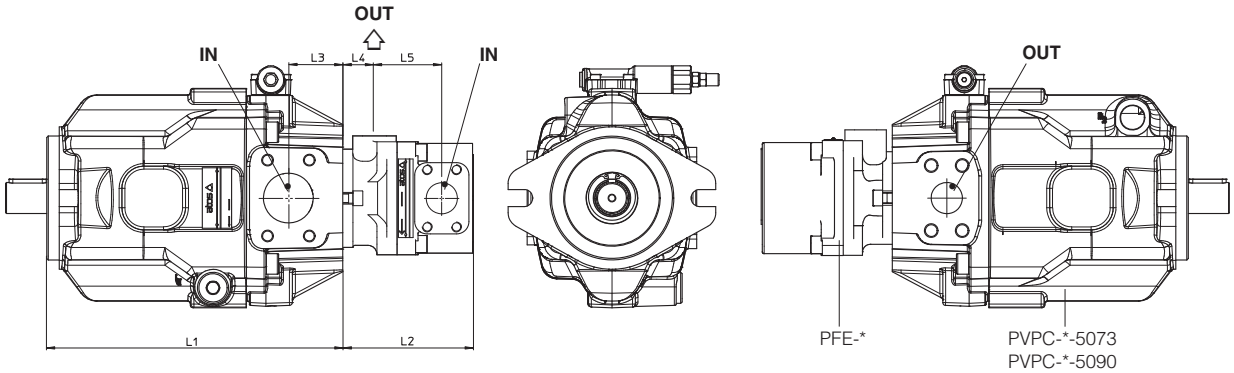
Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PVPCX2E-*-3029/3****	PVPCXA-*-3029	PFE-3****	231,2	134,5	39	27,5	71
PVPCX2E-*-3029/4****	PVPCXB-*-3029	PFE-4****	231,2	160	39	38	82

PVPCX2E-*-4046



Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PVPCX2E-*-4046/3****	PVPCXA-*-4046	PFE-3****	259	134,5	45	27,5	71
PVPCX2E-*-4046/4****	PVPCXB-*-4046	PFE-4****	259	160	45	38	82

PVPCX2E-*-5073
PVPCX2E-*-5090



Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PVPCX2E-*-5073/3****	PVPCXA-*-5073	PFE-3****	303,6	134,5	55,7	27,5	71
PVPCX2E-*-5073/4****	PVPCXB-*-5073	PFE-4****	303,6	160	55,7	38	82
PVPCX2E-*-5073/5****	PVPCXC-*-5073	PFE-5****	303,6	186,5	55,7	38	87
PVPCX2E-*-5090/3****	PVPCXA-*-5090	PFE-3****	303,6	134,5	55,7	27,5	71
PVPCX2E-*-5090/4****	PVPCXB-*-5090	PFE-4****	303,6	160	55,7	38	82
PVPCX2E-*-5090/5****	PVPCXC-*-5090	PFE-5****	303,6	186,5	55,7	38	87

5 ACCESSORIES

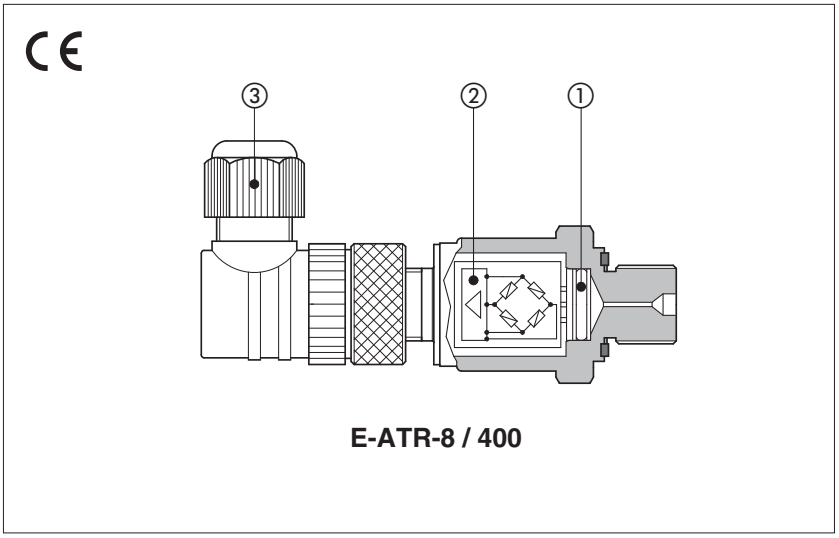
INDEX

ACCESSORIES

Supplementary components range available on **www.atos.com**

Pressure transducers type E-ATR-8

analog, for open and closed loop systems



E-ATR-8 / 400

E-ATR-8

This pressure transducers measure the static and dynamic pressure of the hydraulic fluid, supplying a voltage or current output signal.

The sensor is composed by a thin-film circuit ①, with high resistance to overloads and pressure peaks.

The integrated electronic circuit ② supplies an amplified voltage or current output signal, proportional to the hydraulic pressure, with thermal drift compensation.

E-ATR-8 equip pressure control digital proportional valves with integral transducer and electronics, REB/RES execution (see tech table GS205).

They are also used in association with other Atos digital proportionals to perform closed loop pressure controls:

- variable displacement axial piston pumps, PE(R)S execution (see tech table AS170)
- directional control valves with additional closed loop pressure control, SP and SF options on TES/LES execution (see tech table FS500)

Features:

- Factory preset and calibrated
- Standard 5 pin M12 main connector ③
- IP67 protection degree
- CE mark according to EMC directive

1 MODEL CODE

E-ATR-8	/	400	/	*	*
Pressure transducer		**Pressure measuring range:** **60** = 0 ÷ 60 bar **100** = 0 ÷ 100 bar **160** = 0 ÷ 160 bar **250** = 0 ÷ 250 bar **400** = 0 ÷ 400 bar		**Options:** **-** = voltage output signal 0 ÷ 10 V **I** = current output signal 4 ÷ 20 mA	Series number

2 MAIN CHARACTERISTICS

Pressure measuring range	0 ÷ 60/100/160/250/400 bar; other values availables on request Note: negative pressure can damage the pressure transducer
Overload pressure	2 x FS without exceeding 600 bar
Burst pressure	5 x FS without exceeding 1700 bar
Response time	≤ 2 ms
Temperature range	Operating -40 ÷ +100 °C; Storage -40 ÷ +100 °C; Fluid: -40 ÷ +100 °C
Thermal drift	@ zero: ≤ ±0,025 % FS/°C max; @ FS: ≤ ±0,025 % FS/°C max
Accuracy	≤ ±1,2 % FS
Non-Linearity	≤ ±0,5 % of FS (BFSL) as per IEC 61298-2
Fluid Compatibility	Hydraulic oil as per DIN51524...535; for water-glycol, phosphate ester and skydrol® , please contact Atos technical department
Power supply	24 VDC nominal; 14 ÷ 30 VDC for standard (8 ÷ 30 VDC for /I option); Imax 25 mA
Output signal	Standard: voltage output signal 0 ÷ 10 V (3 pins); Min load > maximum output signal / 1 mA /I option: current output signal 4 ÷ 20 mA (2 pins); Max load ≤ (power supply - 8 V) / 0,02 mA
Wiring protections	Against reverse polarity on power supply and short-circuit on output signal
Materials	Wetted parts: stainless steel 316L (13-8 PH for sensor); seals: FPM/FKM
Mass	Approx. 57 g
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE EN 61326 emission (group 1, class B) and immunity (industrial application)
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Vibration resistance	20 g according to DIN EN 60068-2-6 from 20 to 2000 Hz
Shock resistance	40 g / 6 ms / half-sinusoid, according to DIN EN 60068-2-27
Protection class	IP67 with mating connector
Hydraulic connection	1/4" GAS - DIN 3852 (pressure port orifice Ø 0,6 mm)
Electrical connection	Type: plastic 5 pins M12 at 90° (DIN 43650-C) with cable gland type PG7 for cable max Ø 6 mm Protection: IP67 according to EN 60529; Insulation: according to VDE 0110-C

Notes: FS = Full Scale; **BFSL** = Best Fit Straight Line

3 INSTALLATION AND COMMISSIONING

3.1 Warning

E-ATR-8 transducers have to be installed as near as possible to the point where the pressure have to be measured, taking care that the oil flow is not turbulent.

3.2 Commissioning

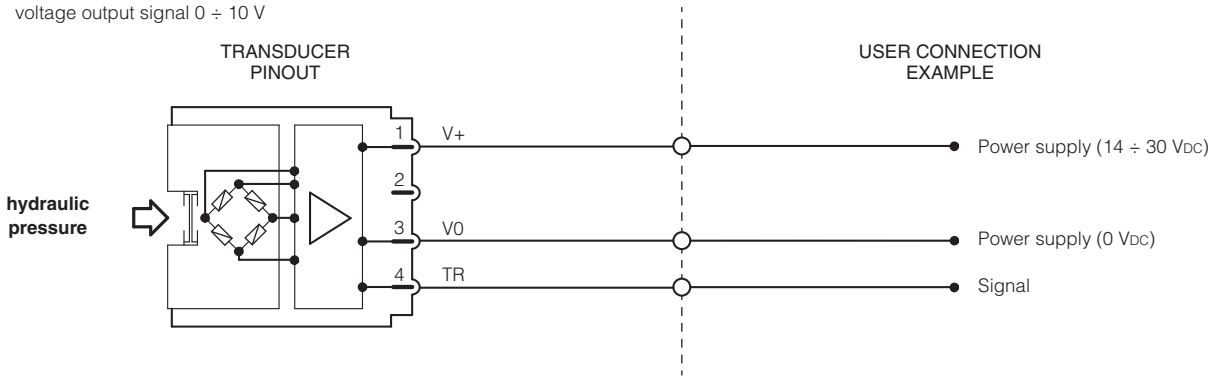
Install the transducer in the hydraulic circuit.

Switch-off the power supply before connecting and disconnecting the transducer connector as shown in scheme 4 .

4 ELECTRONIC CONNECTIONS

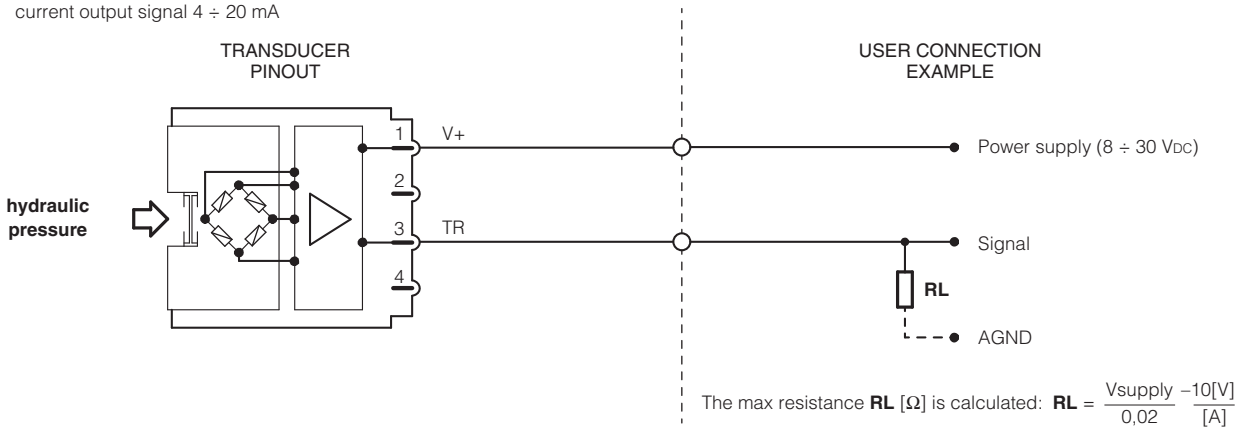
E-ATR-8 / *

voltage output signal 0 ÷ 10 V



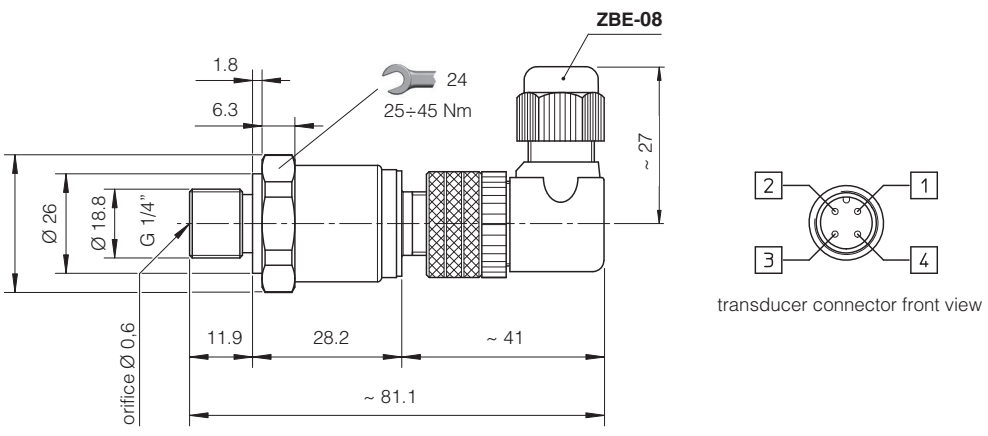
E-ATR-8 / * / I

current output signal 4 ÷ 20 mA



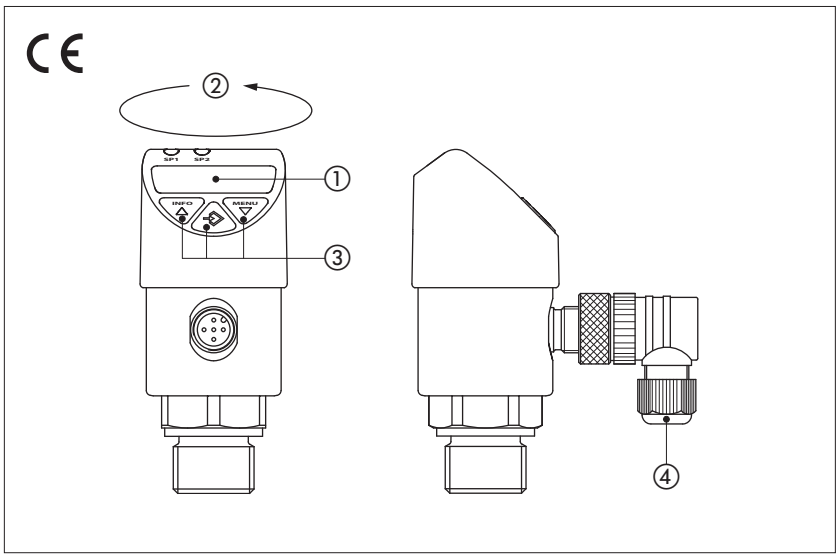
The max resistance **RL** [Ω] is calculated: $\mathbf{RL} = \frac{\text{Vsupply}}{0{,}02} - \frac{10[\text{V}]}{[\text{A}]}$

5 OVERALL DIMENSIONS [mm]



Electronic pressure switches type E-DAP-2

digital, with integral digital display



1 MODEL CODE

E-DAP-2	-	250	/	2	*
Electronic pressure switch		**Pressure range:** **100** = 100 bar **250** = 250 bar **400** = 400 bar		**2** = 2 switching outputs	Series number

E-DAP-2

Compact electronic pressure switch with integral digital display, available for 3 different pressure ranges.

The working pressure is real time measured and monitored on a 4 digits display ① in bar, Mpa, kPa, psi or kg/cm². The display can be mechanically rotated on 1 axis ② and turned electronically through 180°.

It provides two independent output with electronic contacts which are triggered when the pressure in the hydraulic circuit reaches the switch point or window (see section 4).

The functional parameters as the pressure switching point, hysteresis range, pressure measuring units and others additional functions can be easily set by the end user trough proper programming keys ③ .

For detailed instructions about the use of the electronic pressure switch refer to the operating manual supplied with the instrument.

Features:

- Standard 5 pin M12 main connector ④
- IP65 / IP67 protection degree
- CE mark according to EMC directive

2 MAIN CHARACTERISTICS

Model	E-DAP-2-100	E-DAP-2-250	E-DAP-2-400
Pressure measuring range [bar] (1)	0,5 ÷ 100	1,25 ÷ 250	2 ÷ 400
Overload pressure	2 x FS		
Response time	≤ 10 ms		
Temperature range	Operating -40 ÷ +80 °C; Storage -40 ÷ +80 °C; Fluid: -40 ÷ +85 °C		
Thermal drift	Zero ±0,02 % FS / °C (typ); span ±0,01 % FS / °C (typ)		
Accuracy display	≤ ±1,0 % of FS ±1 digit		
Non-Linearity	≤ ±0,5 % of span BFSL as per IEC 61298-2		
Fluid compatibility	Hydraulic oil as per DIN51524...535; for water-glycol, phosphate ester and skydrol® , please contact Atos technical department		
Power supply	15 ÷ 35 VDC; Imax 600 mA		
N° of outputs	2		
Output type	PNP transistor output (ON state ≅ power supply - 1 V)		
Switching current	250 mA max per output (resistive load)		
Wiring protections	Against reverse polarity on power supply and short-circuit on output signal		
Display	4 digit, 14 segment led, red, height 9 mm		
Materials	Wetted parts: stainless steel 316L (13-8 PH for sensor); seals: FPM/FKM		
Mass	174 g		
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE EN 61326 emission (group 1, class B) and immunity (industrial application)		
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Vibration resistance	10 g according to IEC 60068-2-6, under resonance		
Shock resistance	50 g according to IEC 60068-2-27		
Protection class	IP65 / IP67 with mating connector		
Hydraulic connection	1/4" GAS - DIN 3852 form E (pressure port orifice Ø 0,6 mm)		
Electrical connection	Type: plastic 5 pins M12 at 90° (DIN 43650-C) with cable gland type PG7 for cable max Ø 6 mm Protection: IP67 according to EN 60529; Insulation: according to VDE 0110-C		

Notes: FS = Full Scale; **BFSL** = Best Fit Straight Line; **(1)** negative pressure lower than -1 bar can damage the device

3 FEATURES

- Two independent PNP transistor switching outputs. Imax up to 250 mA per output
- 4 digit display, adjustable on one axes without tools for best visual position or visualized digits can be turned electronically of 180°
- Pressure reading selectable in: bar, Mpa, kPa, psi, kg/cm²
- Selection of different display modes: unit switching, offset adjustment, actual pressure value, minimum or maximum pressure value, function switch points, function reset points, display updates/second.
- Hydraulic connection G1/4"
- Electric connector M12x1 supplied with the pressure switch

4 OUTPUTS SWITCHING FUNCTION

The independent outputs can be settable using two different functions: Hysteresis and Windows.

Hysteresis function - see 4.1

If the system pressure fluctuates around the set point, the hysteresis keeps the switching status of the outputs stable. With increasing system pressure, the output switches when reaching the switch point (SP).

- HNO - contact normally open: active
- HNC - contact normally closed: inactive

With system pressure falling again, the output will not switch back before the reset point (RP) is reached.

- HNO - contact normally open: inactive
- HNC - contact normally closed: active

Window function - see 4.2

The window function allows for the control of a defined range.
When the system pressure is between window High (FH) and window Low (FL), the output switches on.

- FNO - contact normally open: active
- FNC - contact normally closed: inactive

When the system pressure is outside window High (FH) and window Low (FL), the output does not switch on.

- FNO - contact normally open: inactive
- FNC - contact normally closed: active

Delay times (0 ... 50 s) - see 4.3

This makes it possible to filter out unwanted pressure peaks of a short duration or a high frequency (damping).

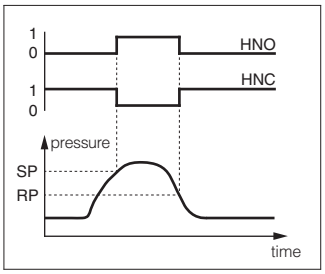
The pressure must be present for at least a certain pre-set time for the output to switch on. The output does not immediately change its status when it reaches the switching event (SP), but rather only after the pre-set delay time (DS).

If the switching event is no longer present after the delay time, the switch output does not change.
The output only switches back when the system pressure has fallen down to the reset point (RP) and stays at or below the reset point (RP) for at least the pre-set delay time (DR).

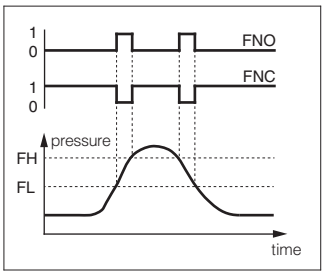
If the switching event is no longer present after the delay time, the switch output does not change.

Delay times is available for Hysteresis and Window functions.

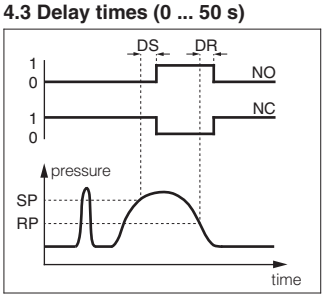
4.1 Hysteresis Function



4.2 Window Function



4.3 Delay times (0 ... 50 s)



5 INSTALLATION AND USE

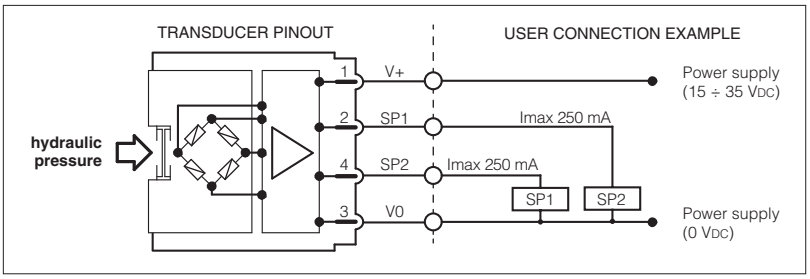
E-DAP-2 can be installed in any position.

Rotate the 4 digit display in order to provide the best visual orientation.

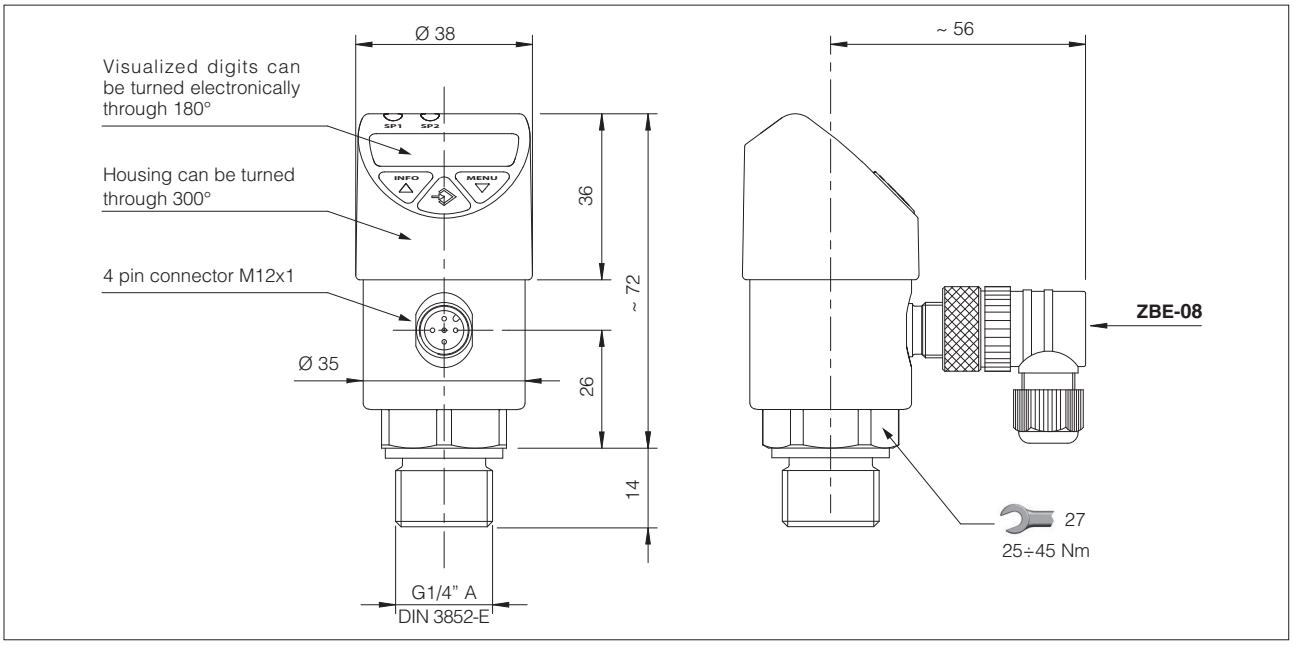
Connect M12 electric connector according the wiring diagram in section 6 .

Consult the operating manual, supplied with the electronic pressure switch, for the parameters setting.

6 ELECTRONIC CONNECTIONS

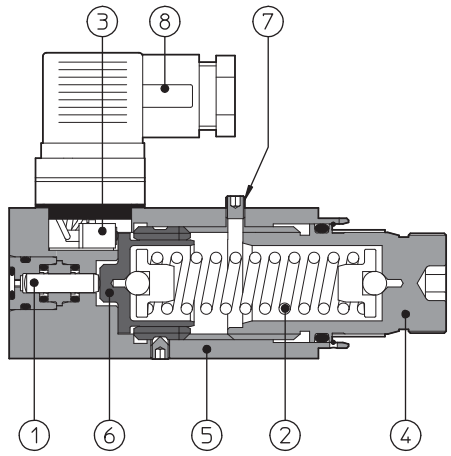


7 OVERALL DIMENSIONS [mm]



Pressure switches type MAP

with fixed switching pressure differential and microswitch with gold plated contacts



① Servo-piston
② Spring
③ Microswitch with gold plated contacts
④ Adjusting knob with graduated scale
⑤ Body
⑥ Switch actuator
⑦ Adjusting knob locking srew
⑧ Electric connector type 664 (included in the supply)

MAP are hydro-electric pressure switches with fixed switching pressure differential. The mechanical microswitch with gold plated contacts grants high reliability and long life service.

The microswitch changes its status when the pressure in the hydraulic circuit reaches the switching value set on the adjusting knob.The microswitch returns to the original rest position when the pressure in the hydraulic circuit drops below the nominal fixed switching pressure differential (hysteresis). The electric connector provides both NC or NO contacts.
The pressure in the circuit operates the piston ① acting against the adjustable spring ②; once the pressure setting is reached, the piston ⑥ actuates the microswitch ③.
The pressure switching value is selectable by a graduated adjusting knob ④.

Clockwise rotation increases the setting pressure.

Max pressure: **630 bar**

1 MODEL CODE

MAP	-	160	/	E	**	/	*

MAP — Fixed differential pressure switch

Pressure range:
40 = 5 ÷ 40 bar
80 = 7 ÷ 80 bar
160 = 10 ÷ 160 bar
320 = 30 ÷ 320 bar
630 = 50 ÷ 630 bar

****** — Series number

***** — Seals material, see section 2:
- = NBR
PE = FKM
BT = HNBR

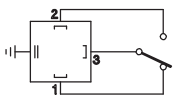
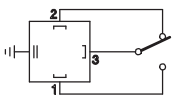
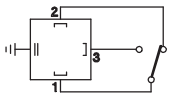
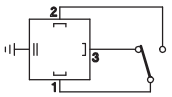
Options:
E = Common electric contact connected to pin 1, see section 3

2 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

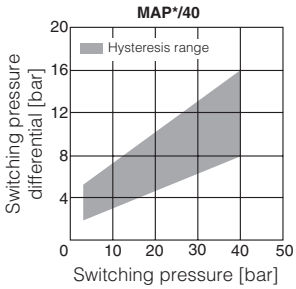
Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	**Standard** = -30°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 µm (β25 ≥75 recommended)

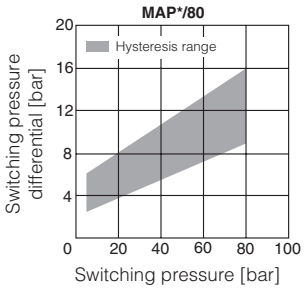
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

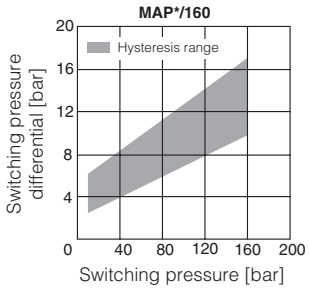
3 CHARACTERISTICS AND WIRING OF INTERNAL MICROSWITCH

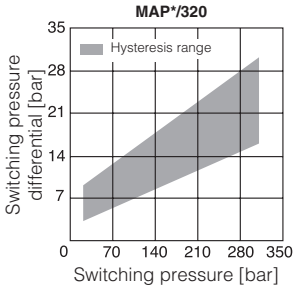
	Supply voltage [V] 125 AC	250 AC	30 DC	250 DC		Rest position	Pressure operated position
Max current resistive load [A]	7	5	5	0,2	**STD**		
Max current inductive load (Cos φ = 0,4) [A]	4	2	3	0,02			
Insulating resistance	≥100MΩ				**/E**		
Contact resistance	15 mΩ						
Electrical life-expectancy	≥1.000.000 switchings						
Mechanical life-expectancy	≥10.000.000 switchings						

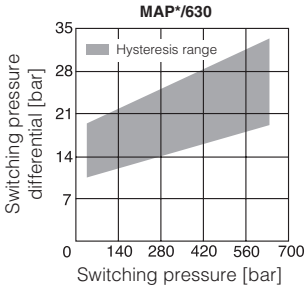
4 DIAGRAMS







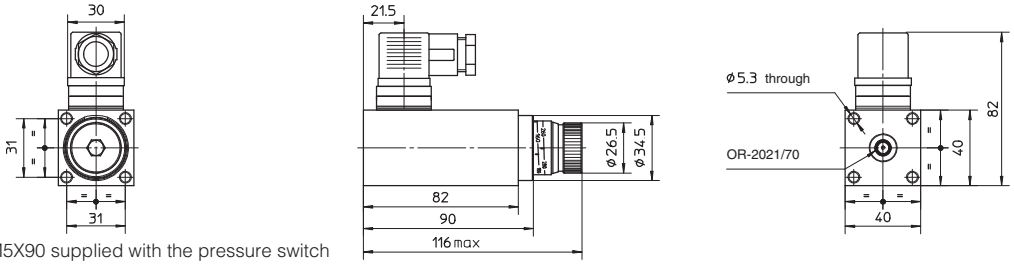




The diagrams show, the switching pressure difference (hysteresis) between the switching positions of the pressure switch electric contacts.

⚠ The switching pressure differential may increased depending to the deterioration of the fluid contamination class.

5 DIMENSIONS OF MAP WITHOUT ADAPTORS [mm]



Fastening bolts:
4 socket head screws M5X90 supplied with the pressure switch

6 MODEL CODE FOR ADAPTORS WHEN SUPPLIED SEPARATELY - BHM and BKM with option **/PE** or **/BT** are available on request

BHM	–	**

Type of adaptor
BMM = male
BMF = female
BFM = in-line
BHM = ISO 4401 size 06
BKM = ISO 4401 size 10

Threated connections for BMM and BFM adaptors, see section 7

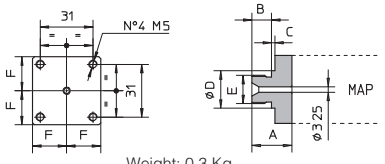
06 = G 1/4" (BMM, BMF, BFM)
10 = G 3/8" (BMM, BFM)
15 = G 1/2" (BMM, BFM)
20 = G 3/4" (BFM)
25 = G 1" (BFM)
32 = G 1 1/4"(BFM)

BHM and BKM adaptors, see section 7

11 = port P
12 = port A and B
13 = port A
14 = port B
17 = port P and A
18 = port P and B

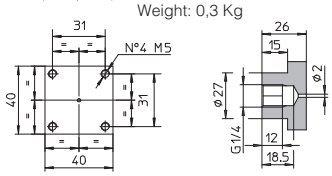
7 DIMENSIONS OF ADAPTORS [mm]

BMM - Male fittings:



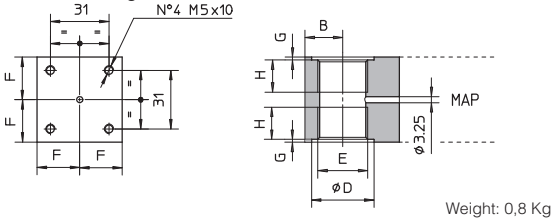
Weight: 0,3 Kg

BMF - Female fittings:



	A	B	C	Ø D	E	F
BMM-06	22,5	11	1,5	18	G 1/4"	20
BMM-10	23,5	11,5	2	22	G 3/8"	20
BMM-15	27,5	15	2,5	26	G 1/2"	20

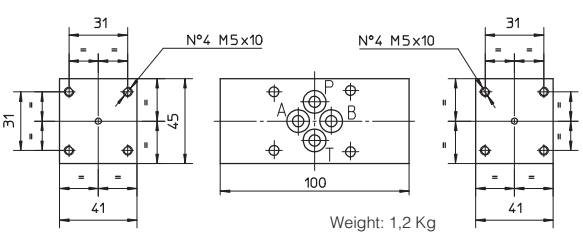
BFM - In-line mounting:



Weight: 0,8 Kg

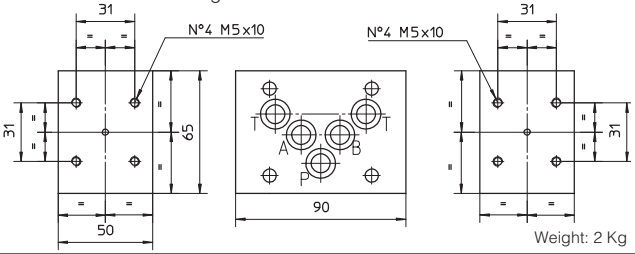
	A	B	Ø D	E	F	G	H
BFM-06	50	20	19	G 1/4"	22,5	1	12
BFM-10	50	20	23	G 3/8"	22,5	1	12
BFM-15	50	20	27	G 1/2"	22,5	1	15
BFM-20	50	20	33	G 3/4"	22,5	1,5	17
BFM-25	70	30	40	G 1"	30	1,5	19
BFM-32	70	30	50	G 1 1/4"	30	1,5	22

BHM - Modular mounting surface ISO 4401-03-02-0-05



Weight: 1,2 Kg

BKM - Modular mounting surface ISO 4401-05-03-0-05



Weight: 2 Kg

For versions 11 and 13 the pressure switch is mounted on side of port A. For version 14 the pressure switch is mounted on side of port B. For versions 12, 17, 18 the pressure switch is mounted on both sides.

Mounting subplates type BA

single, for ISO valves size 06 to 32

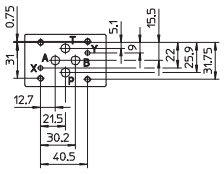
BA-* are single subplates with ISO mounting surface for installation of Atos valves and they are provided with threaded ports for connectios to pressure, tank and users lines. They are characterized by low pressure drops and they are specific for directional, flow and pressure control valves ISO size 06, 10, 16, 20, 25 and 32;
Special subplates or manifolds for customized applications are available upon request.
The set of screws for the valve installation on the BA subplate must be ordered separately, see the code SET SC-* specified in the following sections.

1 TECHNICAL CHARACTERISTICS

Installation position	Any position
Operating pressure	Ports P, T, A, B = 350 bar See technical table of the valves to be assembled
Ambient temperature range	-30°C ÷ +70°C
Fluid	Hydraulic oil as per DIN 51524...535, for other fluids contact our technical office
Recommended viscosity	15÷100 mm2/s - max allowed range: see the technical table of the valves to be assembled
Max fluid contamination level	See technical table of the valves to be assembled and filter section at www.atos.com or KTF catalog
Fluid temperature	See technical table of the valves to be assembled
Surface protection	zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

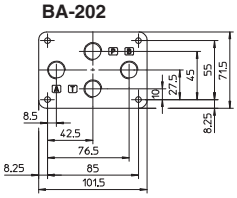
2 SINGLE STATION SUBPLATES FOR VALVES SIZE 06

ISO 4401:2005
Mounting surface: 4401-03-03-0-05

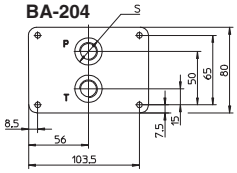


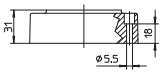
Matching valves	Set of screw (to be ordered separately)
DH-00, DH-01	SET SC-DHZ
DH-02, DH-04	SET SC-DHZ
DH-05, DH-08	SET SC-DHZ
DH-09	SET SC-DHZ
DHI, DHA, DHW	SET SC-DHZ
DHE, DHL	SET SC-DH
DHQ	SET SC-DHZ
DLEH, DLEHM	SET SC-DH
DLAH, DLAHM	SET SC-DHZ
DLWH	SET SC-DHZ
QV-06	SET SC-QV
RZMO, RZMA	SET SC-DHZ
RZME	SET SC-DH
RZGO, RZGA	SET SC-DHZ
RZGE	SET SC-DH
DHZO, DHZA	SET SC-DHZ
DHZE, DHRZE	SET SC-DH
DLHZO, DLHZA	SET SC-DHZ
QVHZO-*-06	SET SC-DHZ
QVHZA	SET SC-DHZ

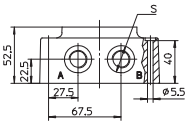
BA-202



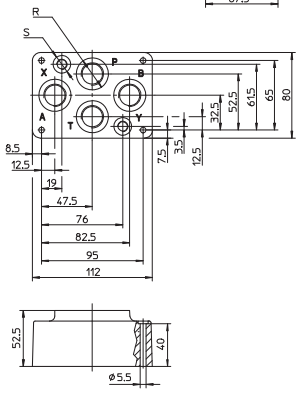
BA-204







BA-302/Y



VERSIONS

BA-202: basic version without ports X and Y; ports P, A, B, T (3/8") on the base.

BA-204: basic version without ports X and Y; ports P and T (3/8") on the base; ports A and B (3/8") on the side.

BA-302: basic version without ports X and Y; ports P, A, B, T (1/2") on the base.

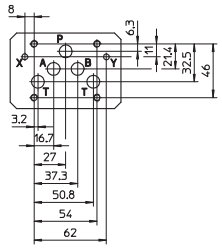
BA-302/Y: version dimensionally identical to the corresponding basic version with the addition of X and Y ports (1/8") on the base (see figure on the left).
The /Y version is always used for DHZO and DLHZO valves when drain from port Y is required.

X and Y ports are only present in the /Y versions.

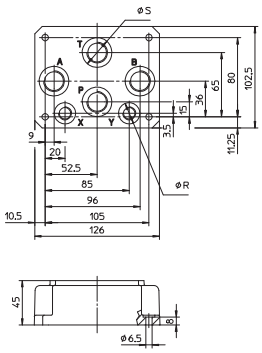
Code	Ports (GAS) A,B,P,T	Ports (GAS) (X-Y)	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-202	3/8"	–	–	–	1,2
BA-204	3/8"	–	25,5	16,5	1,8
BA-302 (/Y)	1/2"	(1/8")	30	16,5	1,8

3 SINGLE STATION SUBPLATES FOR VALVES SIZE 10

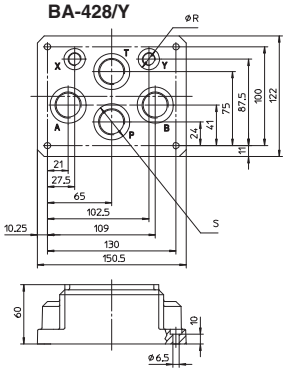
ISO 4401:2005
Mounting surface: 4401-05-05-0-05



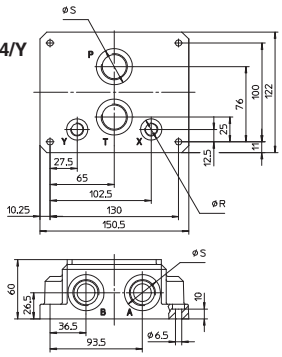
BA-308/Y



BA-428/Y



BA-434/Y



Matching valves	Set of screw (to be ordered separately)
DK-11	SET SC-DK/DP-1
DK-12	SET SC-DK/DP-1
DKE	SET SC-DK/DP-1
DKQ	SET SC-DK/DP-1
DKZOR	SET SC-DK/DP-1
DKZA	SET SC-DK/DP-1
DLKZOR	SET SC-DK/DP-1
DLKZA	SET SC-DK/DP-1

VERSIONS

BA-308: basic version without ports X and Y; ports P, A, B, T (1/2") on the base.

BA-428: basic version without ports X and Y; ports P, A, B, T (3/4") on the base.

BA-434: basic version without ports X and Y; ports P and T (3/4") on the base; ports A and B (3/4") on the side.

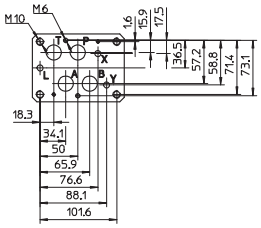
BA-*/Y**: versions dimensionally analogous to the corresponding basic versions with the addition of X and Y ports (1/4") on the base (see figure on the left).
The /Y versions are always used for valves type DKZOR, DLKZO, when drainage from port Y is required.

X and Y ports are only present in the /Y versions.

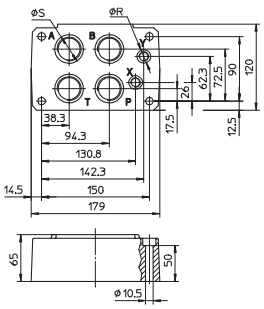
Code	Ports (GAS) A,B,P,T	Ports (GAS) (X-Y)	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA- 308 (/Y)	1/2"	(1/4")	30	21,5	2,5
BA- 428 (/Y)	3/4"	(1/4")	36,5	21,5	5,5
BA- 434 (/Y)	3/4"	(1/4")	36,5	21,5	8,5

4 SINGLE STATION SUBPLATES FOR VALVES SIZE 16

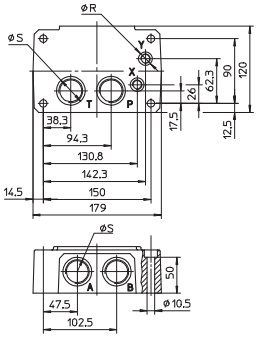
ISO 4401:2005
Mounting surface: 4401-07-07-0-05



BA-518



BA-519



Matching valves	Set of screw (to be ordered separately)
DP-21	SET SC-DP2
DP-24	SET SC-DP2
DP-25	SET SC-DP2
DPH-28	SET SC-DP2
DPH-29	SET SC-DP2
DPHI-2	SET SC-DP2
DPHE-2	SET SC-DP2
DPHA-2	SET SC-DP2
DPHW-2	SET SC-DP2
DPZO-*-2	SET SC-DP2
DPZA-*-2	SET SC-DP2

VERSIONS

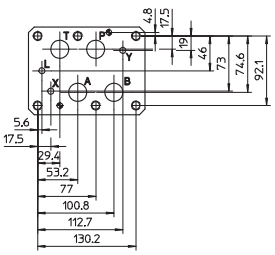
BA-518: basic version with ports P, A, B, T (1") and X, Y (1/4") on the base.

BA-519: basic version with ports P, T (1") and X, Y (1/4") on the base; ports A, B (1") on the side.

Code	Ports (GAS) A,B,P,T	Ports (GAS) X-Y	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-518	1"	1/4"	46	21,5	8
BA-519	1"	1/4"	46	21,5	8

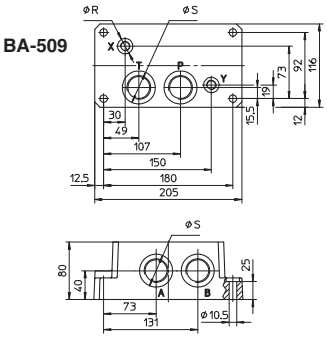
5 SINGLE STATION SUBPLATES FOR VALVES SIZE 25

ISO 4401:2005
Mounting surface: 4401-08-08-0-05

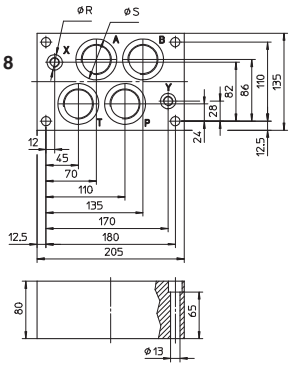


Matching valves	Set of screw (to be ordered separately)
DP-41	SET SC-DP4
DP-44	SET SC-DP4
DP-45	SET SC-DP4
DPH-48	SET SC-DP4
DPH-49	SET SC-DP4
DPHI-4	SET SC-DP4
DPHE-4	SET SC-DP4
DPHA-4	SET SC-DP4
DPHW-4	SET SC-DP4
DPZO-*-4	SET SC-DP4
DPZA-*-4	SET SC-DP4

BA-509



BA-618



VERSIONS

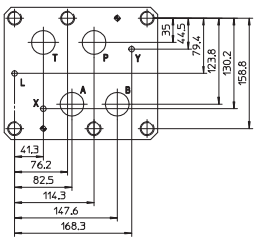
BA-509: basic version with ports P, T (1") and X, Y (1/4") on the base, ports A, B (1") on the side.

BA-618: basic version with ports P, A, B, T (1 1/4") and X, Y (1/4") on the base.

Code	Ports (GAS) A,B,P,T	Ports (GAS) X-Y	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-509	1"	1/4"	46	21,5	12,5
BA-618	1 1/4"	1/4"	57	21,5	13,5

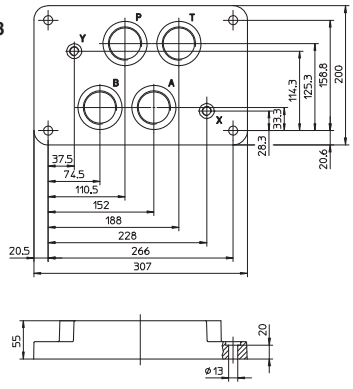
6 SINGLE STATION SUBPLATES FOR VALVES SIZE 32

ISO 4401:2005
Mounting surface: 4401-10-09-0-05



Matching valves	Set of screw (to be ordered separately)
DP-64	SET SC-DP6
DP-65	SET SC-DP6
DPH-68	SET SC-DP6
DPH-69	SET SC-DP6
DPHI-6	SET SC-DP6
DPHE-6	SET SC-DP6
DPHA-6	SET SC-DP6
DPZO-*-6	SET SC-DP6
DPZA-*-6	SET SC-DP6

BA-708



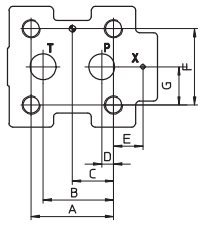
VERSIONS

BA-708: basic version with ports P, A, B, T
(1 1/2") and X, Y (1/4") on the base.

Code	Ports (GAS) A,B,P,T	Ports (GAS) X-Y	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-708	1 1/2"	1/4"	63,5	21,5	17

7 SINGLE STATION SUBPLATES FOR PRESSURE CONTROL VALVE SIZE 10, 20 AND 32

Mounting surface ISO 6264: 1998



Matching valves **Set of screw**
to be ordered separately

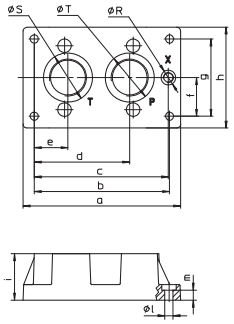
AGAM-10	SET SC-AGA-10
AGMZO-10	SET SC-AGA-10
AGMZA-10	SET SC-AGA-10
AGAM-20	SET SC-AGA-20
AGMZO-20	SET SC-AGA-20
AGMZA-20	SET SC-AGA-20
AGAM-32	SET SC-AGA-32
AGMZO-32	SET SC-AGA-32
AGMZA-32	SET SC-AGA-32

size	A	B	C	D	E	F	G
10	53,8	47,5	22,1	22,1	-	53,8	26,9
20	66,7	55,6	33,4	11,1	23,8	70	35
32	88,9	76,2	44,5	12,7	31,8	82,6	41,3

BA-306
Mounting surface ISO 6264-06-09-0-97
matching valves:
AGAM-10
AGMZO-*-10
AGMZA-*-10

BA-506
Mounting surface ISO 6264-08-13-0-97
matching valves:
AGAM-20
AGMZO-*-20
AGMZA-*-20

BA-706
Mounting surface ISO 6264-10-17-0-97
matching valves:
AGAM-32
AGMZO-*-32
AGMZA-*-32



BA-306
BA-506
BA-706

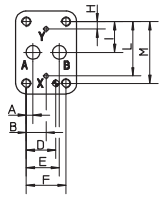
Code	a	b	c	d	e	f	g	h	i	l	m	Ø Blade S	R	T
BA - 306	130	104	97	64,5	19,5	27	54	80	40	8,4	15	36,5	21,5	30
BA - 506	180	150	133,25	92,25	37,25	37,5	75	105	50	10,5	13	46	21,5	46
BA - 706	204	175	173,5	123,5	43,5	50	100	130,5	60	10,5	13	63,5	21,5	63,5

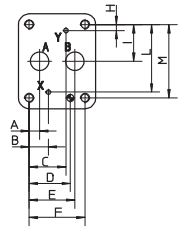
VERSIONS

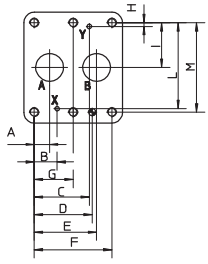
BA-306, BA-506, BA-706: basic version, see figure on left and dimensional tables.

Code	size	Ports (GAS) P	T	X	Mass [Kg]
BA - 306	10	1/2"	3/4"	1/4"	1,5
BA - 506	20	1"	1"	1/4"	3,5
BA - 706	32	1 1/2"	1 1/2"	1/4"	6

Mounting surface ISO 5781: 2000







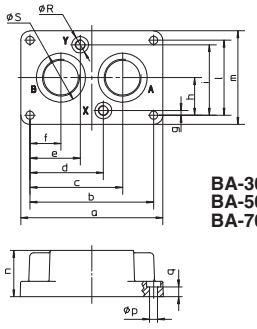
Matching valves **Set of screw**
to be ordered separately

AGI*-10(20)	SET SC-AGI
AGRL(E)-10(20)	SET SC-AGI
AGRCZO-10(20)	SET SC-AGI
AGRCZA-10(20)	SET SC-AGI
AGI*-32	SET SC-AGI-32
AGRL(E)-32	SET SC-AGRL-32

Mounting surface ISO 5781-06-07-0-00
matching valves:
AGI*-10
AGRL-10
AGRLE-10
AGRZO-*-10

Mounting surface ISO 5781-08-10-0-00
matching valves:
AGI*-20
AGRL-20
AGRLE-20
AGRZO-*-20

Mounting surface ISO 5781-10-13-0-00
matching valves:
AGI*-32
AGRL-32
AGRLE-32



BA-305
BA-505
BA-705

Code	a	b	c	d	e	f	g	h	i	l	m	n	p	q	Ø Blade S	R
BA - 305	113	90	67	45	45	23	8	33,3	58,7	66,7	90	30	10,5	10	30	21,5
BA - 505	133	110	82,5	64,5	45,5	27,5	6,4	39,7	73	79,4	102,5	42	10,5	10	46	21,5
BA - 705	184	160	120	95	65	40	6	48,5	91	97	121	60	10,5	13	63,5	21,5

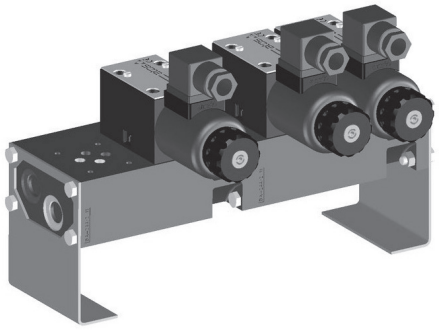
VERSIONS

BA-305, BA-506 and **BA-705**:see figure on left and dimensional tables.

Code	size	Ports (GAS) A	B	X-Y	Mass [Kg]
BA - 305	10	1/2"	1/2"	1/4"	1
BA - 505	20	1"	1"	1/4"	2
BA - 705	32	1 1/2"	1 1/2"	1/4"	7,5

Mounting subplates type BA-214, 314 and 244

Multi-station, for valves ISO 4401 size 06 and 10



example of **BA-244/2 + BA-244/2** modular assembling

BA-214, **BA-314** and **BA-244** are multi-station subplates for assembling of directional and modular valves with mounting surface ISO 4401, size 06 and 10.
They are made in cast iron with high corrosion protection black zinc surface treatment, and they are provided with P, T passing through lines and A, B user ports connections.

BA-214 are **multistaion subplates** with 1 to 10 stations for valves ISO size 06.

BA-314 are **multistaion subplates** with 1 to 6 stations for valves ISO size 10.

BA-244 are **modular subplates** with 1 to 4 stations for valves ISO 4401 size 06.

They are designed for installation on power units cover and they can be easily assembled together by means of n° 4 screws M6 class 12.9 (included in the supply), combining up to max 12 stations.

1 MODEL CODE OF SUBPLATES TYPE BA-214 and BA-314

BA-214	/	5	/	P	*

Type of subplate:
BA-214 = for valves ISO size 06
BA-314 = for valves ISO size 10

Number of stations, see section 4 5 6:
1 = one station
2 = two stations
3 = three stations
4 = four stations
5 = five stations
6 = six stations
7 = seven stations (only for BA-214)
8 = eight stations (only for BA-214)
9 = nine stations (only for BA-214)
10 = ten stations (only for BA-214)

Series number

- = with A and B lateral ports
P = with A and B rear ports (not for **BA-214/1** and all **BA-314**)

Model	Port P	Port T	Ports A, B	Qmax	Qmax ports A, B	Pmax
BA-214	G 1/2"	G 1/2"	G 3/8" lateral	80 l/min	60 l/min	350 bar
BA-214/*/P	G 1/2"	G 1/2"	G 3/8" rear	80 l/min	60 l/min	350 bar
BA-314	G 3/4"	G 1"	G 3/4" lateral	150 l/min	100 l/min	300 bar

2 MODEL CODE OF SUBPLATES TYPE BA-244

BA-244	/	4	*

Type of subplate:
BA-244 = modular subplate for valves ISO size 06

Number of stations:
1 = one station
2 = two stations
3 = three stations
4 = four stations

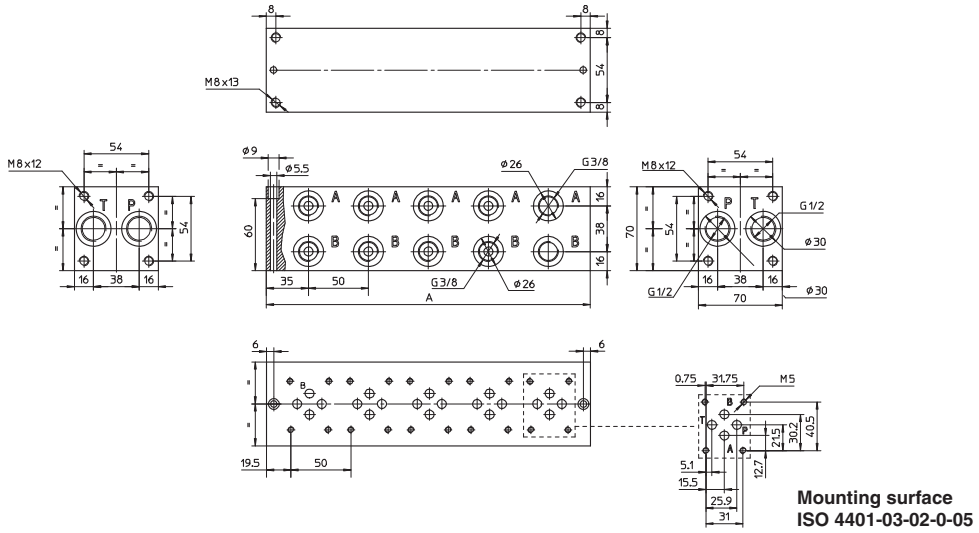
Series number

3 TECHNICAL CHARACTERISTICS

Installation position	Any position. For BA-244, a maximum of 12 stations can be combined; in case of horizontal mounting proper brackets are recommended.
Operating pressure	Ports P, T, A, B = **350 bar** (BA-214), **300 bar** (BA-314), **250 bar** (BA-244) See technical table of the valves to be assembled
Ambient temperature range	-30°C ÷ +70°C
Fluid	Hydraulic oil as per DIN 51524...535, for other fluids contact our technical office
Recommended viscosity	15÷100 mm2/s - max allowed range: see the technical table of the valves to be assembled
Max fluid contamination level	See technical table of the valves to be assembled and filter section at www.atos.com or KTF catalog
Fluid temperature	See technical table of the valves to be assembled
Surface protection	zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214 [mm]

Ports P and T = G 1/2" (passing through)
Ports A and B = G 3/8"
Q_{max} = 80 l/min
Q_{max} A and B ports = 60 l/min
P_{max} = 350 bar



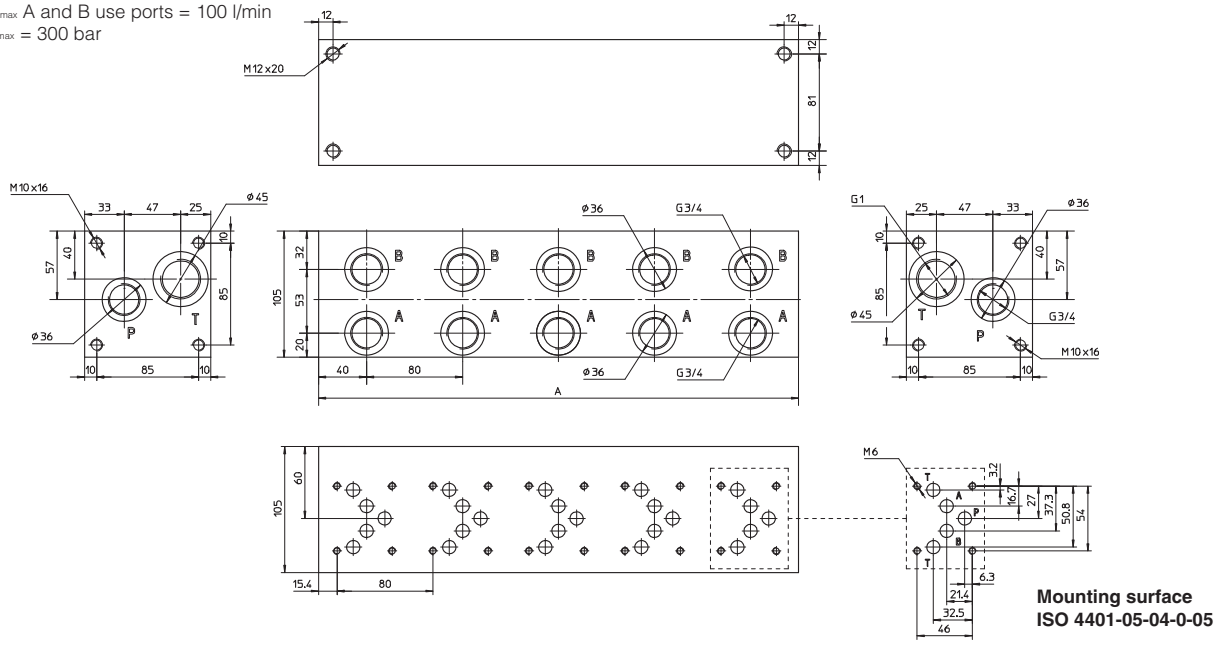
The lenght of the subplate depends to the number of stations as shown in the table below

Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	70	120	170	220	270	320	370	420	470	520
Mass [Kg]	2	3,5	5	6,5	8	9,5	11	12,5	14	15,5

The 5-station version is shown in the drawing

5 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-314 [mm]

Ports P = G 3/4" (passing through)
Ports T = G 1" (passing through)
Ports A and B = G 3/4"
Q_{max} = 150 l/min
Q_{max} A and B use ports = 100 l/min
P_{max} = 300 bar



The lenght of the subplate depends to the number of stations as shown in the table below

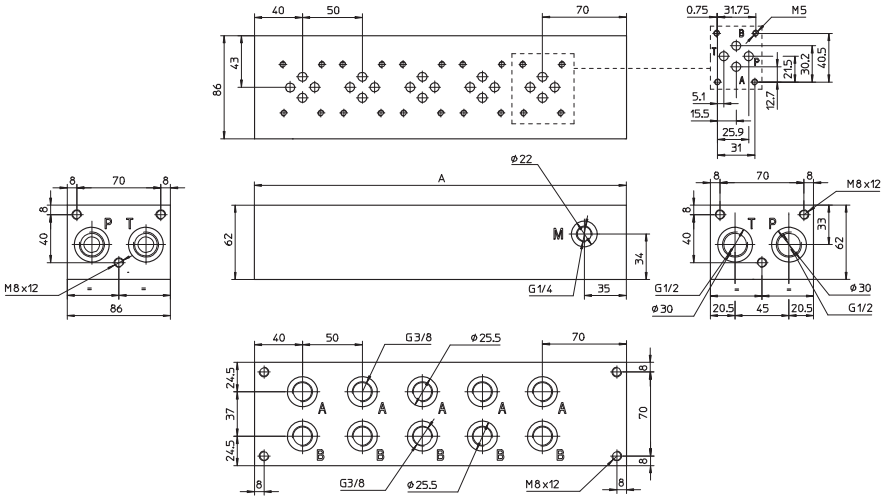
Stations	1	2	3	4	5	6
Dimension A	80	160	240	320	400	480
Mass [Kg]	4	8,5	13	17,5	22	26,5

The 5-station version is shown in the drawing

6 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*/P [mm]

Ports P and T = G 1/2"
Ports A and B = G 3/8"
Q_{max} = 80 l/min
Q_{max} A and B ports = 60 l/min
P_{max} = 350 bar

Mounting surface
ISO 4401-03-02-0-05



The lenght of the subplate depends to the number of stations as shown in the table below

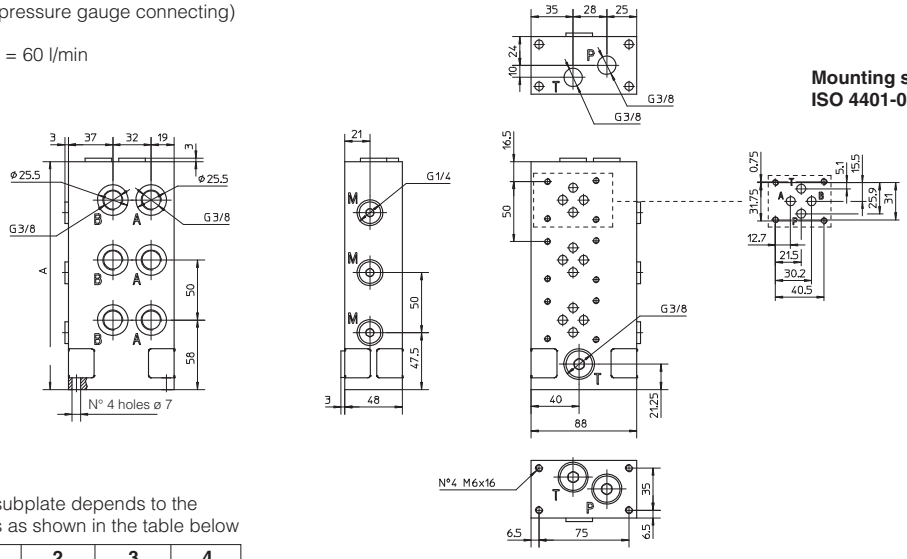
Stations	2	3	4	5	6	7	8	9	10
Dimension A	160	210	260	310	360	410	460	510	560
Mass [Kg]	5,4	7	8,7	10,4	12,1	13,8	15,5	17,2	18,9

The 5-station version is shown in the drawing

7 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-244 [mm]

Ports P and T = G 3/8" (passing through)
Ports A and B = G 3/8"
Ports M = G 1/4" (pressure gauge connecting)
Q_{max} = 35 l/min
Q_{max} A and B ports = 60 l/min
P_{max} = 250 bar

Mounting surface
ISO 4401-03-02-0-05



The lenght of the subplate depends to the number of stations as shown in the table below

Stations	1	2	3	4
Dimension A	90	140	190	240
Mass [Kg]	2,5	3,5	5,2	7

The 3-station version is shown in the drawing

Fastening bolts: 4 exagonal head screws M6x20 class 12.9 included in the supply
Tightening torque = 15 Nm
Seals: 2 OR-3081 included in the supply

Mounting subplates type BA-214/*-AL

multi-station, for valves ISO 4401 size 06, in aluminium

The multi-stations subplates type BA-214/*-AL for directional control valves are in aluminium and their mounting surface are in accordance with the international standards ISO 4401.

They perform limited pressure drop and are made by a **single subplate** from 1 to 10 stations for directional valves and modular elements ISO 4401 size 06.

Main characteristics:
P and T ports = G 1/2; A and B lateral use ports G 3/8; M pressure gauge connection G1/4; Q_{max} = 80 l/min; Q_{max} use ports = 60 l/min; Pmax = 250 bar
Note: for versions /M and /MH Q_{max} = 35 l/min;

For other technical characteristics, see section 2 and 3.

1 MODEL CODE OF SUBPLATES TYPE BA-214/*-AL

BA-214 / **5** / **MH** / **210** - **AL** ***** **PE**

Type of subplate:
BA-214 = for valves ISO size 06
On request, available with rear ports A and B

Number of stations:
1 = one station
2 = two stations
3 = three stations
4 = four stations
5 = five stations
6 = six stations
7 = seven stations
8 = eight stations
9 = nine stations
10 = ten stations

Series number

Seals material: only for **M**, **MH**
- = HNBR
PE = HNBR

AL = in aluminium
On request, available with anodizing

Pressure range of pressure relief valve, for versions /M and /MH:
100 = 100 bar
210 = 210 bar
250 = 250 bar

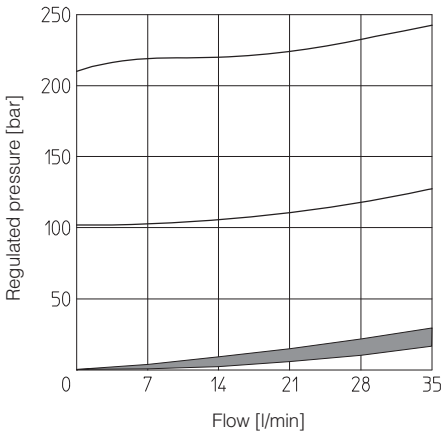
M = with direct operated pressure relief cartridge CART M-5/** - see tab. C010 (available also as spare part)
MH = with pressure relief valve type CART M-5, arranged with venting solenoid valve

2 TECHNICAL CHARACTERISTICS

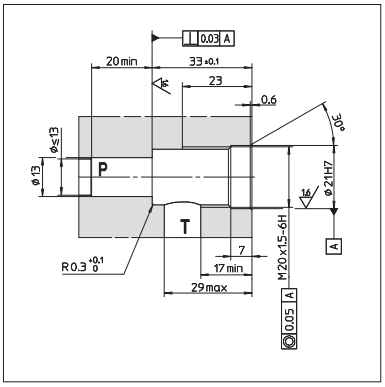
Installation position	Any position.
Operating pressure	Ports P, T, A, B = **250 bar** See technical table of the valves to be assembled
Ambient temperature range	-30°C ÷ +70°C
Fluid	Hydraulic oil as per DIN 51524...535, for other fluids contact our technical office
Recommended viscosity	15÷100 mm2/s - max allowed range: see the technical table of the valves to be assembled
Max fluid contamination level	See technical table of the valves to be assembled and filter section at www.atos.com or KTF catalog
Fluid temperature	See technical table of the valves to be assembled
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

3 REGULATED PRESSURE/FLOW DIAGRAM FOR VERSIONS /M and /MH

MAIN CHARACTERISTICS OF ENCLOSED PRESSURE RELIEF VALVE	
Model code	Regulation range
CART M-5/100	3 ÷ 100 bar
CART M-5/210	5 ÷ 210 bar
CART M-5/250	7 ÷ 250 bar
Q_{max} = 35 l/min	

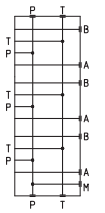


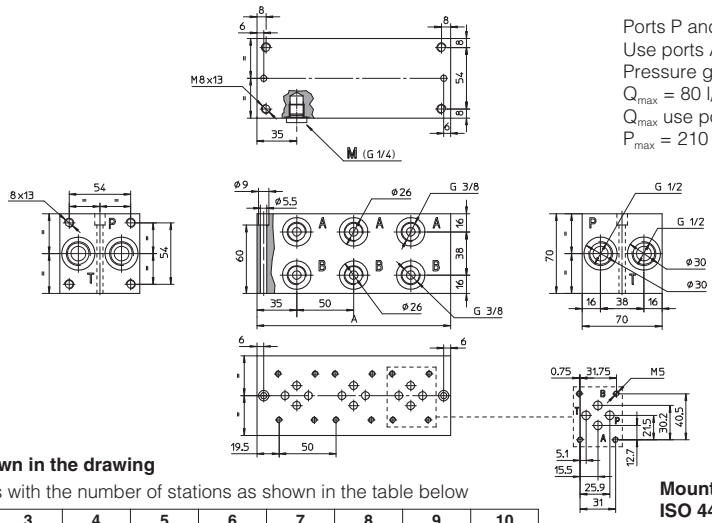
4 INSTALLATION DIMENSIONS OF CART M-5/***



5 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*-AL [mm]

Hydraulic scheme





Ports P and T = G 1/2
Use ports A and B = G 3/8
Pressure gauge port M = G1/4 (plugged)
Q_{max} = 80 l/min
Q_{max} use ports = 60 l/min
P_{max} = 210 bar

The 3-stations subplate is shown in the drawing

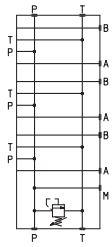
The lenght of the subplate varies with the number of stations as shown in the table below

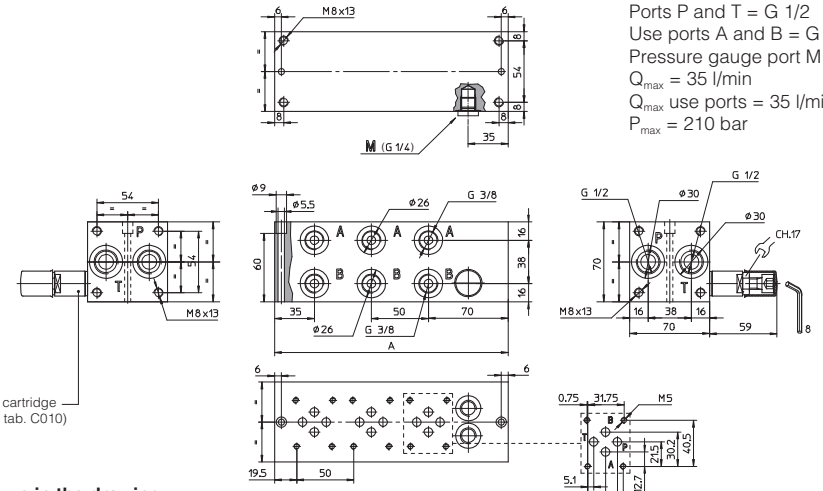
Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	70	120	170	220	270	320	370	420	470	520
Mass [Kg]	1	1,4	2	2,6	3,2	3,8	4,4	5	5,6	6,2

Mounting surface ISO 4401-03-02-0-05

6 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*/M/*-AL [mm]

Hydraulic scheme





Ports P and T = G 1/2
Use ports A and B = G 3/8
Pressure gauge port M = G1/4 (plugged)
Q_{max} = 35 l/min
Q_{max} use ports = 35 l/min
P_{max} = 210 bar

The 3-stations subplate is shown in the drawing

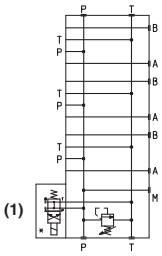
The lenght of the subplate varies with the number of stations as shown in the table below

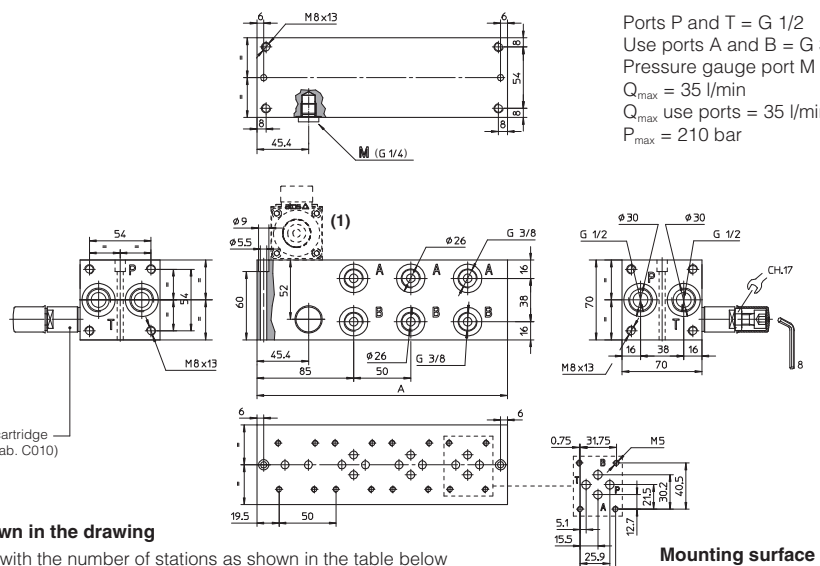
Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	105	155	205	255	305	355	405	455	505	555
Mass [Kg]	1,1	1,5	2,1	2,7	3,3	3,9	4,5	5,1	5,7	6,3

Mounting surface ISO 4401-03-02-0-05

7 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*/MH/*-AL [mm]

Hydraulic scheme





Ports P and T = G 1/2
Use ports A and B = G 3/8
Pressure gauge port M = G1/4 (plugged)
Q_{max} = 35 l/min
Q_{max} use ports = 35 l/min
P_{max} = 210 bar

The 3-stations subplate is shown in the drawing

The lenght of the subplate varies with the number of stations as shown in the table below

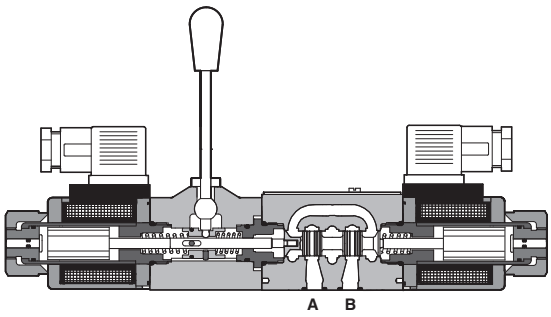
Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	120	170	220	270	320	370	420	470	520	570
Mass [Kg]	1,2	1,6	2,2	2,8	3,4	4	4,6	5,2	5,8	6,4

Mounting surface ISO 4401-03-02-0-05

(1) The venting directional valve in the dashing line must be ordered separately

Auxiliary hand levers for solenoid valves

direct operated on-off and proportional, ISO 4401 size 06



DHE-0711/MV

Auxiliary hand levers for direct operated on-off solenoid valves size 06, type DHI, DHE, DHA and proportional valves size 06, type DHZO, DHZE, DHZA and QVHZO.

This option allows to operate the valves in absence of electrical power supply, i.e. during commissioning, maintenance or in case of emergency.

It is available with two different configurations depending to the installation requirements:
MV = lever positioned vertically (perpendicular to the valve axis)
MO = lever positioned horizontally (parallel to the valve axis)

When the valve is electrically operated the hand lever remains stopped in its rest position

The hand lever execution does not affect the performances of the original valves.

1 **MODEL CODE FOR ON-OFF DIRECTIONAL VALVES** (for the details, see indicated tech. table)

DHE - 0	63	1/2	/	MV	-	X	24 DC	**	/*

Directional control valves size 06
DHI-0= for AC and DC supply, with **cURus** certified solenoids - see table E010
DHE-0 = for AC and DC supply, high performances, with **cURus** certified solenoids - see table E015
DHA-0 = ex-proof - see table EX010

Valve configuration: **61 - 63 - 71**

Available spools: **0 - 0/2 - 1 - 1P - 1/2 - 1/2P - 3 - 3P - 4 - 7**

Options, hand lever configuration:
MO = horizontal hand lever (not for DHA)
MV = vertical hand lever
AMO = horizontal hand lever installed at the side of port B (not for DHA)
AMV = vertical hand lever installed at the side of port B

Only for DHI and DHE:
00 = solenoids without coils, for DHI valve
00-AC = AC solenoids without coils, for DHE valve
00-DC = DC solenoids without coils, for DHE valve
X = without connector

Voltage code: see relevant tech. table

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

(1) For DHA model code see table E120 (Multicertification) or E125 (UL)

2 **MODEL CODE FOR PROPORTIONAL DIRECTIONAL VALVES AND FLOW CONTROL VALVES** (for the details, see indicated tech.table)

DHZO	-	A	-	0	71	-	S5	/	MV	/*	**	/*

Directional proportional valves size 06
DHZO = see table F160
DHZE = see table F150
DHZA = ex-proof - see table FX010

Flow control valves size 06
QVHZO = see tab F410

A = without position transducer **(2)**

Valve size
0 = ISO 4401 size 06 (for DHZ*)
06 = ISO 4401 size 06 (for QVHZO)

Valve configuration (only DHZ*): **51, 53, 71, 73**

Options:
MO = horizontal hand lever (not for DHA, DHZA)
MV = vertical hand lever
BMO = horizontal hand lever installed at the side of port A (not for DHZA, QVHZO)
BMV = vertical hand lever installed at the side of port A (not for QVHZO)
O = Horizontal cable entrance (only for DHZA)
Y = External drain (only for DHZA, DHZO)

Spool size (for DHZ*): **S3 - S5 - D3 - D5 - L3 - L5**
Max regulated flow (for QVHZO): **3-12-18-36-45** l/min

Coil option: see relevant tech. table

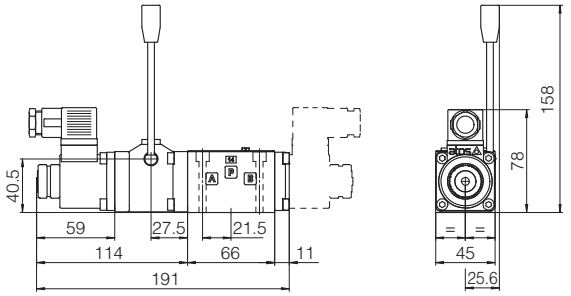
Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

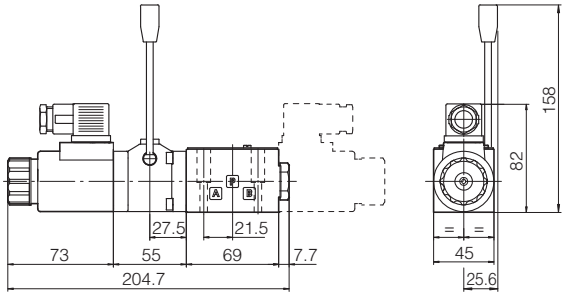
3 LEVER CHARACTERISTICS

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

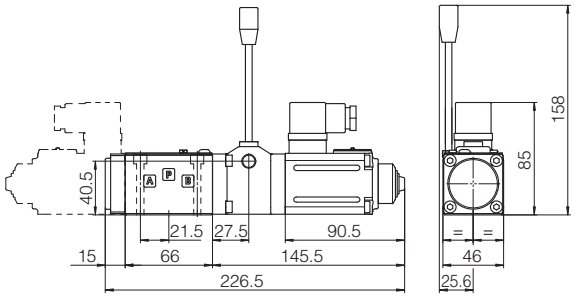
4 INSTALLATION DIMENSIONS [mm]



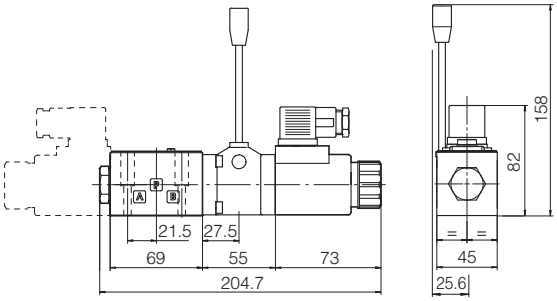
DHI-06*/MV Mass: 2,4 kg (single solenoid)
DHI-07*/MV (dotted line) Mass: 2,7 kg (double solenoid)



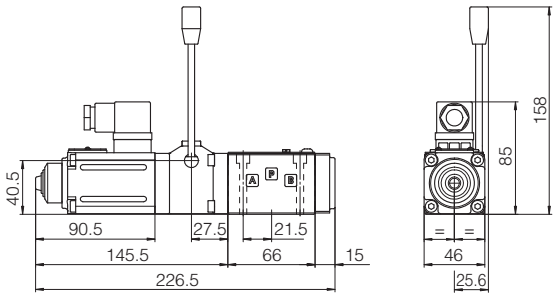
DHE-06*/MV Mass: 2,7 kg (single solenoid)
DHE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



DHZO-A-05*/MV Mass: 2,8 kg (single solenoid)
DHZO-A-07*/MV (dotted line) Mass: 3,5 kg (double solenoid)

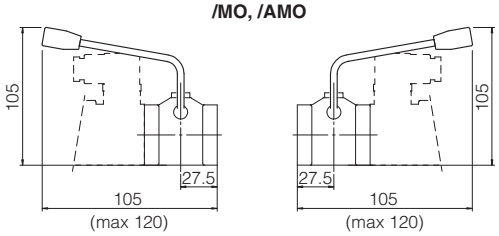


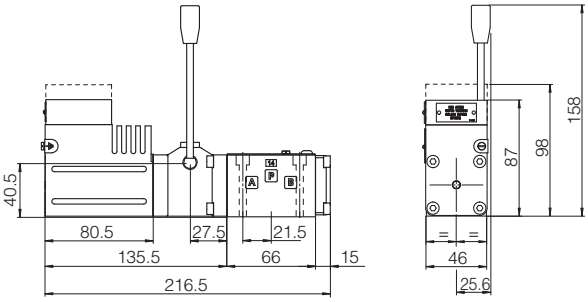
DHZE-05*/MV Mass: 2,7 kg (single solenoid)
DHZE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



QVHZO-A-06*/MV Mass: 3,2 kg

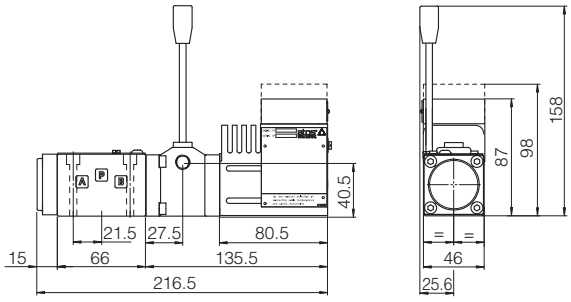
Horizontal hand lever device /MO, /AMO





DHA/*-06*/MV Mass: 3,4 kg
DHA/UL-*-06*/MV (dotted line)

Note: see tech. table FX010 for DHA/MV models

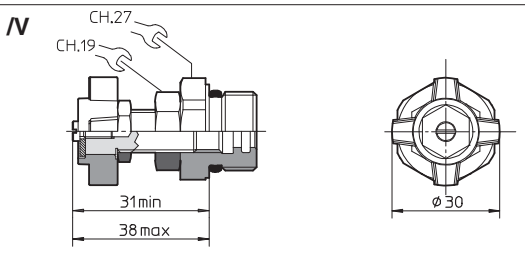
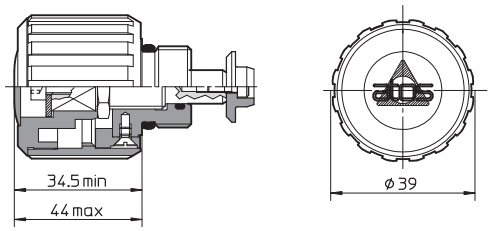
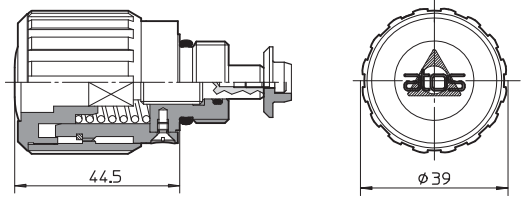
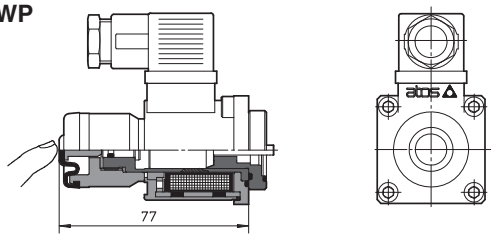
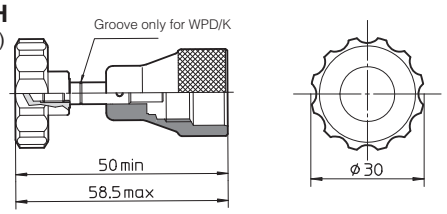
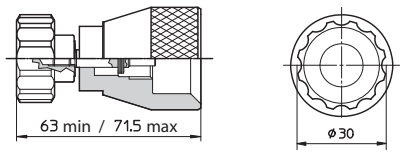
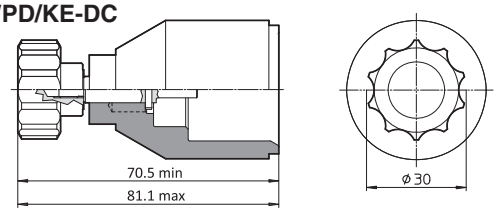


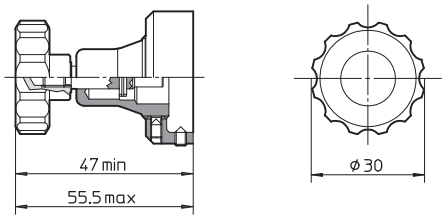
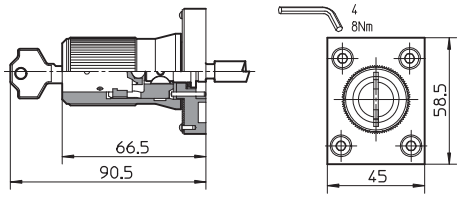
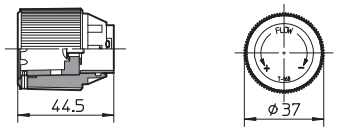
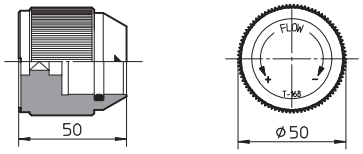
DHZA/*-06*/MV Mass: 3,4 kg
DHZA/UL-*-06*/MV (dotted line)

Note: see tech. table FX100 for DHZA/MV models

Handwheels for hydraulic controls

on-off and proportional valves

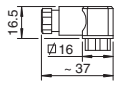
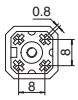
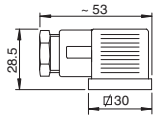
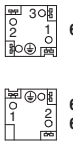
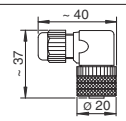
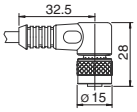
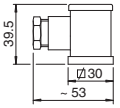
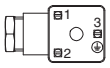
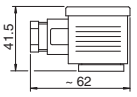
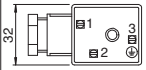
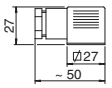
	OPTIONS CODES AND DIMENSIONS	FEATURES	VALVE TYPE
OPTION	**/V** 	Regulating handwheel	ARE, CART ARE, CART M-6, ARAM, AGAM, REM, AGIR, AGIS, AGIU, HMP, HM, KM, HS, KS, HG, KG, LIMM, LIRA, LICM
OPTION	**/VF** 	Regulating knob	ARE, CART ARE, CART M-6, AGIS, AGIU (as spare part, code VFG instead of VF and VSG instead of VS), HMP, HS, HG.
OPTION	**VS** 	Manual override with safety locking. Regulation possible only with pushed knob.	
OPTION	**/WP** 	Prolonged manual override protected by rubber cap	DHI, DHE DKE DLEH, DLEHM DPHI, DPHE LID*
SPARE PART	**WPD/H** (size 06) 	Manual override with detent, for mechanical operation and fixed actuation of spools	DHI
SPARE PART	**WPD/HE-DC** 		DHE (only DC version)
SPARE PART	**WPD/KE-DC** 		DKE-DC

	OPTIONS CODES AND DIMENSIONS	FEATURES	VALVE TYPE
SPARE PART	**WPD/Z** 	Manual override with detent, for mechanical operation and fixed actuation of spools. Only for open-loop valves.	DHZO, DKZOR, DPZO, QVHZO, QVKZOR
OPTION	**/K** 	Lock key for the setting knob	DHQ, DKQ QV-06,
OPTION	**/G** 	Adjustment by graduated micrometer	HQ, KQ, JPQ-2
OPTION	**/G** 		JPQ-3

Electric and electronic connectors

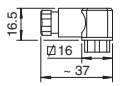
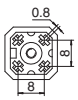
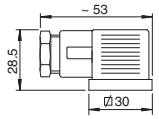
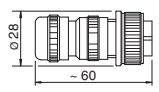
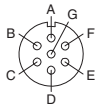
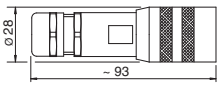
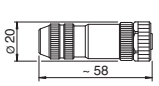
for transducers, on/off and proportional valves

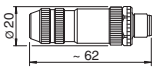
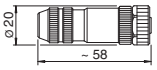
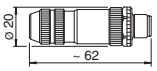
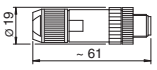
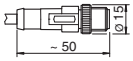
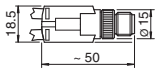
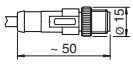
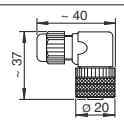
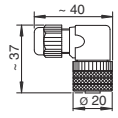
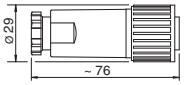
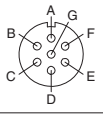
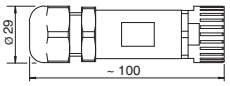
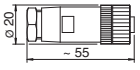
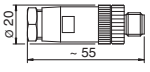
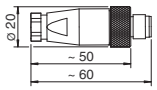
1 CONNECTORS FOR ON/OFF VALVES

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
345 	Female plastic connector - 4 pin: - inductive proximity sensor, /FI option for DHI, DHE			PG7 ø 4 ÷ 6 mm	Protection degree IP 65 EN 60529
664 **666** (black) **666/A** (grey) **667-24** **667-110** **667-220** 	Female plastic connector - 4 pin: - pressure switch type MAP - inductive proximity sensor, /FI option for DKE-17* Female plastic connector - 3 pin: - standard coil connector for on/off valves - inductive proximity sensor, /FI option for DKE-16* Female plastic connector - 3 pin: - standard coil connector for on/off valves with built-in led			PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
ZBE-06 	Female plastic connector - 4 pin: - inductive position switch, /FV option			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
BKS-B-20-4-03 	Female plastic connector - 4 pin (3 wire): - inductive proximity sensor for LIFI Cable length: 3 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
669 (black) **669/A** (grey) 	Female plastic connector - 3 pin: - optional electronic connector for on/off valves with built-in rectifier bridge for supplying DC coils by AC current			PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
E-SD/AC 	Female plastic connector - 3 pin: - electronic connector which eliminate electric disturbances when AC solenoid valves are deenergized Power supply: 110/50, 115/60, 220/50, 230/60 VAC			PG11 ø 8 ÷ 10 mm	DIN 43650 Protection degree IP 65 EN 60529
E-SD/DC 	Female plastic connector - 3 pin: - electronic connector which eliminate electric disturbances when DC solenoid valves are deenergized Power supply: 12, 24, 48 VDC			PG11 ø 8 ÷ 10 mm	DIN 43650 Protection degree IP 65 EN 60529

(1) the wiring of electrical terminals has to be made according to specific valve's technical table

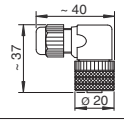
2 CONNECTORS FOR PROPORTIONAL VALVES

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
345 	Female plastic connector - 4 pin: - position transducer for ZO(R)-T and ZO-L valves			PG7 ø 4 ÷ 6 mm	Protection degree IP 65 EN 60529
666 (black) 	Female plastic connector - 4 pin: - standard coil connector for proportionals valves			PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
ZM-7P 	Female metallic connector - 7 pin: - main connector for integral electronic driver			PG11 ø 7 ÷ 9 mm	According to MIL-C-5015 Protection degree IP 67 EN 60529
ZM-12P 	Female metallic connector - 12 pin: - main connector for integral electronic driver			PG13,5 ø 8 ÷ 11 mm	DIN 43651 Protection degree IP 67 EN 60529
ZM-5PF 	Female metallic connector - 5 pin: - CANbus for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding A IEC 60947-5-2 Protection degree IP 67 EN 60529

ZM-5PM 	Male metallic connector - 5 pin: - CANbus for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-5PF/BP 	Female metallic connector - 5 pin: - PROFIBUS DP for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-5PM/BP 	Male metallic connector - 5 pin: - PROFIBUS DP for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding B IIEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-4PM/E 	Male metallic connector - 4 pin: - EtherCAT, POWERLINK, EtherNet/IP, PROFINET RT/IRT for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding D IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM/1.5 **ZH-5PM/5** 	Male plastic connector - 5 pin - single pressure/force transducer - analog position transducer Cable length: 1.5 m or 5 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM-2.2 	Male plastic connector - 4 pin: - double pressure/force transducers Splitting cable length: 2 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-8PM/5 **ZH-8PM/10** 	Male plastic connector - 8 pin: - digital position transducer Cable length: 5 m or 10 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZBE-06 	Female plastic connector - 4 pin: - position transducer (LIQZO-T* size 50) - integral pressure transducer (TERS)			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZBE-08 	Female plastic connector - 5 pin: - position transducer E-THT-15 (LIQZP)			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-7P 	Female plastic reinforced with fiber glass connector - 7 pin: - main connector for integral electronic driver			PG11 ø 8 ÷ 10 mm	According to MIL-C-5015 Protection degree IP 67 EN 60529
ZH-12P 	Female plastic reinforced with fiber glass connector - 12 pin: - main connector for integral electronic driver			PG16 ø 6 mm x 2 cable	DIN 43651 Protection degree IP 67 EN 60529
ZH-5P 	Female plastic connector - 5 pin: - RS232 Serial, CANbus - digital electronic driver E-MI-AS-IR, /M12 option			PG9 ø 6 ÷ 8 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5P/BP 	Male plastic connector - 5 pin: - PROFIBUS DP			PG9 ø 6 ÷ 8 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM 	Male plastic connector - 5 pin: - pressure, force, position transducers (TEZ/LEZ series 10 or lower)			PG7 ø 4 ÷ 6 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be realized according to specific valve's technical table

3 CONNECTOR FOR PRESSURE TRANSDUCERS AND PRESSURE SWITCHES

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
ZBE-08 	Female plastic connector - 5 pin: - pressure transducer E-ATR8 - electronic pressure switch type E-DAP-2			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be made according to specific transducer's technical table

6 GENERAL INFORMATION

INDEX

GENERAL INFORMATION

Basics for digital proportional electrohydraulics

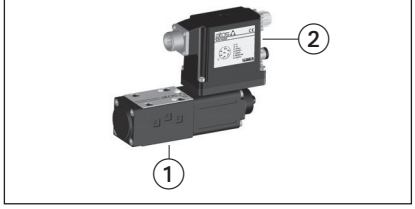
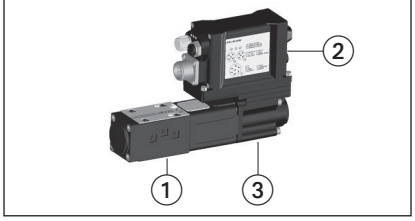
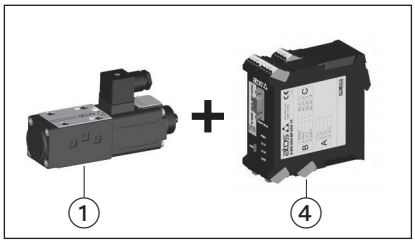
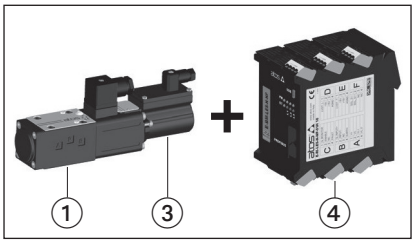
Digital electrohydraulics enables new functionalities within the conventional control architectures and represents the fundamental premise to realize machines with high technological contents.
The digital electronics integrates several logic and control functions (distributed intelligence) and allows the introduction into the hydraulic system of the most modern fieldbus communication networks.

The integration of advanced digital technologies into Atos proportional valves brings important advantages and innovative features:
- better performances of electrohydraulic components: hysteresis, response time, linearity, repeatability, valve to valve riproducibility
- numerical software setting of hydraulic parameters (scale, bias, ramp, compensation of non-linearities) for full valve to valve riproducibility
- advanced diagnostics (alarms history, built-in oscilloscope function) and computer assisted maintenance
- industry 4.0 connectivity through direct interfacing with fieldbus networks

Atos digital components range includes:
- proportional valves and drivers, see sections [1] and [2]
- proportional P/Q pumps, see 4.3
- axis controls and servoactuators, see section [5]

[1] PROPORTIONAL VALVES CONFIGURATION

PERFORMANCES →

VALVES / DRIVERS	WITHOUT TRANSDUCER	WITH TRANSDUCER
	The valve regulation is performed by modulating the current supplied to the solenoid, without any feedback of the regulated value. The reguation accuracy is affected by the operating conditions.	The valve regulation is performed by modulating the current to the proportional solenoid according to the feedback signal from the LVDT or pressure transducer. The reguation accuracy is very high and it is independent to the hydraulic conditions.
ON-BOARD On-board digital drivers simplifies the electrical wiring and they are factory preset to assure repetitive regulation characteristics.		
OFF-BOARD Off-board digital drivers are the ideal solution for remote cabinet installation in applications with critical temperatures or vibrations.		

① Proportional valve ② On-board driver ③ Transducer ④ Off-board driver

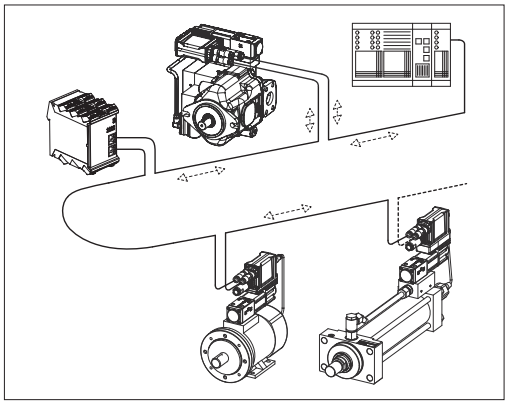
[2] PROPORTIONAL VALVES CLASSIFICATION - with on-board or off-board driver

PERFORMANCES ↑

Valve classification	Type of valve	Transducer	Hydraulic features	Application
Servoproportionals	Directional	LVDT	Zero spool overlap	Actuator position and speed control P/Q control
High performance proportionals	Directional	LVDT	Positive spool overlap	Actuator direction and speed control P/Q control
	Flow	LVDT	Pressure compensated	System flow regulation, actuator speed control
	Pressure	Pressure	Relief Reducing Compensator	System pressure control Actuator force control Load sensing control
Proportionals	Directional	None	Positive spool overlap	Actuator direction and speed control
	Flow		Pressure compensated	System flow regulation, actuator speed control
	Pressure		Relief Reducing Compensator	System pressure control Actuator force control Load sensing control

3 FIELDBUS INTERFACES - see tech table **GS510**

Drivers with fieldbus communication interface allow an higher level of integration with the machine automation architecture: machine central unit (fieldbus master), wired with all the controlled devices (fieldbus node).



Fieldbus available:

BC = CANopen **BP** = PROFIBUS DP **EH** = EtherCAT
EW = POWERLINK **EI** = EtherNet/IP **EP** = PROFINET RT/IRT

Fieldbus interface allows:

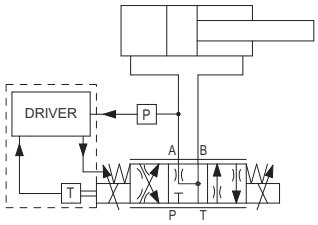
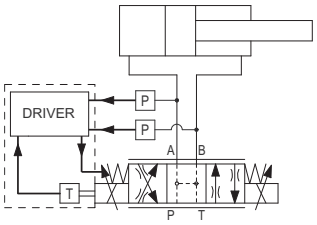
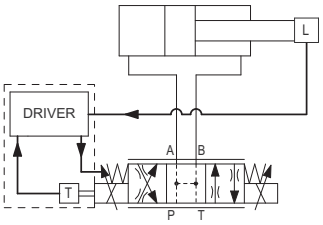
- complete diagnostic of the driver status
- improved information available for machine operation
- improved accuracy and robustness of digital transmitted information
- real time modification of the valve parameters
- direct access to all driver parameters
- costs reduction due to simpler and standardized wiring solutions
- costs reduction due to fast and simple installation and maintenance

4 P/Q CONTROLS - see tech table **FS500**

4.1 P/Q controls for servoproportional and high performance directional valves

In most of the machines functions, the typical movement of a single actuator requires direction, speed and sometime force regulations, normally performed by different type of valves.
Digital proportional valves with SP, SF, SL options add the pressure or force closed loop control to the basic directional control.
A single proportional valve with P/Q control allows to manage complex machine operations requiring high performance combined regulations (typical application: injection cycle or mould motion in plastic machinery).
The closed loop pressure or force control requires the installation in the system of one/two remote pressure transducers or a load cell, to be connected to the valve digital driver.
The option SP performs the closed loop pressure control on one side of the actuator by using one remote pressure transducer.
The other two options perform the closed loop force control by two remote pressure transducers (SF) or one load cell (SL).
Pressure/force and flow are regulated according to two different command signals.
The selection from pressure-force to flow control and vice versa is self performed by the digital driver through dedicated algorithm.

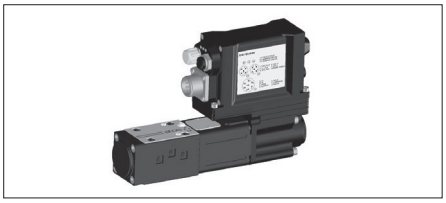
P/Q control configurations

SP = pressure control	**SF = force control**	**SL = force control**
		
one remote pressure transducer has to be installed on the actuator's port to be controlled	two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve spool transducer P pressure transducer L load cell

4.2 Proportional valves with P/Q control - with on-board or off-board driver/axis card

Valve classification	**Application**
Servoproportionals	SF, SL SP only in 3-way connection
High performance proportionals	SP, SF, SL

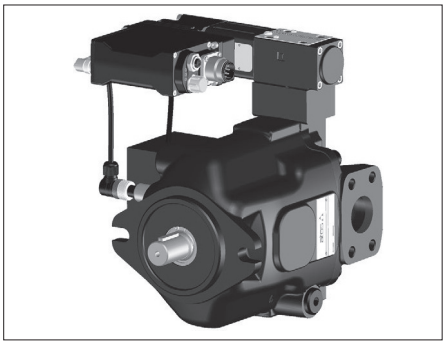


4.3 P/Q controls for variable piston pumps - see tech table **AS170**

PVPC-PERS/PES variable displacement axial piston pumps, integrate the digital combined closed loop pressure and flow control with the electronic max power limitation.

A multiple set of PID parameters can be real time selected during the axis motion via the 12 pin connector (option /S) or through the fieldbus interface, to optimize the P/Q control performances.

The PVPC-PES pumps allow the accurate and dynamic closed loop control of the delivered flow and the system pressure.



5 AXIS CONTROLS

The modern architecture of industrial machinery strongly increases the demand of accuracy, repeatability and performance.
This leads to the need of devices that integrate to the traditional axis positioning also the pressure/force controls.

Atos focuses the integration of axis cards functions with proportional electrohydraulics either in on-board or off-board format.

They improve motion performances, simplify the automation architecture and may be integrated in the fieldbus network.

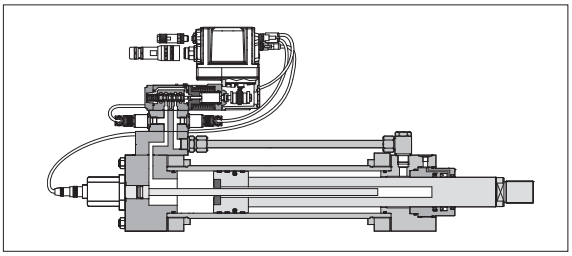
5.1 Synthetic comparison

TYPE		ON BOARD AXIS CARD AND DRIVER	AXIS CARD WITH DRIVER FUNCTION	AXIS CARD
FORMAT / MAIN FUNCTION			 DIN-rail format	 DIN-rail format
Techincal table		**FS610 FS620 FS630**	**GS330**	**GS340**
Valve's driver function		●	●	n.a.
Nr. of controlled axis		1	1	1
Internal programmable cycles		simple	simple	complete
Graphic programming software		●	●	●
Position control		●	●	●
Position transducer interface:	Analog	●	●	●
	Digital (SSI or Encoder)	●	●	●
P/Q control		●	●	●
Analog transducer interface, pressure or force		2	2	2
Performance parameters setting (e.g. Dither, PID)		●	●	●
Valve parameters setting (e.g. Bias, Ramp, Scale)		● factory preset	● factory preset	●
Alternated control		●	●	●
USB interface		●	●	●
CANopen		●	●	●
PROFIBUS DP		●	●	●
EtherCAT		●	●	●
POWERLINK		●	●	●
EtherNet/IP		●	●	●
PROFINET RT/IRT		●	●	●
Digital input		1	1	3
Digital output		1	1	1
Analog input reference		2	2	2
Analog output monitor		2	2	up to 3

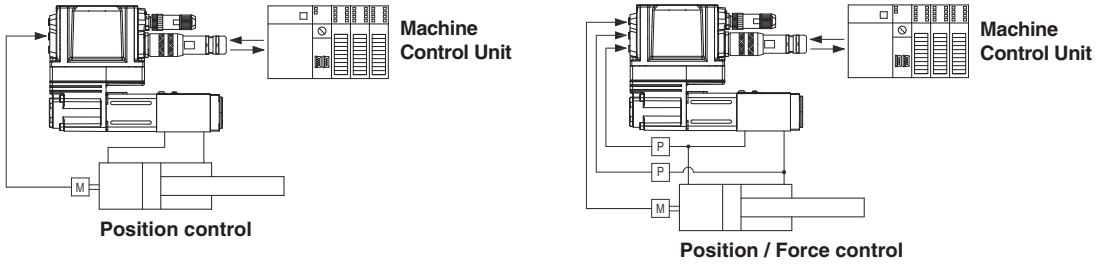
= options

5.2 Servoactuators - see tech table **FS700**

They are stand-alone units performing closed loop position plus optional alternated P/Q controls. These units are made by a servocylinder with position transducer and a servoproportional valve with on-board driver + axis card, factory assembled and tested.

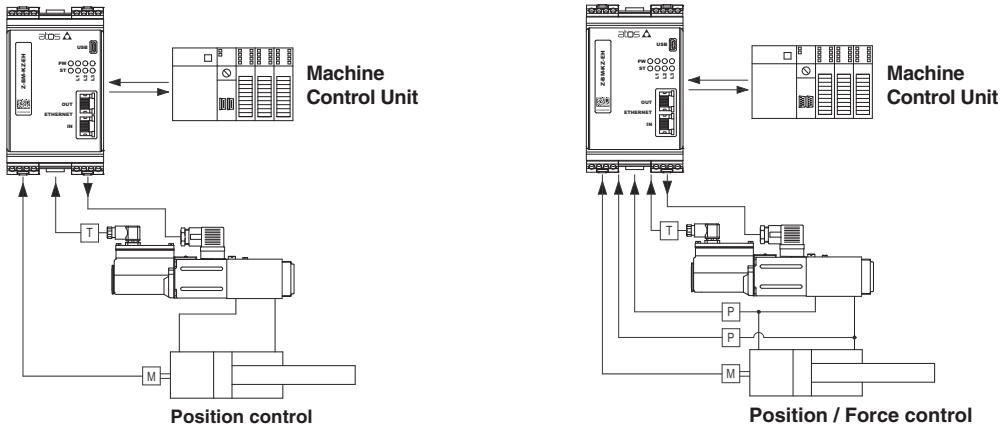


5.3 Digital servoproportionals with on-board axis card and driver, application example - see **FS610**, **FS620**, **FS630**



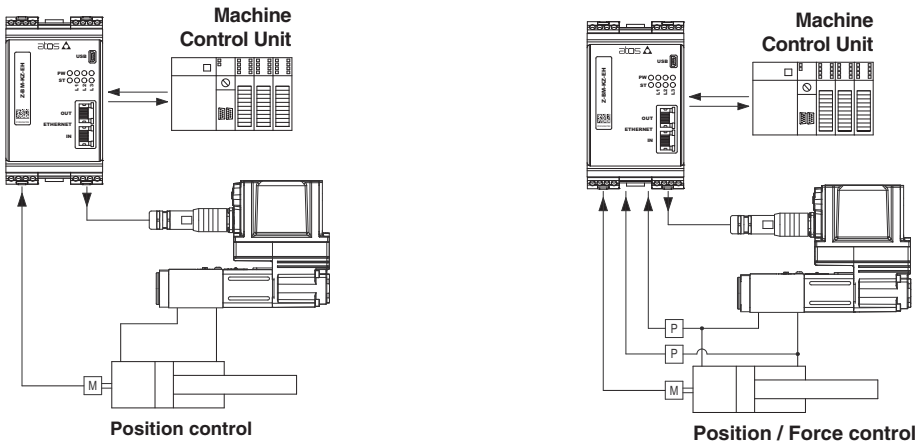
P pressure transducer M actuator position transducer

5.4 DIN-rail axis card with driver function, application example - see tech table **GS330**



P pressure transducer M actuator position transducer T valve's spool transducer

5.5 DIN-rail axis card, application example - see tech table **GS340**



P pressure transducer M actuator position transducer

6 ATOS PROGRAMMING SOFTWARE - see tech table **GS500**

The valve functional parameters and configurations can be easily set and optimized using Atos programming software.
E-SW and Z-SW software are supplied in DVD format and can be easily installed on a desktop or a notebook computer.

The software graphic interface is organized in pages and levels related to different specific functional groups and allows to:

- simply access all the functional parameters of Atos digital proportional valves and drivers
- numerically adapt the factory preset parameters to the application requirements
- verify the actual working conditions
- identify and quickly solve fault conditions
- store the customized setting into the valve/driver or into the PC

The software automatically recognizes the connected valve model and adapts the displayed parameters.

Basics for on-off solenoid directional valves

Atos solenoid valves have been designed and tested with innovative concepts to satisfy the advanced needs of modern machines: rapid or damped switching, quiet operation, reduced power absorbed, versatility, reliability and safety of use.
This table gives engineers, in condensed form, a series of useful information for the choice and the use of modern solenoid valves.

1 DESCRIPTION OF FUNCTION

Solenoid directional valves are used for changing flow direction in hydraulic systems.
Main features are:

1.1 New integrated design between hydraulic and electrical parts with more compact construction and better efficiencies.
1.2 Wet solenoids for maximum reliability, also available in flame-proof, intrinsically safe and stainless steel execution.
1.3 All seals are static and all the moving parts are protected and lubricated by the fluid.
1.4 Smoother switching with effective regulation thanks to optional switching control devices.
1.5 Plastic encapsulated coils easily interchangeable and UL certified.
1.6 Electric or electronic connectors, depending on the application and on electric control board interface.
1.7 Cored oil passages with low pressure drops.
1.8 Interchangeable spools for various directional functions.

2 SOLENOID IDENTITY

According to European Convention, solenoid "A" is close to "A" port and solenoid "B" is close to "B" port of the valve body (pilot valve body for two stage valves).

3 SPOOLS CHARACTERISTICS

Standard interchangeable spools are available in a wide range of configurations, as indicated in table 3.

Specific spools to reduce water hammer-shocks during switching: variants 1/1, 4/8 and 5/1. Their special shape reduces water hammer-shocks during switching. Use of these spools is not recommended with maximum flow greater than 80% of the nominal values, because of higher pressure drops generated in the valve.

Response times and control of switching time: direct operated solenoid valves.
The solenoid valve response times can be controlled by the use of specific devices (option L); associated with the spools */1 and */8 it is possible to control smooth acceleration/deceleration of the connected actuator. The L* devices allow an effective control of the solenoid valve switching time, slowing down the spool speed without reducing the solenoid force.
They are available in different configurations. For correct use a slight backpressure (2 bar) on solenoid valve T port is recommended. Valve response time is also influenced by operating conditions (oil characteristics and temperature), elasticity of the hydraulic circuit and by use of electronic connectors.

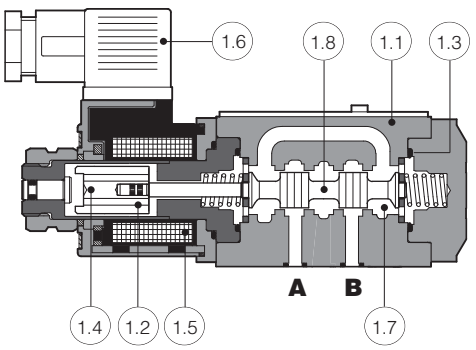


Fig. 1 Cross-section of direct operated solenoid valve

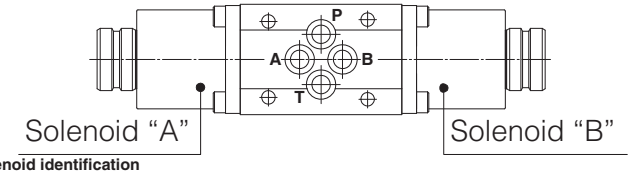


Fig. 2 Solenoid identification

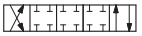
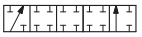
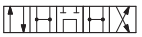
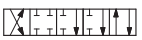
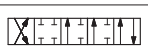
Type	Scheme	Intermediate passages
0		
1		
2		
3		
4		
5		
58		
6		
7		
8		
0/2		
1/2		
2/2		
16		
17		

Table 3 Basic spools, schemes and intermediate passages between central and external positions. **The spools are not available for all the directional valves. For their availability see the relevant valve table.**

Response time and control of switching time: pilot operated solenoid valves.
The response time of the piloted valves can be adjusted by means of the options /H (meter-out control) or /H9 (meter-in control). This options provide the installation between the main stage and the pilot valve of a modular throttle valve, type HQ-*/U specific for fine pilot flow control.
Associated with */1 and */8 spools, smooth acceleration/deceleration can be controlled on loads.

***P spools for direct operated solenoid valves to reduce leakage.**
They are normally used on pilot valve for pressure and directional control valves, for cartridge valves and systems with specific requirements.
Use of these spools is not recommended with maximum flow greater than 70% of the nominal values, because of the higher pressure drops generated in the valve.
Following types available: 1P, 3P, 1/2 P, 8P (for ISO size 06 valves).

4 COIL CHARACTERISTICS

Solenoid valves are available both with DC and AC coils.
- OI solenoids for DHI valves are available for AC and DC supply (only replacing coils)
- OE-AC and OE-DC solenoids for DHE valves are available respectively for AC and DC supply
- AE-AC and AE-DC solenoids for DKE valves are available respectively for AC and DC supply

For solenoids OE and AE, the coils of different voltages are interchangeable only for the same type of power supply AC or DC.
The DC solenoids can be also fed with AC supply, by using 669 connector.

5 ELECTRICAL CONNECTORS TO ISO 4400 (DIN 43650)

The cable entry on electrical plugs can be fitted at 90° intervals by reassembling the contact holder relative to the plug housing.
The cable entry is Pg. 11 suitable for cable Ø 6-10 mm.
Following types are available:
Standard connectors, IP65 protection degree (666);
Connectors with built in LED (667);
Connectors with built in rectifier bridge (669) to supply DC coils by alternating current AC.
In addition to the above DIN connectors, other type of electrical interfaces are available on request:
- Lead Wire connection
- Deutsch connector DT-04-2P (IP67)
- AMP Junior Timer connector (IP67)

6 ELECTRONIC CONNECTORS

Operational principle
E-SD to eliminate electric disturbances when solenoids are deenergized;

7 OPERATING NOTES

Tightening of the fixing screws to the subplates and of the plastic coil ringnut.
It is particularly important to check that the tightening of the fixing screws respects the torque limits indicated in table 4.
Higher values may cause anomalous deformations of the body and prevent sliding of the spool. 12.9 class fixing screws are recommended. The plastic coil ringnuts will be fixed on the solenoid with a torque 4Nm: this deforms properly the seals and protects against external particles and water entrance.

Operation in circuits with flow exceeding the nominal valve flow
In circuits with flow rates greater than the nominal values and in circuits with accumulators, where the instantaneous flow can exceed nominal values, is recommended a plug-in restrictor on P port of solenoid valve to limit the maximum flow on the valve.
Dilatation and contraction of flexible hoses subjected to variations of system pressure can generate high instantaneous flow rates.
The version indicated in fig.5 can be directly inserted into P port of the valve but also in other valve ports.
The plug-in restrictors can be ordered separately:
PLUG H-** (for DH* valves)
PLUG K-** (for DKE* valves)
** the double asterisk identifies the dimension in tenths of a millimeter.
Example: PLUG H-05 = 0,5 mm diameter

Limits on two-way and three-way operation for direct operated solenoid valves.
When used as two-way and three-way valves with P, A or B ports blocked or not subject to flow, or with flow much lower than flow on other ports, maximum catalogue performance cannot be assured.

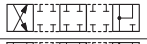
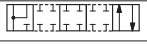
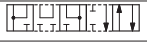
Minimum pilot pressure for pilot operated solenoid valves.
A minimum pressure value must be guaranteed for piloting the valve. This value is 8 bar. For spools with P-T connection in rest position, the option /R should be used.

Operation combined with hydraulic cylinders with high section ratios.
Operational limits may occur with cylinders with section ratios (piston/rod) greater than 1.25. In these cases multiplications or demultiplications of flow and pressure may disturb the correct operation of the solenoid valve.

Table 3.2 Spools to reduce water hammer shocks associated with switching

Type	Scheme	Intermediate passages
0/1		
1/1		
3/1		
4/8		

Table 3.3 Specific spools for special uses or in regenerative circuits

Type	Scheme	Intermediate passages
09		
90		
19		
91		
39		
93		
49		
94		

8 SPECIAL VERSION SOLENOID VALVES

- for explosion-proof environments
- for intrinsically safe operation
- stainless steel execution for marine or aggressive environments or water base fluids
- for operation beyond the allowed temperature limits.

Table 4
Recommended torque for the fixing screws

Valve type	Fixing screws class 12.9	Torque
DH*	M5	8 Nm
DKE*	M6	15 Nm
DP**-2	M10 & M6	70 Nm & 15 Nm
DP**-4	M12	125 Nm
DP**-6	M20	600 Nm

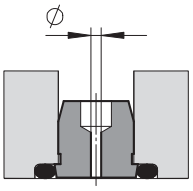
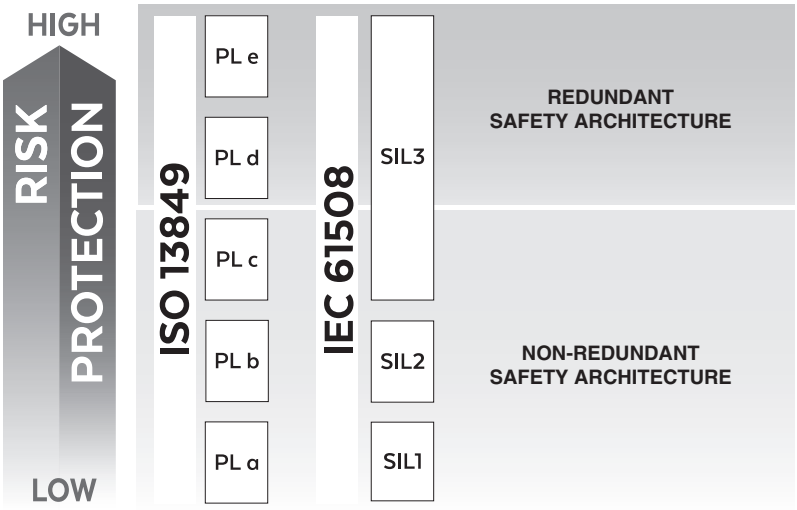


Fig. 5
Plug-in restrictor for DKE valves

Basics for safety components

IEC 61508 Safety Integrity Level and **ISO 13849** Performance Level - certified by



Safety in engineering of modern machinery is becoming a primary issue to protect people from potential risks caused by accidental failures of machines and systems.

The **Machine Directive 2006/42/EC** with relevant norms **IEC 61508 Safety Integrity Level** (SIL) and **ISO 13849 Performance Level** (PL), represents the framework of the functional safety, which is a key aspect in terms of general principles of prevention concerning safety of devices or systems with health implications.

It defines the safety requirements that the machine manufacturer must comply with, in order to obtain the certification and thus the possibility to apply the CE mark required to sell the machine within the European market.

Machine Directive 2006/42/EC replaces the existing 98/37/EC and it is universally applicable to machinery, safety components, and other specific equipment.

1 SAFETY NORMS

IEC 61508 and relevant norms **IEC 61511** (process control system) plus **IEC 62061** (machine control systems) introduce the integrated probabilistic approach to the functional safety. They specify the Safety Integrity Levels (SIL) required to perfom safety functions.

ISO 13849 norm provides safety requirements and guidance on the principles for the design and integration of safety-related parts of control systems including the design of software.

It specifies the Performance Level (PL) required to perform safety functions.
PL: discrete value that specify the ability of safety related parts of control systems to perform a safety function under forseeeable conditions.

The requirements are classified into five Performance Levels, where **PL e** identifies the highest protection level.

2 CERTIFICATION

Atos safety valves (on-off and proportionals) are certified by TÜV in compliance with IEC 61508, IEC 61511, IEC 62061, ISO 13849

The certification guarantees the valve compliance with related safety norms and it proves that all requirements have been met for the SIL and PL levels claimed for the specific valve.

The certification also confirms the following data which can be used by the machine manufacturer for the certification of the whole system:

- the design process used by the valve manufacturer to avoid failures
- the design techniques and measures used to control failures
- the methods used to define hardware fault tolerances
- the methods used to measure the safe failure fractions
- the methods used to measure the probabilities of failure

⚠ **The use of non-certified products invests the machine manufacturer of the responsability for validating that all above aspects have been carried out according to the applicable standards.**

Without valve's certification the machine manufacturer has to alternatively:

- collect from valve's manufacturer all the reliability data necessary to evaluate the safety level of the whole system
- consider the worst case concerning the safety level (e.g. assign to valves the lower safety level **PL a** or **SIL 1** in order to calculate system safety)

3 RISK ASSESSMENT

The first step for determining the necessary risk reduction is the Risk Assessment.
It is a procedure carried out to identify which risks in the machine require a mitigation by means of safety control systems (e.g. laser barriers, shut-off valves, enabling devices, etc). Each of these control systems become a Safety Function.
At that point the safety functions must be defined and satisfied by the machine design (see 3.1).

⚠ **It is the responsibility of the machine manufacturer to ensure that all safety requirements are satisfied and to conduct a documented risk assessment to ensure that all potential machine hazards are covered.**

3.1 Machine Manufacturer

With the name of “Machine Manufacturers” are identified OEMs or end users who manufacture machinery for their own needs or everybody who performs “significant modifications “as:

- change the machine function
- change the machine application area
- change the equipment
- change the machine performance

If changing any of the above parameters results in either change of intended use or change of safety system or safety component, a machine modification should be treated as “significant”.

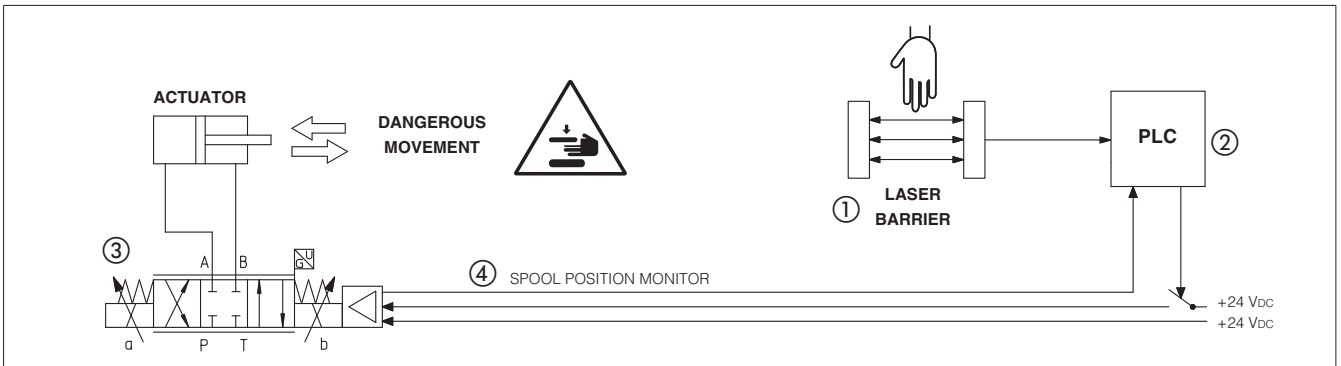
Example:

Adding air-gun pneumatic connection = NOT significant modification

Adding hydraulic accumulator to increase the speed and improve cycle time of the machine = significant modification

4 SAFETY RELATED PARTS

They are parts of machine control systems performing safety functions, allowing the system to achieve or maintain a safe status.
These parts consist of either hardware or software and stand-alone or integrated components of the machine control system.
Safety-related parts incorporate the entire effective chain of a safety function provided by control unit, valves, sensors and actuator.



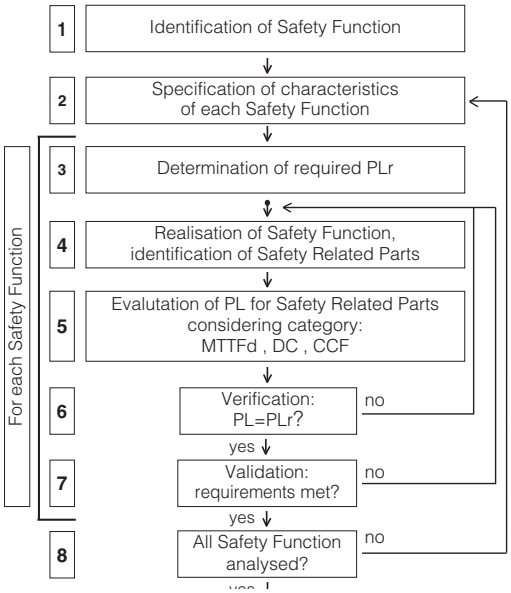
①	②	③	④
SENSORS	LOGIC	VALVE	VALVE DIAGNOSTICS
Detect dangerous situations	Controls the machine operations and activates the safety procedures in case of dangerous situations	Controls the actuator and avoids the dangerous movement	Monitors the correct valve operation

5 SAFETY ANALYSIS

The second step after the identification of the risk is the Safety Analysis.
The process for the design of the safety-related parts of control systems, is iterative.

The aside scheme shows the one used by EN ISO 13849-1:

- The first step consists in the identification of the Safety Functions.
- Any characteristics of all safety functions must be described and documented.
- The Performance Level required (PLr) by each safety function must be defined. ISO13849-1 uses a path like the one shown in section 5.1.
- The machine manufacturer must designe a system to protect the operator, granting a Performance Level (PL) equal or higher than the Performance Level required (PLr). The Performance Level (PL) must be defined considering following parameters:
  - MTTFd, reliability of safety system – see section 5.2
  - DC, capability to detect faults – see section 5.3
  - CCF, vulnerability of the system to failures – see section 5.4
  - architecture categories of the safety system – see section 6

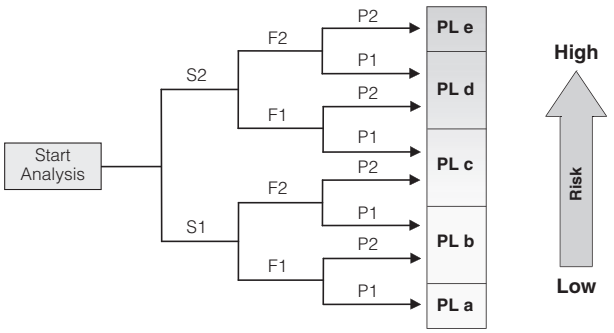


5.1 Performance Level required - PLr

The determination of PLr for ISO 13849-1 is carried out analysing the following parameters:

- Severity of harm:
  S1 = slight
  S2 = serious
- Frequency and duration of exposure to the hazard:
  F1 = not often
  F2 = frequent
- Possibility of avoiding the hazard or limiting the harm:
  P1 = possible
  P2 = rarely possible

Each of five performance levels corresponds to a further parameter scale, based on the probability of a dangerous failure per hour.



Performance Level	Average probability of dangerous failures per hour, h-1
PL e	$\geq 10^{-8}$ to $< 10^{-7}$
PL d	$\geq 10^{-7}$ to $< 10^{-6}$
PL c	$\geq 10^{-6}$ to $< 3 \times 10^{-6}$
PL b	$\geq 3 \times 10^{-6}$ to $< 10^{-5}$
PL a	$\geq 10^{-5}$ to $< 10^{-4}$

5.2 Mean Time to Failure dangerous - MTTFd

The achievement of a specific PL or SIL relies on the reliability of the system.
The reliability is quantified by Mean Time to Failure dangerous (MTTFd) which is measured in hours.

The MTTFd should be determined from the component manufacturer's data.

5.2 Diagnostic Coverage - DC

The Diagnostic Coverage (DC) is a measure of how effectively the potential dangerous failures can be detected by the monitoring system.

EN ISO 13849-1 suggests how to define DC.

Diagnostic Coverage is defined as the measure of the effectiveness of diagnostics: it is determined as the ratio between the failure rate of detected dangerous failures and the failure rate of total dangerous failures;

DC = 0% no dangerous faults are detected

DC ≅ 100% most of dangerous faults are detected (it is impossible to reach a DC = 100% because diagnostics are not considered to be completely reliable)

Diagnostic Coverage categories:

Category	Range
None	DC < 60%
Low	60% ≤ DC < 90%
Medium	90% ≤ DC < 99%
High	DC ≥ 99%

5.3 Common Cause Failure - CCF

The CCF value is a parameter for evaluating the measures against the common cause failure.
It is a failure in redundant systems where two or more channels fail at the same time in consequence of a single common cause.
The redundancy can be compromised if both channels fail simultaneously due to the same cause.
EN ISO 13849-1 provides a score for CCF, which is used to determine the Performance Level (PL).

For this score, EN ISO13849-1 defines a checklist of seven important countermeasures:

1. The signal paths of different channels are physically separated (score = 15 points)
2. Diversity in the technology, the design or the physical principles of the channels (score = 20 points)
3. Protection against possible overloading (15 points) and the use of well-tried components [which are those components which have been widely used or made and verified for safety related application (score = 5 points)]
4. Failure mode and effects analysis during development for the identification of potential common cause failures (score = 5 points)
5. Training of designer/service personnel in CCF and its avoidance (score = 5 points)
6. Protection against common failures caused by contamination (fluid filtration) and electromagnetic interference for electrical parts(score = 25 points)
7. Protection about common cause failures caused by unfavorable environmental conditions (score = 10 points)

For architecture categories 2, 3 and 4 a minimum score of 65 points is required (see section 6).

Note: CCF always depends on the system and application.

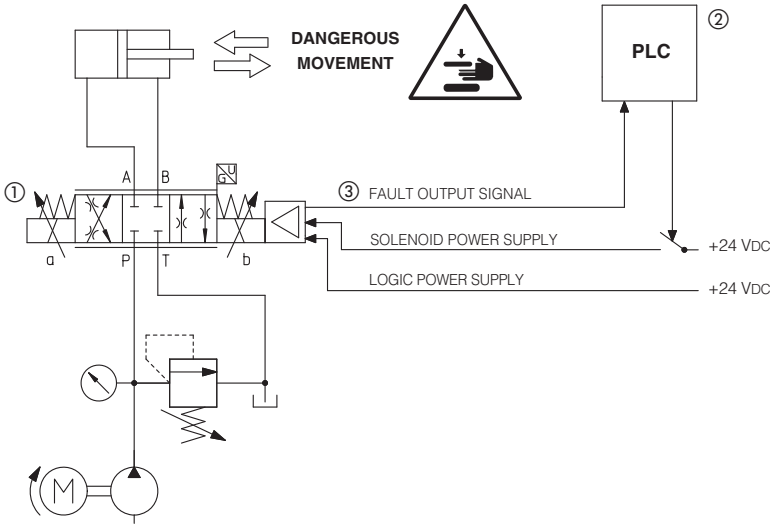
6 ARCHITECTURE CATEGORIES

SIL and PL levels depend not only on the characteristics of the single component but also on the architecture of the hydraulic system and of the signals diagnostic.
Architecture categories help to define the probability of failure and the PL of the safety related parts of a control system in relation to their resistance to faults and their subsequent behavior in the fault condition
There are five architecture categories, identified as : **B, 1, 2, 3, 4**
The higher is the number, the higher is the complexity of the safety system and the higher is the achieved Performance Level PL.

6.1 Architecture categories B and 1

In categories B and 1, the resistance to faults is mainly achieved by the selection of proper components. They are not-redundant architecture so the occurence of a failure may lead to the loss of the safety function.
Category 1 has a greater resistance than category B because of the use of special components and principles which are considered well-tried and tested in a safety system.

Example of architecture category 1



Safety function = to prevent the dangerous cylinder movement in a certain phase of the cycle or in emergency

The safety function is achieved by disabling the current to the solenoids of safety proportional valve so that the spool is moved by the springs to the rest position with positive overlap.

Through the continuous monitoring of the valve's spool position, the machine PLC verifies if the "safe condition" is fully accomplished.

⚠ **The safety function is not performed in case of valve ① failure**
Fault tolerance HFT = 0

① Digital proportional valve with double power supply - option /U
(i.e. DHZO-TES-SN-NP-07*-L5 **/U**)

② Machine PLC supervising the safety function

③ Fault output signal used for safety diagnostics

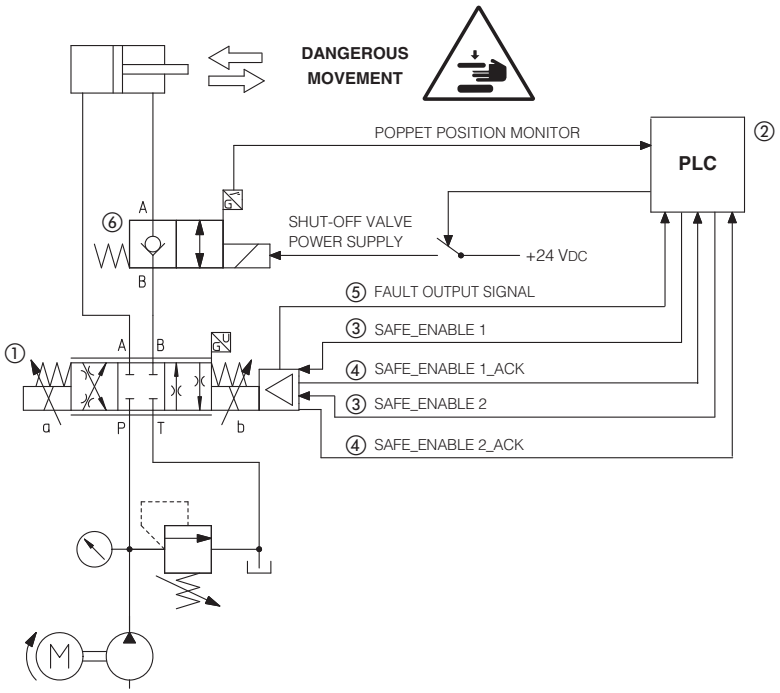
6.2 Architecture - category 2

In category 2 all of the requirements of architecture B and 1 are combined. In addition, the system is monitored to intercept faults affecting the safety function.
These monitors are made at regular intervals, e.g. at startup or before the next demand on the safety function.
By using an appropriate selection of test intervals, a suitable risk reduction can be obtained.

6.3 Architecture categories 3 and 4

In categories 3 and 4, the occurrence of a single fault does not result in the loss of the safety function.
In category 4 such faults are detected automatically.
Accumulation of faults will not lead to a loss of the safety function.

Example of architecture category 4



① Digital proportional valve - option /K
(i.e. DHZO-TES-SN-NP-07*-L5 **/K**)

② Machine PLC supervising the safety function

③ Signals used to enable/disable the current to the valve's solenoids

④ Signals confirming the valve safe status

⑤ Fault output signal used for safety diagnostics

⑥ Safety shut-off valve with poppet position monitor (i.e. JO-DL **/FV**)

Safety function = to prevent the dangerous cylinder movement in a certain phase of the cycle or in emergency

In this example a safety shut-off valve with poppet position switch has been added to the safety proportional valves to grant a **redundant safety architecture**.

The safety function is performed by disabling the current to the solenoid of safety proportional valve and safety shut-off valve so that the spool is moved by the springs to the rest position with positive overlap.

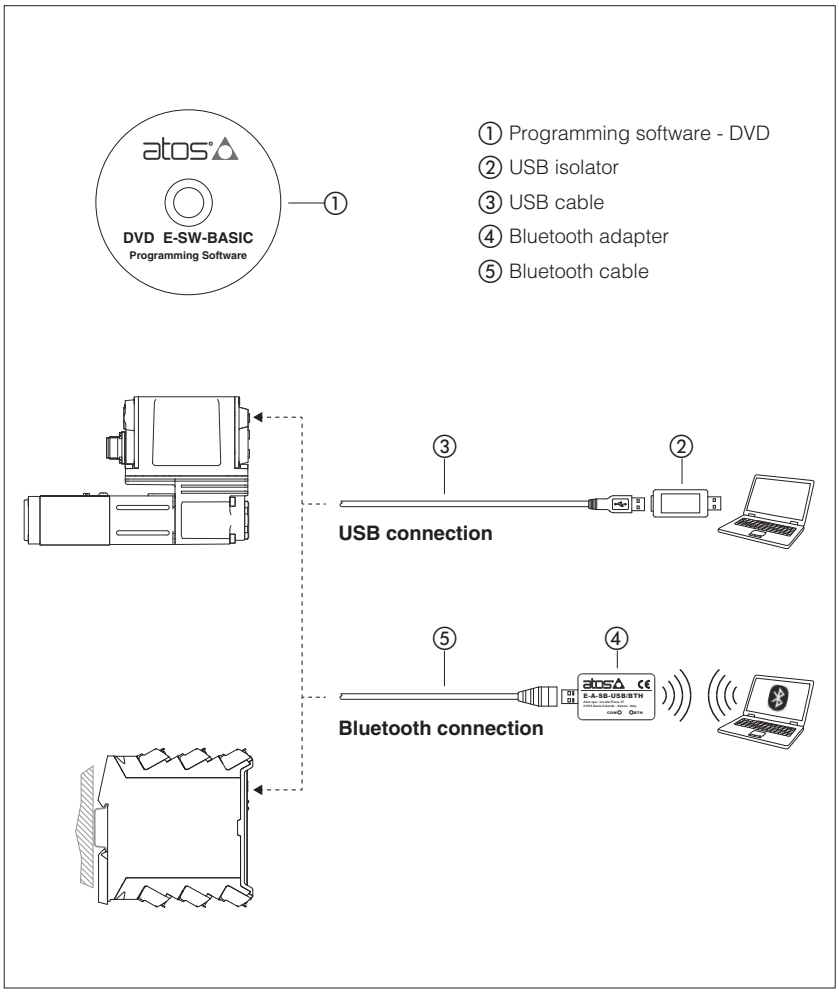
The safety condition is confirmed by:

- SAFE_ENABLE_ACK status = 24 VDC
- shut-off valve poppet position monitor signals

⚠ **The safety function is performed even in case of failure of one valve, ① or ⑥**
Fault tolerance HFT = 1

Programming tools for digital electronics

Atos PC software, USB adapters, cables and terminators



The E-SW and Z-SW programming software are supplied in DVD format and can be easily installed on a desktop or a notebook computer. The intuitive graphic interface allows:

- set up valve's functional parameters
- verify the actual working conditions
- identify and quickly solve fault conditions
- adapt the factory preset parameters to the application requirements
- store the customized setting into the valve
- archive the customized setting into the PC

The graphic interface is organized in pages related to different specific groups of functions and parameters.

The software automatically recognizes the connected valve model and adapts the displayed parameter groups, according to the selected access level.

The software is available in different versions according to the driver and axis card communication interfacing.

Fieldbus communication software includes also dedicated manuals and configuration files for user self management of the Atos electronics, using a fieldbus master.

Features:

- automatic valve recognition
- multilevel graphic interface
- numeric parameters settings (scale, bias, ramp, linearization, dither, etc.)
- real-time parameters modification
- diagnostic and monitor signals
- preset data storing into the digital driver and axis card
- internal oscilloscope function
- internal database of customized preset

DVD contents:

- software installer
- user and fieldbus communication manuals
- fieldbus configuration files

1 PROGRAMMING SOFTWARE

Valve functional parameters can be easily set up with Atos E-SW and Z-SW programming software using proper connection to the digital driver/axis card.

E - SW	-	BASIC	/	*	-	*

E-SW= for valve drivers

Supplies:
- = first supply
N = next supply

Supported valve drivers communication:

BASIC	= NP (USB)	PS (Serial)	IR (Infrared)
FIELDBUS	= BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

Option:
PQ = for valve drivers with alternated P/Q controls SP, SF, SL

Notes: E-SW-FIELDBUS supports also valve drivers without fieldbus communication;
E-SW-*/PQ supports also valve drivers without P/Q control

Z - SW	-	FULL	-	*

Z-SW= for axis cards

Supplies:
- = first supply
N = next supply

Supported axis cards communication:

FULL	= NP (USB)	PS (Serial)	
	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

1.1 Programming software versions

Different software versions are available according to the valve drivers and axis cards type to be connected and communication interface.

Note: the E-SW and Z-SW software are supplied in DVD format; E-SW-BASIC software can be free downloaded from the Atos website

Free programming software, web download:

E-SW-BASIC Software can be downloaded upon web registration at www.atos.com; service and DVD not included.
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area.
The software remains active for 10 days from the installation date and then it stops until the user inputs the Activation Code.

DVD first supply of programming software, to be ordered separately:

E-SW-BASIC
E-SW-BASIC/PQ
E-SW-FIELDBUS
E-SW-FIELDBUS/PQ
Z-SW-FULL

Software has to be activated via web registration at www.atos.com; 1 year service included.
Upon web registration user receive via email the Activation Code (software license) and login data to access personal Atos Download Area.
The software remains active for 10 days from the installation date and then it stops until the user inputs the Activation Code.

DVD next supplies of programming software, to be ordered separately:

E-SW-BASIC-N
E-SW-BASIC/PQ-N
E-SW-FIELDBUS-N
E-SW-FIELDBUS/PQ-N
Z-SW-FULL-N

Only for supplies after the first; service not included, web registration not allowed.
Software has to be activated with Activation Code received upon first supply web registration.

Notes: the E-SW and Z-SW software are NOT interchangeable and have to be ordered separately;
programming software FIELDBUS and FULL can program digital electronics through USB communication port for all industrial and ex-proof versions of drivers/axis cards

1.2 DVD contents

Include software installer, user manuals and fieldbus configuration files:
EDS for BC - GSD for BP - XML for EH - XDD for EW - EDS for EI - GSDML for EP

1.3 Atos Download Area

Direct access to latest releases of programming software, manuals, USB drivers and fieldbus configuration files at www.atos.com
Software and USB drivers can be easily installed following the instruction contained in the “info.txt” files.
An automatic mailing message will inform all the registered users whenever a new software upgrade is available.

1.4 E-SW / Z-SW minimum PC requirements

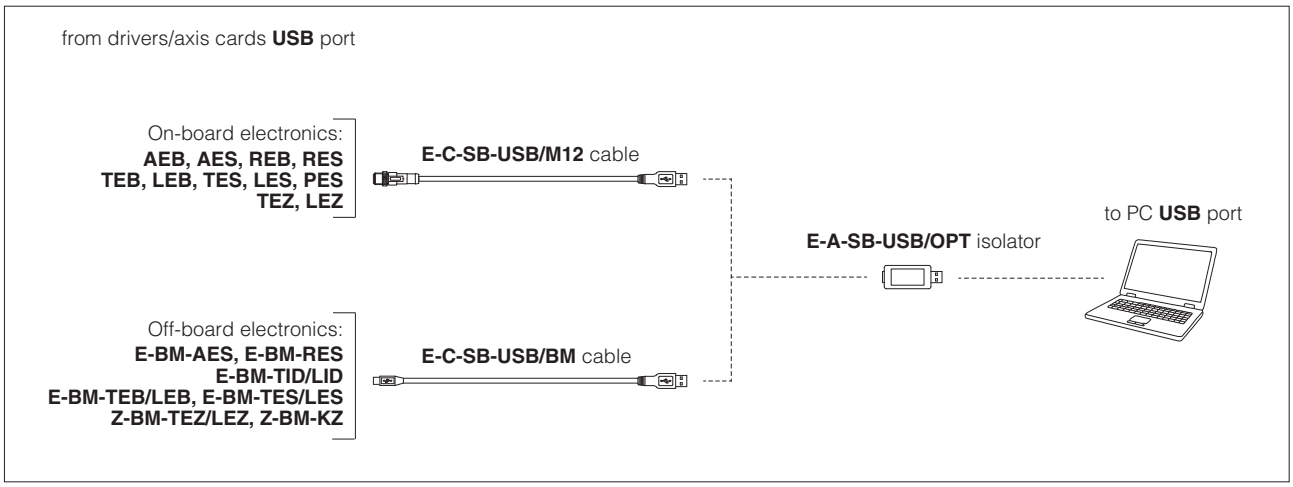
Personal Computer	Pentium® processor 1GHz or equivalent	**Memory**	512 MB RAM + Hard Disk with 250MB free space
Operating System	Windows XP SP3	**Device**	DVD reader
Monitor Resolution	1024 x 768	**Interface**	Serial RS232 port (only for PS) or USB port

2 USB connection - ISOLATOR AND CABLE

E-SW / Z-SW software permit valve's parameterization through USB port.

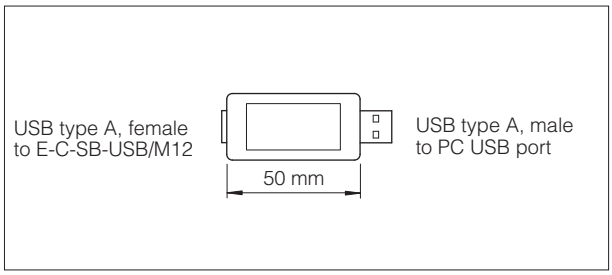
2.1 Connection tools

Isolator and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: **E-KIT-USB**



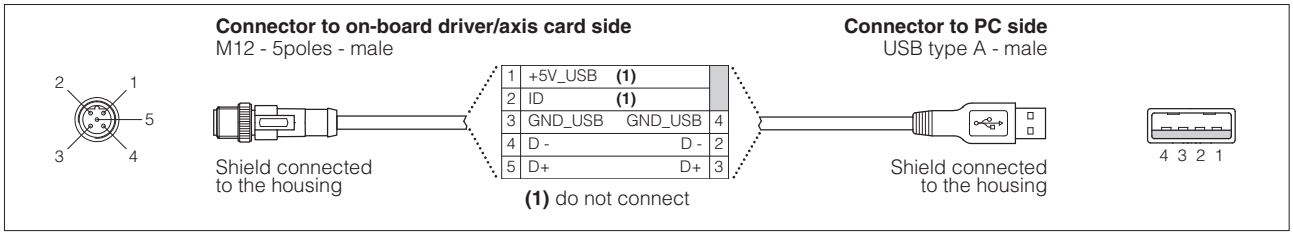
WARNING: drivers/axis cards USB port is not isolated! Use of USB isolator adapter is highly recommended for PC protection: wrong earthing connections may cause high potential difference between GNDs, generating high currents that could damage the PC connected to drivers/axis cards.

2.2 **E-A-SB-USB/OPT** - isolator adapter

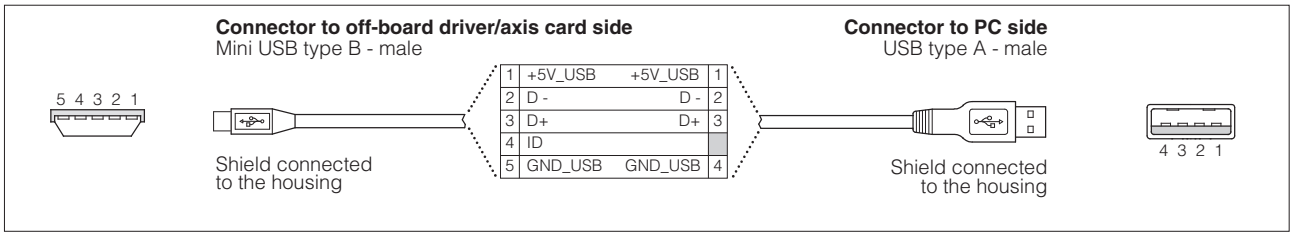


- USB 2.0 Full speed (12 MBps)
- electrical isolation 1 kV
- temperature range, -40° ÷ +50° (relative humidity 25% ÷ 75%)
- external power supply not required (power 400 mA output, 5 V ±10%)
- MTBF >1,2 million hours (MIL standard)

2.3 **E-C-SB-USB/M12** - 4 m cable - only for on-board electronics



2.4 **E-C-SB-USB/BM** - 3 m cable - only for off-board electronics

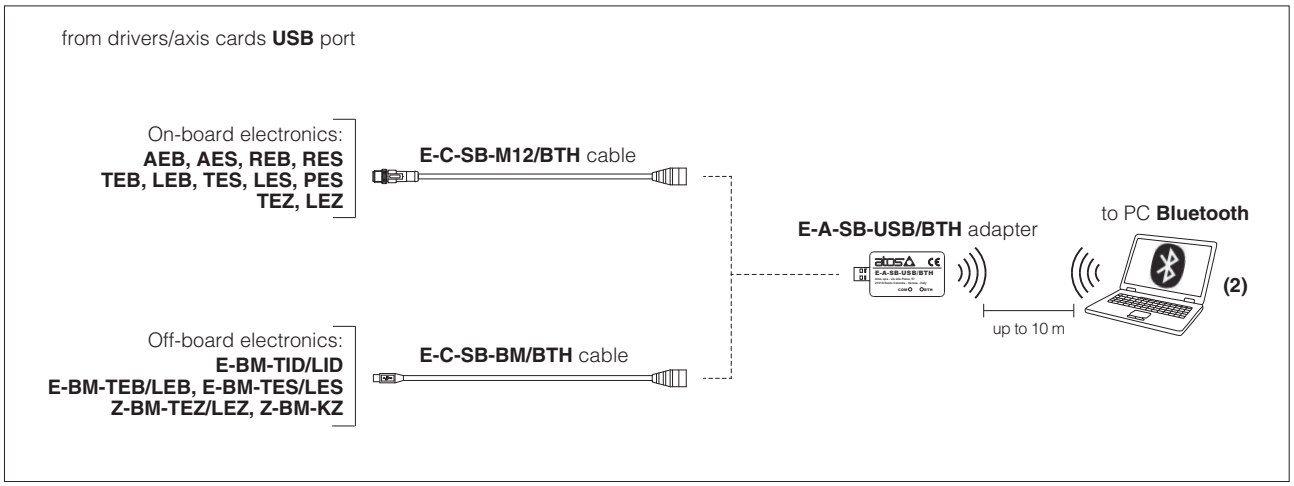


3 BLUETOOTH connection - ADAPTER AND CABLE

E-SW / Z-SW software permit valve's parameterization through Bluetooth **(1)**.

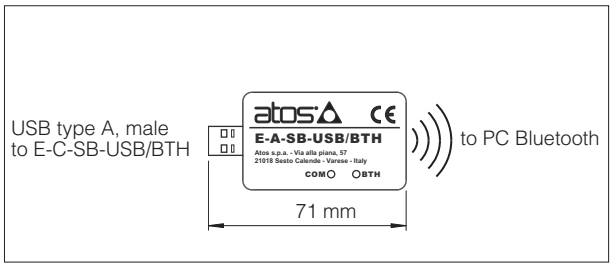
3.1 Connection tools

Adapter and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: **E-KIT-BTH**



(1) Bluetooth adapter is not compatible with E-BM-AES and E-BM-RES drivers
(2) If PC has not built-in Bluetooth, use standard USB to Bluetooth dongle compatible with E-A-SB-USB/BTH specification (please refer to STARTUP-BTH guide)

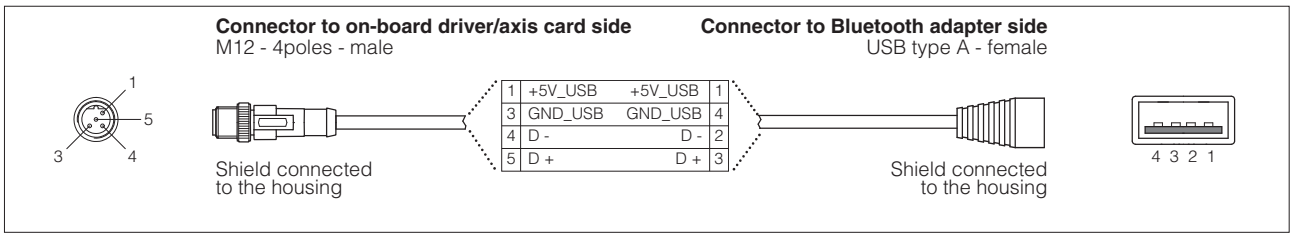
3.2 E-A-SB-USB/BTH - Bluetooth adapter



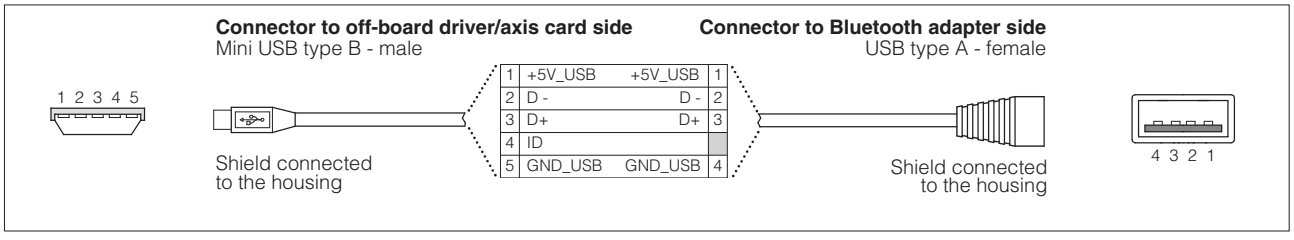
- USB male connector, type A
- type of radio interface: Bluetooth Class 2
- temperature range, -20 ÷ +70 °C (storage -40 ÷ +70 °C)
- external power supply not required (from Atos drivers/axis cards only)
- protocol: Bluetooth Classic Version 2.x , 3.x supporting Serial Port Profile
- max RF transmission power: Class 2 Output Power (+1.5 dBm typical)
- frequency: 2.402 GHz to 2.480 GHz
- LEDs indicate the actual working condition
- IP20 protection degree

WARNING: Bluetooth adapter is available only for Europe, USA, Canada, China, Japan, India, Korea markets!
Bluetooth adapter is certified according to RED (Europe), FCC (USA), ISED (Canada), SRRC (China), MIC (Japan), BIS (India), KC (Korea) directives

3.3 E-C-SB-M12/BTH - 0,4 m cable - only for on-board electronics



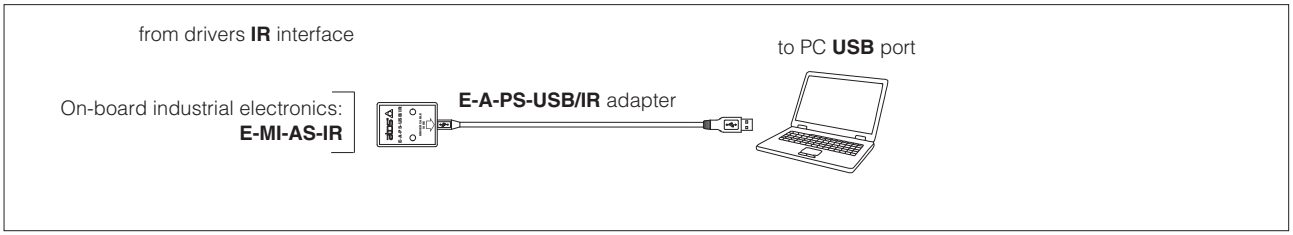
3.4 E-C-SB-BM/BTH - 0,2 m cable OTG - only for off-board electronics



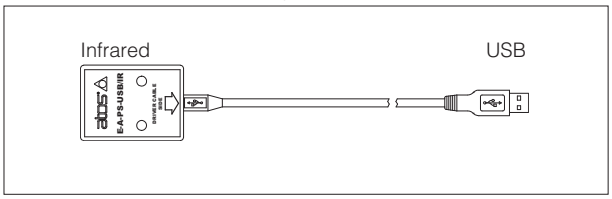
4 IR infrared - USB COMMUNICATION ADAPTER - only for **E-MI-AS-IR** drivers

The adapter have to be connected to the USB communication port of PC to activate the IR infrared communication interface towards Atos digital electrohydraulics.

4.1 Connection tools



4.2 **E-A-PS-USB/IR** - 3 m adapter

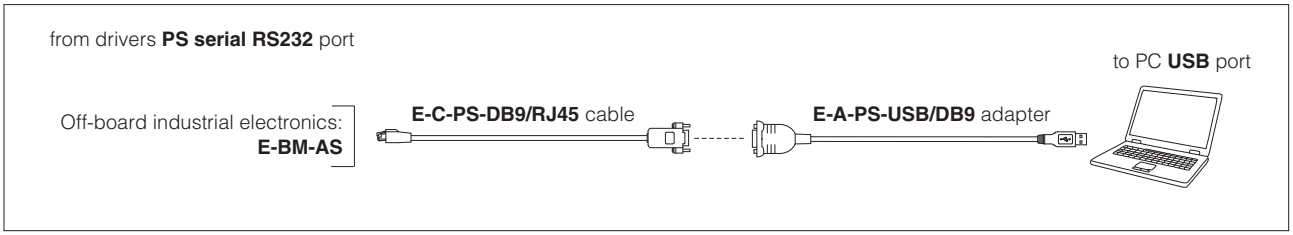


- direct infrared communication with the driver
- USB male connector, type A
- plug-in format for direct infrared connection on the driver
- transmission rate 9,6 kbit/s
- external power supply not required (USB supply)

5 PS serial RS232 - USB COMMUNICATION ADAPTER AND CROSS CABLES - only for **E-BM-AS** drivers

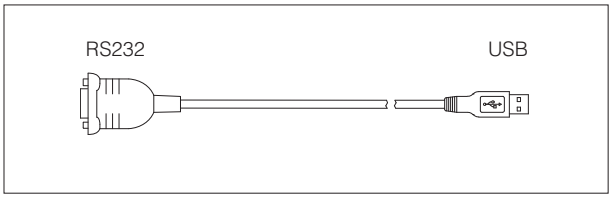
The adapter have to be connected to the USB communication port of PC to activate the PS serial RS232 communication interface towards Atos digital electrohydraulics. The cross cables connect the relevant connector of the USB adapter with the communication port of the digital drivers.

5.1 Connection tools



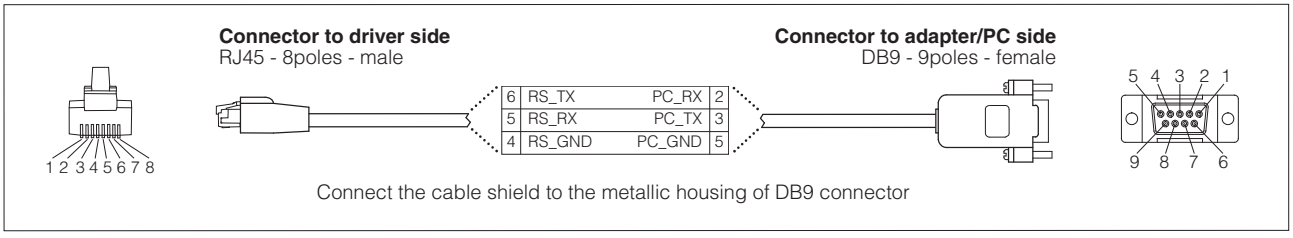
Note: the adapter is not required if PC is already equipped with a serial RS232 communication port

5.2 **E-A-PS-USB/DB9** - 0,45 m adapter



- DB9 male connector according to serial RS232 specification
- USB male connector, type A
- transmission rate from 1,6 kbit/s up to 225 kbit/s
- external power supply not required (USB supply)

5.3 **E-C-PS-DB9/RJ45** - 2,5 m cable



6 FIELDBUS TERMINATORS - only for **BC** and **BP**

The fieldbus terminators are required when output fieldbus connector has to be used as network end point.

Note: fieldbus terminators not available for ex-proof electronics

E - TRM	-	BC	-	M12	/	5PM

Terminator

Fieldbus interfaces:
BC = CANopen
BP = PROFIBUS DP

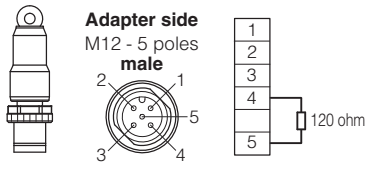
Connector:
M12 = from M12 output fieldbus connector **(1)**
DB9 = from DB9 connector, adapter side **(2)**

Connector:
5PM = to BC executions **(1)**
4PF = to BP executions **(1)**
DB9 = to DB9 connector, cable side **(2)**

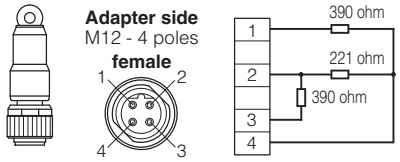
(1) for on-board TES, LES, PES, TEZ, LEZ series 40 or higher
(2) for off-board E-BM-AES, E-BM-RES, E-BM-TID/LID, E-BM-TEB/LEB, E-BM-TES/LES, Z-BM-TEZ/LEZ, Z-BM-KZ

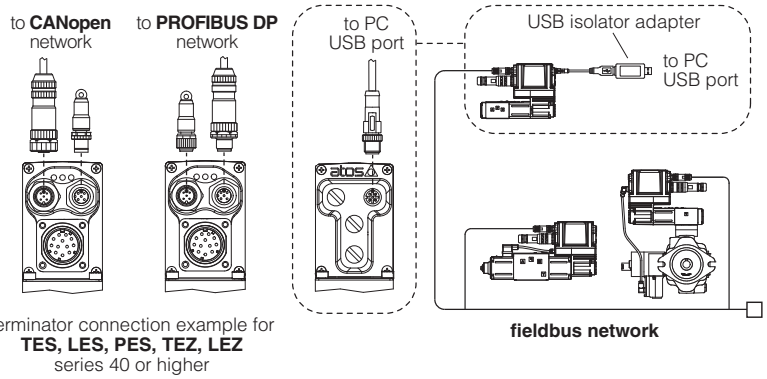
6.1 M12 terminators

E-TRM-BC-M12/5PM network CANopen terminator



E-TRM-BP-M12/4PF network PROFIBUS DP terminator

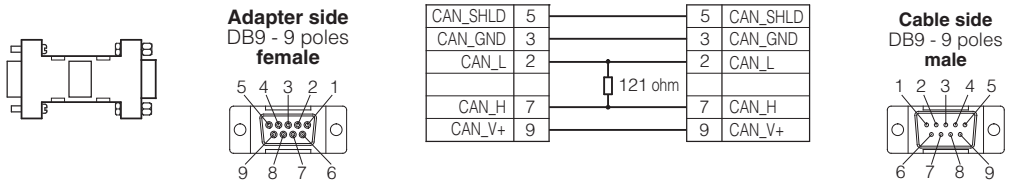




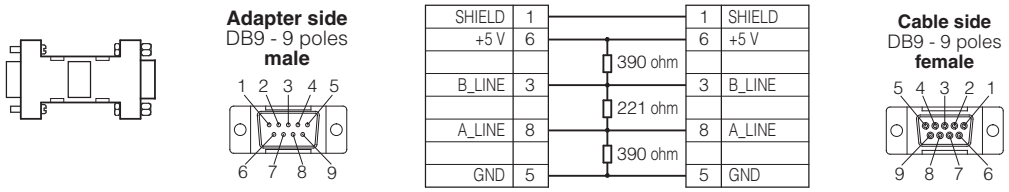
terminator connection example for
TES, LES, PES, TEZ, LEZ
series 40 or higher

6.2 DB9 terminators

E-TRM-BC-DB9/DB9 CANopen terminator for E-A-BC-USB/DB9 USB adapter



E-TRM-BP-DB9/DB9 PROFIBUS DP terminator for E-A-BP-USB/DB9 USB adapter



7 FIRMWARE UPDATE

It is possible to update the firmware of the following digital drivers and axis cards, using proper USB communication port.
The firmware update is allowed starting from electronics series listed into the table or higher series:

Industrial electronics

E-RI-AEB s10 E-RI-AES s40	E-RI-REB s10 E-RI-RES s10	E-RI-TEB s10 E-RI-LEB s10	E-RI-TES s40 E-RI-LES s40	E-RI-TES-S s40 E-RI-LES-S s40	E-RI-PES-S s40
E-BM-AES s10	E-BM-RES s10	E-BM-TID s10 E-BM-LID s10	E-BM-TEB s10 E-BM-LEB s10	E-BM-TES s10 E-BM-LES s10	E-BM-TES-S s10 E-BM-LES-S s10
Z-RI-TEZ s40 Z-RI-LEZ s40	Z-BM-KZ s10	Z-BM-TEZ s10 Z-BM-LEZ s10			

Ex-proof electronics

E-RA-AES s40	E-RA-RES s40	E-RA-TES s40 E-RA-LES s40	E-RA-TES-S s40 E-RA-LES-S s40
Z-RA-TEZ s40 Z-RA-LEZ s40	Z-RA-TEZ-S s40 Z-RA-LEZ-S s40		

8 RECCOMENDED TOOLS SELECTION

8.1 Industrial and ex-proof electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
IR	E-MI-AS-IR	11	E-SW-BASIC		E-A-PS-USB/IR	
PS	E-BM-AS	10 or higher		E-C-PS-DB9/RJ45	E-A-PS-USB/DB9	
NP	E-BM-AES, E-BM-RES	10 or higher		E-C-SB-USB/BM	E-A-SB-USB/OPT	
	E-BM-TID, E-BM-LID **(1)**	10 or higher				
	E-BM-TEB, E-BM-LEB, E-BM-TES, E-BM-LES **(1)**	10 or higher				
	AEB, REB **(1)**	10 or higher		E-C-SB-USB/M12		
	TEB, LEB **(1)**	10 or higher				
	TES, LES **(1)**	40 or higher				
	TES, LES, PES with SP, SF, SL options **(1)**	40 or higher	E-SW-BASIC/PQ			
	E-BM-TES, E-BM-LES with SP, SF, SL options **(1)**	10 or higher		E-C-SB-USB/BM		
	TEZ, LEZ **(1)**	40 or higher	Z-SW-FULL	E-C-SB-USB/M12		
	Z-BM-KZ, Z-BM-TEZ, Z-BM-LEZ **(1)**	10 or higher		E-C-SB-USB/BM		
BP BC EH	E-BM-AES, E-BM-RES	10 or higher	E-SW-FIELDBUS	E-C-SB-USB/BM	E-A-SB-USB/OPT	
	RES **(1)**	10 or higher		E-C-SB-USB/M12		
	AES **(1)**	40 or higher				
BC BP EH EW EI EP	E-BM-TES, E-BM-LES **(1)**	10 or higher	E-SW-FIELDBUS	E-C-SB-USB/BM	E-A-SB-USB/OPT	
	TES, LES **(1)**	40 or higher		E-C-SB-USB/M12		
	E-BM-TES, E-BM-LES with SP, SF, SL options **(1)**	10 or higher	E-SW-FIELDBUS/PQ	E-C-SB-USB/BM		
	TES, LES, PES with SP, SF, SL options **(1)**	40 or higher		E-C-SB-USB/M12		
	TEZ, LEZ **(1)**	40 or higher	Z-SW-FULL	E-C-SB-USB/M12		
	Z-BM-KZ, Z-BM-TEZ, Z-BM-LEZ **(1)**	10 or higher		E-C-SB-USB/BM		

(1) Drivers and axis cards compatible with Bluetooth adapter E-A-SB-USB/BTH (see 3.1)

8.2 Obsolete industrial electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
IR	E-MI-AS-IR	10	E-SW-IR		E-A-PS-USB/IR	
PS	AES	30	E-SW-BASIC	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31				
	TES, LES, PES with SP, SF, SL options	31	E-SW-BASIC/PQ			
	TEZ, LEZ	10	Z-SW-FULL			
	Z-ME-KZ-PS	10 or higher		E-C-PS-DB9/DB9		
BP	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BP-DB9/M12	E-A-BP-USB/DB9	E-TRM-BP-DB9/DB9
	TES, LES, PES with SP, SF, SL options	31	E-SW-FIELDBUS/PQ			
	TEZ, LEZ	10	Z-SW-FULL			
	Z-ME-KZ-PS/BP	10 or higher		E-C-PS-DB9/DB9	E-A-PS-USB/DB9	
BC	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BC-DB9/M12	E-A-BC-USB/DB9	E-TRM-BC-DB9/DB9
	TES, LES, PES with SP, SF, SL options	31	E-SW-FIELDBUS/PQ			
	TEZ, LEZ	10	Z-SW-FULL			
EH	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	

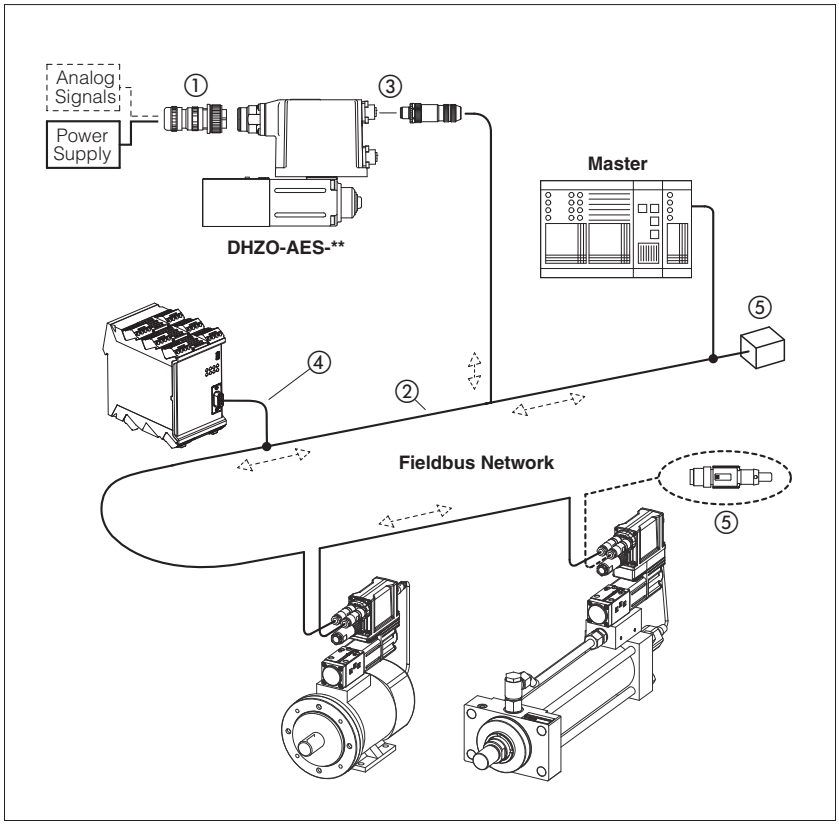
8.3 Obsolete ex-proof electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
PS	AES	30	E-SW-BASIC	E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31				
BP	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BP-DB9/RA	E-A-BP-USB/DB9	E-TRM-BP-DB9/DB9
BC	AES	30		E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BC-DB9/RA	E-A-BC-USB/DB9	E-TRM-BC-DB9/DB9

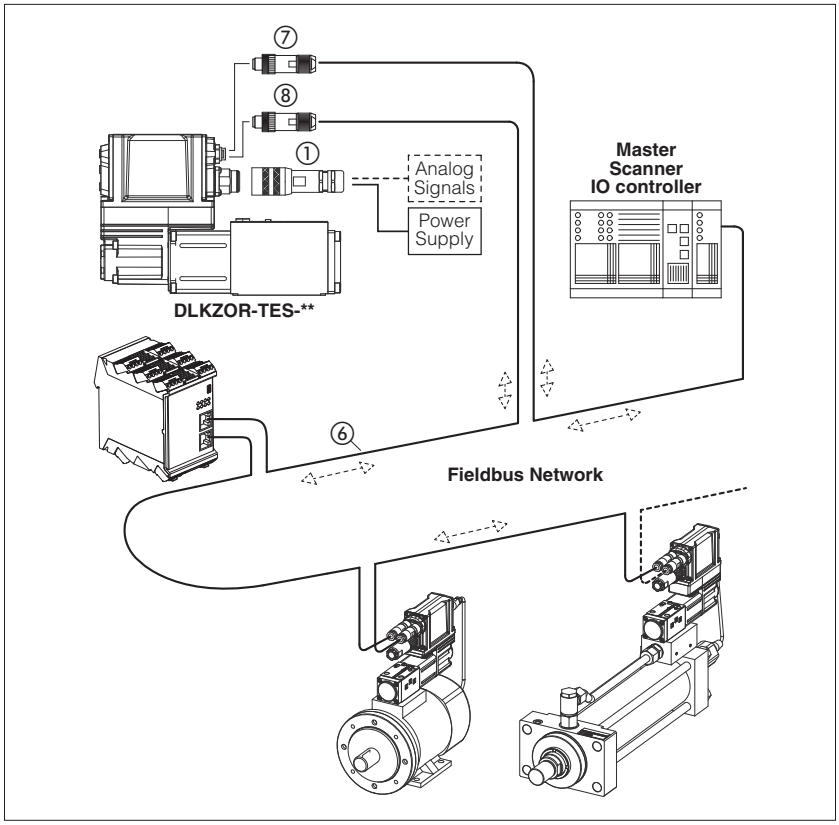
Fieldbus features

BC (CANopen), BP (PROFIBUS DP), EH (EtherCAT),
EW (POWERLINK), EI (EtherNet/IP), EP (PROFINET RT/IRT)

Typical CANopen or PROFIBUS DP fieldbus network



Typical EtherCAT, POWERLINK, EtherNet/IP or PROFINET RT/IRT fieldbus network



Fieldbus communication interfaces are available for digital proportional drivers and controllers, granting several plus:

- more information available for machine operation to enhance its performances
- improved accuracy and robustness of digital transmitted information
- costs reduction due to simpler and standardized wiring solutions
- costs reduction due to fast and simple installation and maintenance
- direct integration into machine's communication networks

These executions allow to operate proportional valves and pumps through fieldbus or using the analog signals on main connector ①.

Fieldbus distributed-control

Fieldbus communication allows to share all the available information of the digital drivers and controllers (reference, monitor, etc).
This distributed-control design allows to implement powerful machines functionalities for tuning, diagnostic, maintenance, etc.

CANopen and PROFIBUS DP networks consist of a common cable (2 twisted wire, ②) for digital communication: several devices (node ③) can be connected to this main cable by means of short cable branches ④.
The two endpoints of the main cable must be terminated with specific devices (terminator, ⑤) to dissipate the communication signal's energy thus preventing interferences and degradations of fieldbus transmission.

EtherCAT, POWERLINK, EtherNet/IP and PROFINET RT/IRT networks consist in a Ethernet common cable (4 twisted wire, ⑥) for digital communication. All slave, adapter and IO device have always the double connector for signal input ⑦ and signal output ⑧.
The main Ethernet cable starting from the master, scanner and IO controller has to be connected to the slave, adapter and IO device input connector.
The slave, adapter and IO device output connector has to be connected to the next slave, adapter and IO device input connector.

1 CANopen features for digital drivers and controllers in BC execution

Physical

Serial input format	Industrial field-bus with optical insulation type CAN-Bus ISO11898
Transmission rate	Transmission rates from 10 Kbit/s to 1 Mbit/s
Max node	32 per segment without repeater; 127 per segment with repeater

Communication Protocol

Data Link Layer	DS301 V4.2.0 - based on CAN standard frame with 11-bit identifier
Device Profile	DS408 - Fluid Power Technology (EN50325-4)
Device type	Slave

Startup and configuration (as per DS301+DSP305)

Boot up process	Minimum boot-up
Node setting	LSS (Layer Setting Services) SDO E-SW-FIELDBUS and Z-SW-FULL programming software
Baudrate setting	LSS (Layer Setting Services), SDO
Baudrate	10 / 20 / 50 (default) / 125 / 250 / 500 / 1000Kbit/s

Fieldbus communication diagnostic (as per DS301)

Device Error	Emergency
Network Error	Node Guarding Heartbeat

Real-time communication (as per DS301 + DS408)

RPDO	4 mappable PDOs to the drivers: AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES 4 mappable PDOs to the controllers: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
TPDO	4 mappable PDOs from the drivers: AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES 4 mappable PDOs from the controllers: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
R(T)PDO types	Event Triggered, Remotely requested, Sync(cyclic) and Sync(acyclic)

Non real-time communication (as per DS301 + DS408)

SDO	1 SDO (1 Server + 1 Client)

Standard references

ISO 11898
Road Vehicles – Interchange of digital information controller area network (CAN) for High-speed communication

EN50325-4
Industrial communication subsystem based on ISO 11898 (CAN) for controller device interfaces

CiA DS301
CANopen – Application Layer and Communication Profile for Industrial Systems

CiA DR303-1
Cabling and connector pin assignment

CiA DSP305
CANopen – Layer Setting Services and Protocol

CiA DS408
CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.2

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or CANopen master device

Configuration file

EDS (Electronic Data Sheet), enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-BC and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-BC and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

2 PROFIBUS DP features for digital drivers and controllers in BP execution

Physical

Serial input format	Industrial field-bus with optical insulation type PROFIBUS-DP RS485 European fieldbus standard (lev.1 – EN50170-part 2)
Transmission rate	Transmission rates from 9,6 Kbit/s to 12 Mbit/s
Max node	32 per segment without repeater; 126 node with repeater

Communication Protocol

Data Link Layer	PROFIBUS DPV0 - IEC 61158 (type 3)
Device Profile	PROFIBUS-DP Profile for Fluid Power Technology
Device type	Slave

Startup and configuration

Boot up process	SAP 61 for sending parameter setting data SAP 62 for checking configuration data
Node setting	SAP 55 E-SW-FIELDBUS and Z-SW-FULL programming software
Baudrate setting	Automatic
Baudrate	9,6 / 19,2 / 45,45 / 93,75 / 187,5 / 500 / 1500 / 3000 / 6000 / 12000 Kbit/s

Fieldbus communication diagnostic

Device error	SAP 60

Real-time communication

PZD	Process data area of PPO telegram by Data Exchange, default SAP: cyclic transmission of standard Profibus frame **Standard electronics - drivers** *PPO type 3, 113, 213, 230 for:* AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES *PPO type 5, 115, 214, 240 for:* TES, BM-TES, LES, BM-LES, PES with alternated P/Q control **Note:** PPO type 213, 230, 214, 240 are customizable by user **Standard electronics - controllers** *PPO type 1, 111, 121, 123 for:* TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ *PPO type 1, 101, 103, 111, 121, 123, 223, 227 for:* TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ with alternated P/Q control **Note:** PPO type 223, 227 are customizable by user
Cyclic mode	standard, sync and freeze

Non real-time communication

PKW	Parameter data area of PPO telegram by Data Exchange, default SAP: acyclic transmission of standard Profibus frame

Standard references

PROFIBUS profile
PROFIBUS Profile,
Fluid Power Technology,
Edition Oct. 2001

VDMA profile
Fluid Power Technology,
Proportional Valves and
Hydrostatic Transmissions, ver 1.1

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or PROFIBUS DP master device

Configuration file

GSD (General Station Description) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-BP and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-BP and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

3 EtherCAT features for digital drivers and controllers in EH execution

Physical

Serial input format	Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2
Transmission rate	2 x 100 Mbit/s (Fast Ethernet, Full-Duplex)
Max node	65535 slaves
Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x88A4 according to IEEE 802.3
Cable length	0,2 - 100m (between two slave devices)
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	Line, tree and star
Termination	Device internally

Communication Protocol

Data Link Layer	EtherCAT use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2
Device Profile	CANopen over EtherCAT (CoE) DS408 - Fluid Power Technology EN 50325-4
Device type	Slave
Supported protocol	CANopen SDO Mailbox-Interface “CoE” Network Management PDO PDO Watchdog Cycle time min 1 msec

Startup and configuration (as per DS301+DSP305)

Node setting	Automatic position addressing Device node addressing
Baudrate	100 Mbit/s (Automatic)

Fieldbus communication diagnostic (as per DS301)

Device Error	Emergency

Real-time communication (as per DS301 + DS408)

RPDO	4 PDOs messages to the driver and controller (up to 32 byte for each PDO)
TPDO	4 PDOs messages from the driver and controller (up to 32 byte for each PDO)
R(T)PDO types	Remotely requested

Non real-time communication (as per DS301 + DS408)

SDO	1 SDO (1 Server + 1 Client)

Standard references

ISO 11898
Road Vehicles – Interchange of digital information controller area network (CAN) for High-speed communication

EN 50325-4
Industrial communication subsystem based on ISO 11898 (CAN) for controller device interfaces

CiA DS301
CANopen – Application Layer and Communication Profile for Industrial Systems

CiA DSP305
CANopen – Layer Setting Services and Protocol

CiA DS408
CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.1

IEC 61076-2-101
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-2
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61784-2
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or EtherCAT master device

Configuration file

XML (Extensible Markup Language) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EH and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EH and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

4 POWERLINK features for digital drivers and controllers in EW execution

Physical

Serial input format	Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2
Transmission rate	2 x 100 Mbit/s (Fast Ethernet, Half-Duplex)
Max node	239 slaves
Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x88AB according to IEEE 802.3
Integrated Hub	
Cable length	0,2 - 100m (between two slave devices)
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	Line, tree, star, daisy chain, ring structure or any combination of these topologies
Ethernet Hub	Integrated with 2 ports: - one led for Link/Activity indicator (on each port) - one bicolor led Status/Error indicator

Communication Protocol

Data Link Layer	POWERLINK use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2
Comm. Profile	EPSG DS 301 v1.2
Device Profile	CANopen over Ethernet based on DS408 - Fluid Power Technology
Device type	Slave - supported features: - Ethernet POWERLINK v2.0 - Ring Redundancy - Support PollRsponse Chaining - Support Multiplexing - Cycle time min 200 µsec - SDO Multiple Parameter Read/Write

Startup and configuration (as per EPSG DS301 + EPSG DS 302-A/B/C/D/E)

Node setting	E-SW-FIELDBUS and Z-SW-FULL programming software
Baudrate	100 Mbit/s (Automatic)

Fieldbus communication diagnostic

Custom parameters mappable on TPDO for emergency diagnosis

Real-time communication (as per EPSG DS301 + DS408)

RPDO	1 PDO message to the driver (max number of of mapping parameters is Device specific)
TPDO	1 PDO message from the driver (max number of of mapping parameters is Device specific)

Standard references

EPSG DS301
Ethernet POWERKLINK
Communication Profile Specification v 1.2

EPSG DS302-A/B/C/D/E
Ethernet POWERKLINK
Part A: High Availability v1.1
Part B: Multiple ASnd v1.0
Part C: PollResponse Chaining v1.0
Part D: Multiple PReq/PRes v1.0
Part E: Dynamic Node Allocation v1.0

EPSG DS311
Ethernet POWERKLINK
XML Device Description v 1.0

CiA DS408
CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.1

IEC 61076-2-101
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-2
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61784-2
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

IEC 61784-3
Industrial communication networks
- Profiles -
Part 3: Functional safety fieldbuses - General rules and profile definitions

IEC 61158-300/400/500/600
Industrial communication networks
- Fieldbus specifications -
Part 300: Data Link Layer service definition
Part 400: Data Link Layer protocol specification
Part 500: Application Layer service definition
Part 600: Application Layer protocol specification

ISO 15745-1
Industrial automation systems and integration - Open systems application integration framework -
Part 1: Generic reference description

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or POWERLINK master device

Configuration file

XDD (XML Device Description) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EW and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EW and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

5 EtherNet/IP features for digital drivers and controllers in EI execution

Physical

Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x08E1 according to IEEE 802.3
Transmission rate	10/100 Mbit Full/Half-Duplex
Integrated	2-port switch
Cable length	max 100m
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	Device Level Ring (DLR), linear, star structure
Ethernet switch	integrated with two ports
Led indicator	2 led for Link/Activity indicator (on each port) and 1 bicolor led for Status/Error indicator

Communication Protocol

ODVA CIP Object Model

ODVA CIP Object library for Generic Device Profile

- Identity Object (0X01)
- Message Router Object (0x02)
- Assembly Object (0x04)
- Connection Manager Object (0x06)
- Parameter Object (0x0F)
- DLR Object (0x47)
- QoS Object (0x48h)
- Port Object (0xF4)
- TCP/IP Object (0xF5)
- Ethernet Link Object (0xF6)

Valve parameters accessible via Vendor Specific Object 0xA2

IP address setting (range 0.0.0.0 - 255.255.255.255):

- TCP/IP Object (0xF5)
- DHCP
- Auxiliary USB communication + Atos Software

I/O Adapter and Explicit Message Server device type

Cyclic data transmission via Implicit Messages (transport class 1)

- Minimum RPI for Implicit Messages 1ms
- Total number of supported class 1 connections: 4
- Up to 5 parameters and 20 bytes for each connection
- Trigger types: Cyclic CoS

Acyclic data transmission via Connected and Unconnected Explicit Messages (transport class 3)

- Minimum RPI for Explicit Messages 100ms
- No. of simultaneous Class 3 connections: 6

Standard references

IEC 61918
Industrial communication networks
- Installation of communication networks in industrial premises

IEC 61076-2-101
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-1
Industrial communication networks
- Fieldbus specification -
Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series

IEC 61158-2
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61784-1
Industrial communication networks
- Profiles -
Part 1: Fieldbus profile

IEC 61784-2
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

IEC 61784-3
Industrial communication networks
- Profiles -
Part 3: Functional safety fieldbuses - General rules and profile definitions

IEC 61784-5-2
Industrial communication networks
- Profiles -
Part 5-2: Installation of fieldbuses - Installation profiles for CPF 2

ISO 15745-4
Industrial automation systems and integration - Open systems application integration framework -
Part 4: Reference description for Ethernet-based control systems

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or EtherNet/IP scanner device

Configuration file

EDS (Electronic Data Sheet) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EI and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EI and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

6 PROFINET RT/IRT features for digital drivers and controllers in EP execution

Physical

Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x8892 according to IEEE 802.3
Transmission rate	100 Mbit Full-Duplex
Integrated	2-port switch
Cable length	max 100m
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	line, star, tree and ring structure
Ethernet switch	integrated with two ports
Led indicator	2 led for Link/Activity indicator (on each port) and 1 bicolor led for Status/Error indicator

Communication Protocol

Data Link Layer	PROFINET use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2
Device type	IO device - supported features: - complies with PROFINET IO conformance Class A, B, C - Acyclic parameter Channel - Real Time (RT) and Isochronous Real Time (IRT) communication - Up to 8 input/output parameters for real time data exchange - PROFINET specific diagnostic support - Media Redundancy Protocol (MRP) - DCP Discovery and Configuration Protocol supported - Identification & Maintenance (I&M) - Cycle time min: 1 msec [RT] , 250 µsec [IRT]

Startup and configuration

Address setting	IP Address and Station Name are assigned automatically by IO controller (e.g. Discovery and Configuration Protocol)
Baudrate	100 Mbit/s (Automatic)

Fieldbus communication diagnostic

Custom parameters mappable on real time communication for emergency diagnosis

Real-time communication

Modular config	for drivers: AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES up to 5 input parameters for real time data exchange up to 5 output parameters for real time data exchange for controllers: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ up to 8 input parameters for real time data exchange up to 8 output parameters for real time data exchange

Standard references

IEC 61918
Industrial communication networks
- Installation of communication networks in industrial premises

IEC 61076-2-101
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-1
Industrial communication networks
- Fieldbus specification -
Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series

IEC 61158-2
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61158-5-10
Industrial communication networks
- Fieldbus specification -
Part 5-10: Application layer service definition – Type 10 elements

IEC 61784-1
Industrial communication networks
- Profiles -
Part 1: Fieldbus profile

IEC 61784-2
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

IEC 61784-5-3
Industrial communication networks
- Profiles -
Part 5-3: Installation of fieldbuses - Installation profiles for CPF 3

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or PROFINET controller.

Configuration file

GSDML (Electronic Data Sheet) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

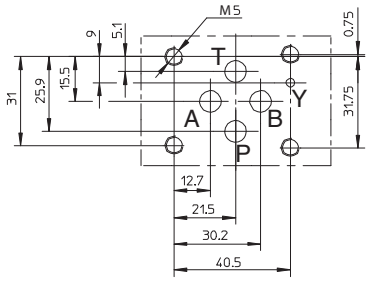
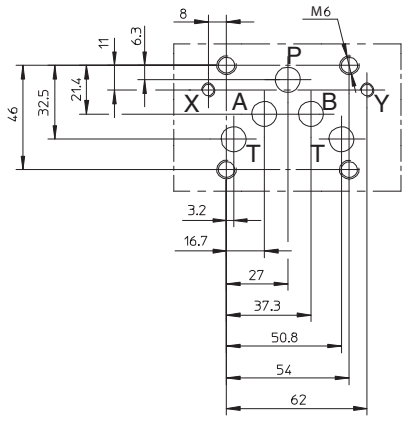
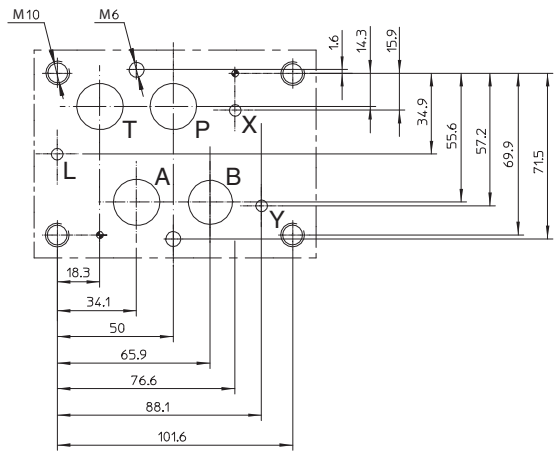
Manuals

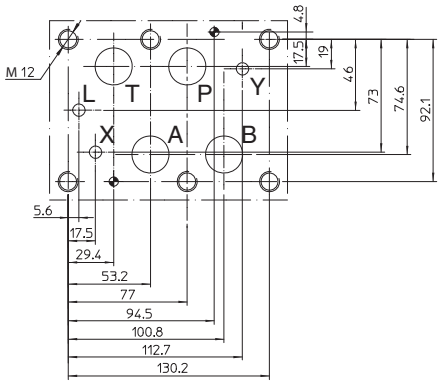
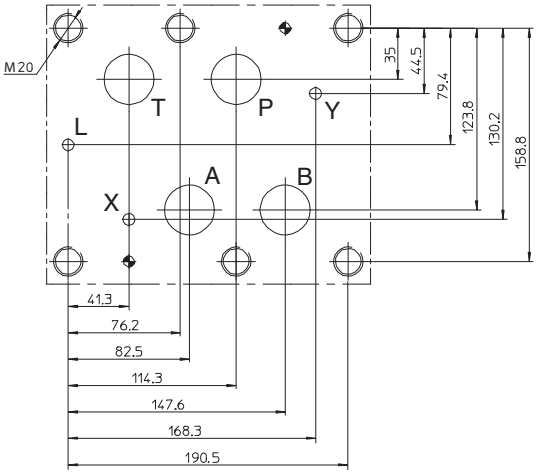
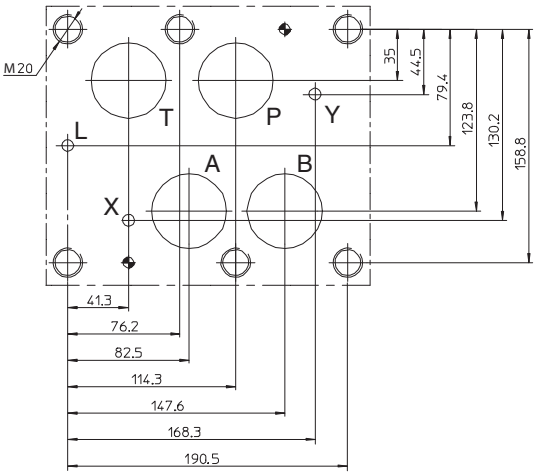
E-MAN-S-EP and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EP and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

Mounting surfaces for electrohydraulic valves

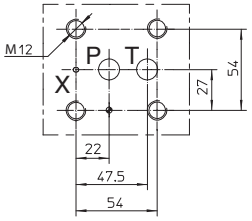
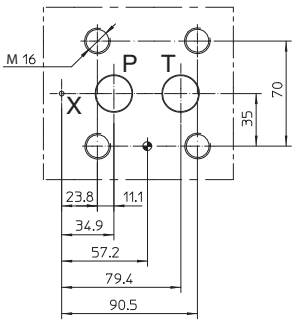
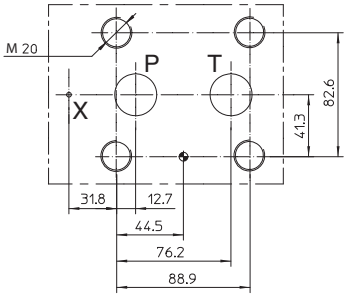
ISO standard, for directional, pressure and flow control valves plus pressure switches

1 **ISO 4401: 2005 - for directional, pressure and flow control valves**

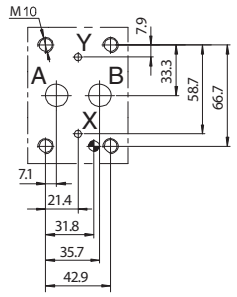
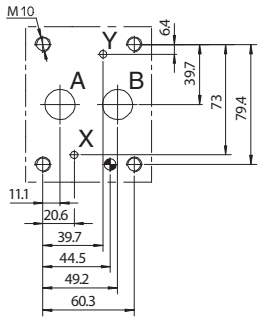
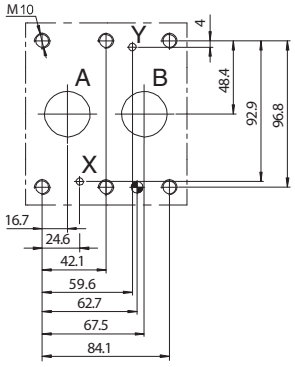
Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	**ex-proof**
 **Y port only for 4401-03-03-0-05**	**4401-03-02-0-05** P, A, B, T = Ø 7,5 max without Y port	DH* DLOH / DLOK DLEH / DLEHM QV-06 RZMO RZGO DHZE / DHZO DLHZO QVH* H* (modular)	DHA / DHW DLAH / DLWH RZMA RZGA DHZA DLHZA QVHZA
	4401-03-03-0-05 P, A, B, T = Ø 7,5 max Y = Ø 3,3 max	DHZO / Y DLHZO / Y	DHZA / Y DLHZA / Y
 **X and Y port only for 4401-05-05-0-05**	**4401-05-04-0-05** P, A, B, T = Ø 11,2 max without X and Y port	DKE DKZOR DLKZOR QVKZOR K* (modular)	DKZA DLKZA QVKZA
	4401-05-05-0-05 P, A, B, T = Ø 11,2 max X, Y = Ø 6,3 max	DKE/Y DKZOR / Y DLKZOR / Y DP-1* DPH-1* DPZO-*-1*	DKZA / Y DLKZA / Y DPHA-1*/ DPHW-1 DPZA-*1
	**4401-07-07-0-05** P, A, B, T = Ø 17,5 max Y = Ø 6,3 max	DP-2* DPH*-2* DPZO-*-2* JP*-2* (modular)	DPHA-2 / DPHW-2 DPZA-*-2

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	**4401-08-08-0-05** P, A, B, T = Ø 25 max X, Y, L = Ø 11,2 max	DP-4* DPH*-4* DPZO-*-4* JP*-3* (modular)	DPHA-4 / DPHW-2 DPZA-*-4
	4401-08-08-0-05 P, A, B, T = Ø 32 max X, Y, L = Ø 11,2 max	DPZO-*-4M*	DPZA-*-4M*
	**4401-10-09-0-05** P, A, B, T = Ø 32 max X, Y, L = Ø 11,2 max	DP-6* DPH*-6* DPZO-*-6*	DPHA-6 DPZA-*-6
	**4401-10-09-0-05** P, A, B, T = Ø 50 max X, Y, L = Ø 11,2 max	DPZO-*-8*	-

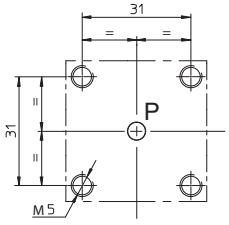
2 **ISO 6264: 2007 - for pressure relief valves**

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	**6264-06-09-1-97** P, T = Ø 14,7 max X = Ø 4,8 max	AGAM-10 AGMZO-*-10	AGAM-10 / AO AGAM-10 / WO AGMZA-*-10
	**6264-08-11-1-97** P, T = Ø 23,4 max X = Ø 6,3 max	AGAM-20 AGMZO-*-20	AGAM -20 / AO AGAM-20 / WO AGMZA-*-20
	**6264-10-17-1-97** P, T = Ø 32 max X = Ø 6,3 max	AGAM-32 AGMZO-*-32	AGAM-32 / AO AGAM-32 / WO AGMZA-*-32

3 **ISO 5781: 2000 - for pressure reducing and piloted check valves**

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	**5781-06-07-0-00** A, B = Ø 14,7 max X, Y = Ø 4,8 max	AGIS-10 AGIR-10 AGIU-10 AGRL*-10 AGRCZO-*-10	AGRCZA-*-10
	**5781-08-10-0-00** A, B = Ø 23,4 max X, Y = Ø 4,8 max	AGIS-20 AGIR-20 AGIU-20 AGRL*-20 AGRCZO-*-20	AGRZA-*-20
	**5781-10-13-0-00** A, B = Ø 32 max X, Y = Ø 4,8 max	AGIS-32 AGIR-32 AGIU-32 AGRL*-32	-

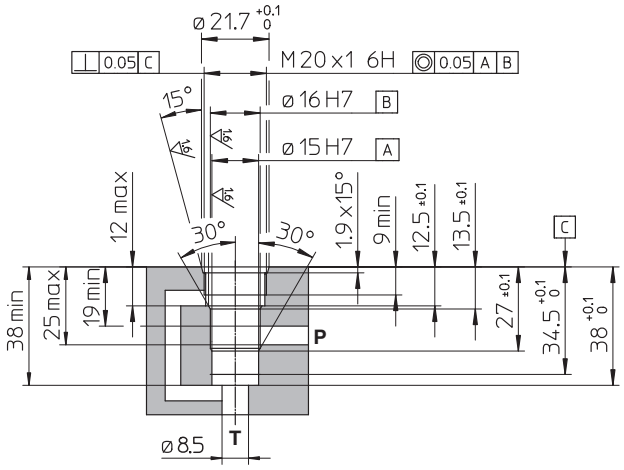
4 **ISO 16873: 2002 - for pressure switches**

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type
	**16873-01-01-0-02** P = Ø 4 max	MAP

Mounting surfaces and cavities for cartridge valves

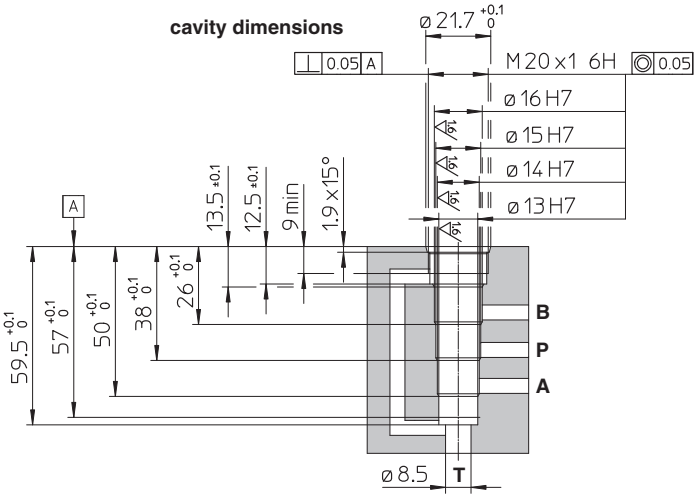
1 **CAVITIES DIMENSIONS for 2 WAY and 3 WAY CARTRIDGE VALVES type CART-LEH, CART-LEHM [mm]**

CAVITY for CART-LEH 2 way

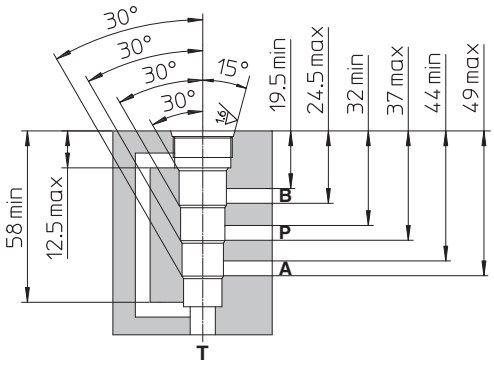


CAVITY for CART-LEH 3 way

cavity dimensions

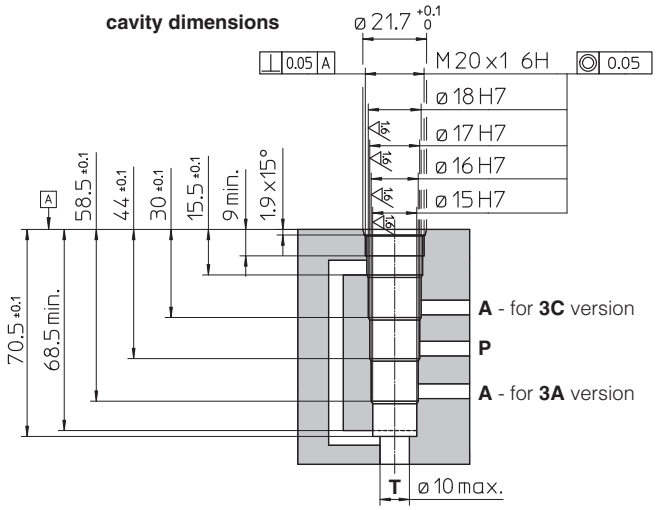


cavity edges and P, A, B, T connections

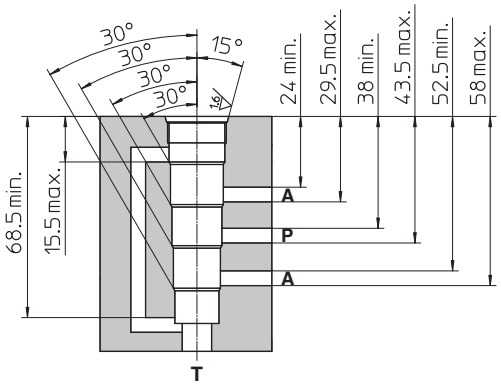


CART-LEHM 3 way

cavity dimensions

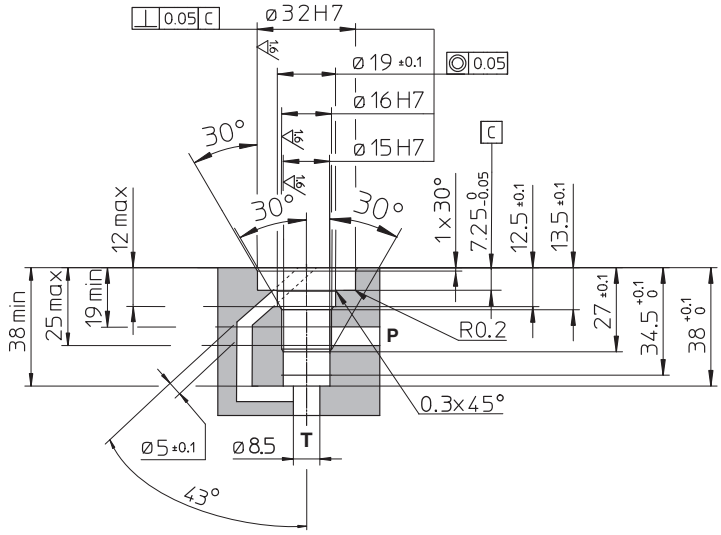


cavity edges and P, A, T connections



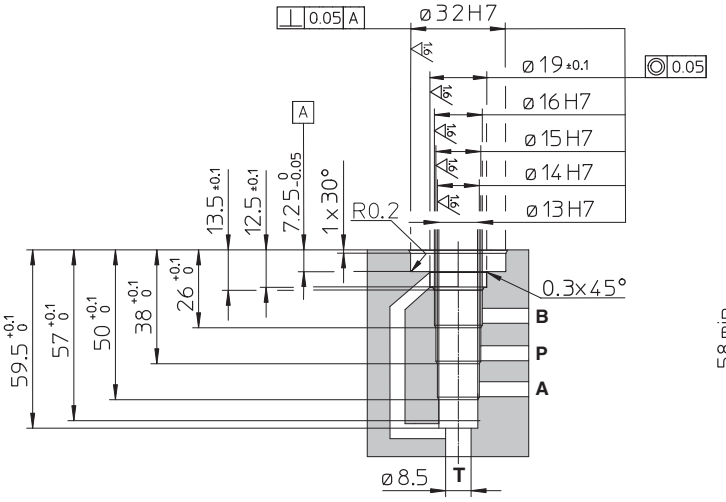
2 CAVITIES DIMENSIONS for 2 WAY and 3 WAY EX-PROOF CARTRIDGE VALVES type CART-LAH [mm]

CAVITY for CART-LAH 2 way

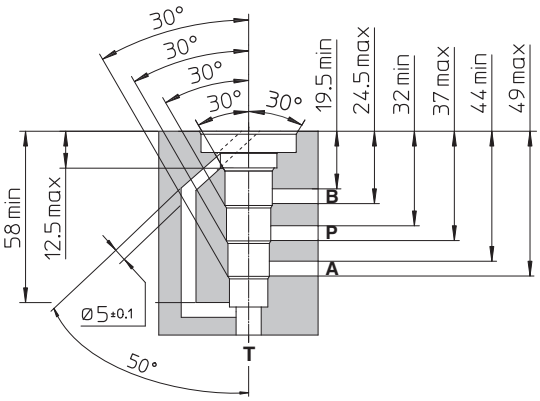


CAVITY for CART-LAH 3 way

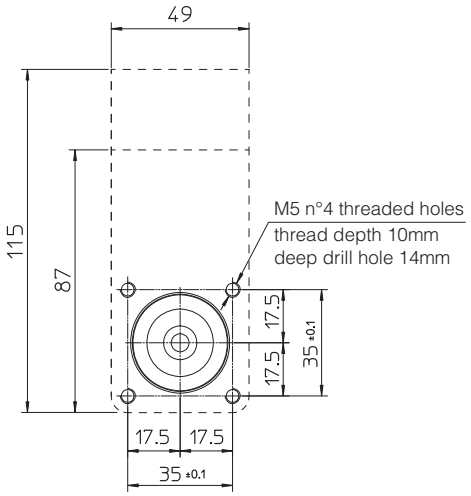
cavity dimensions



cavity edges and P, A, B, T connections



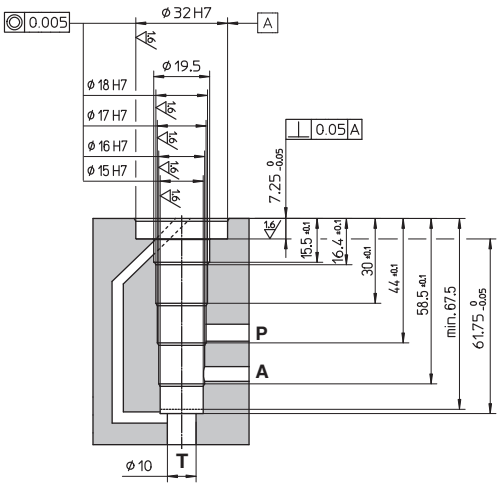
MOUNTING SURFACE for CART-LAH 2 and 3 way



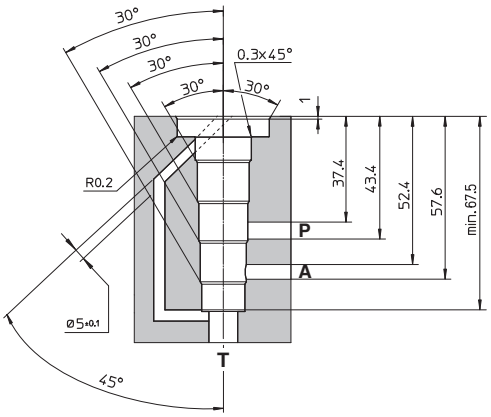
3 CAVITIES DIMENSIONS for 3 WAY EX-PROOF CARTRIDGE VALVES type CART-LAHM [mm]

CAVITY for CART-LAHM-3A

cavity dimensions

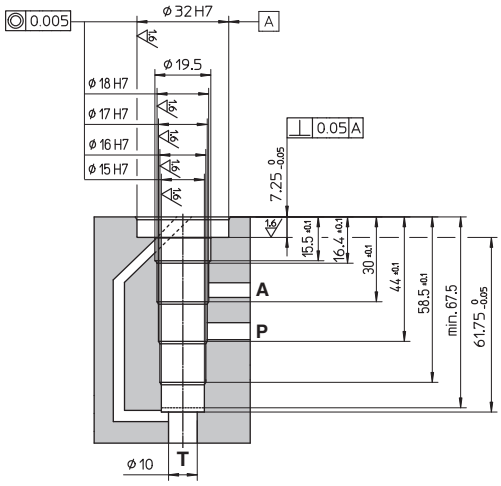


cavity edges and P, A, T connections

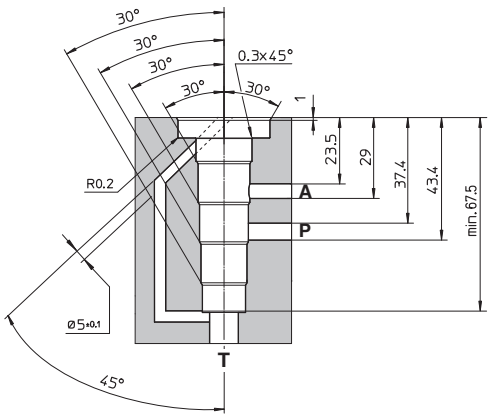


CAVITY for CART-LAHM-3C

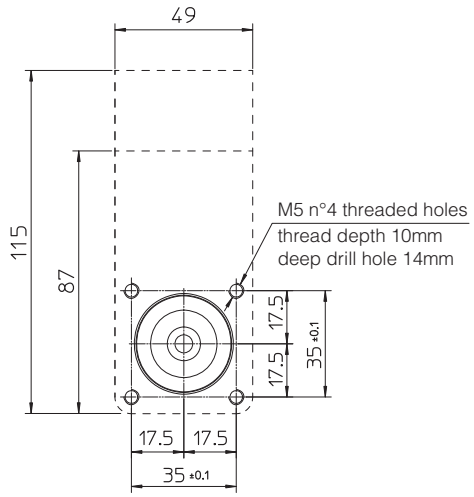
cavity dimensions



cavity edges and P, A, T connections

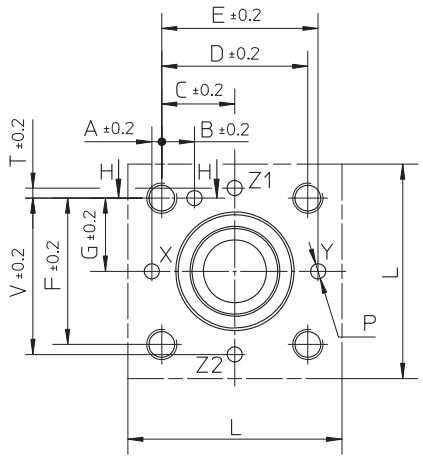


MOUNTING SURFACE for CART-LAHM 3 way



4 ISO 7368 COVER INTERFACE DIMENSIONS for 2 WAY and 3 WAY CARTRIDGE VALVES [mm]

Size from 16 to 63



VALVE TYPE

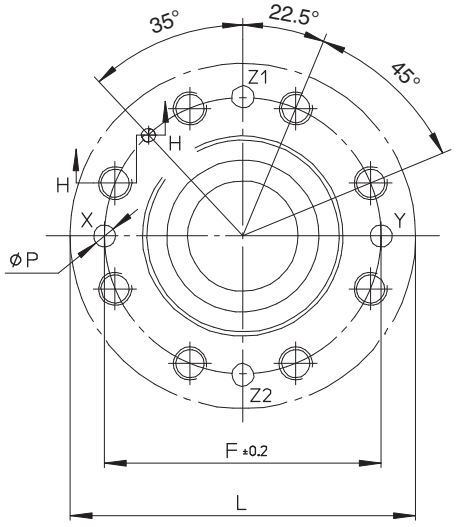
on off

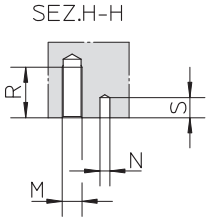
LIM
LIR
LIC
LIQV
LIDD
LIDEW
LIDBH
LIDO
LIDB
LIDR
LIDAS

proportional

LIQZO-T*
LIQZO-L* 2 way
LIQZO-L* 3 way
LIQZP-L* 2 way
LIQZP-L* 3 way

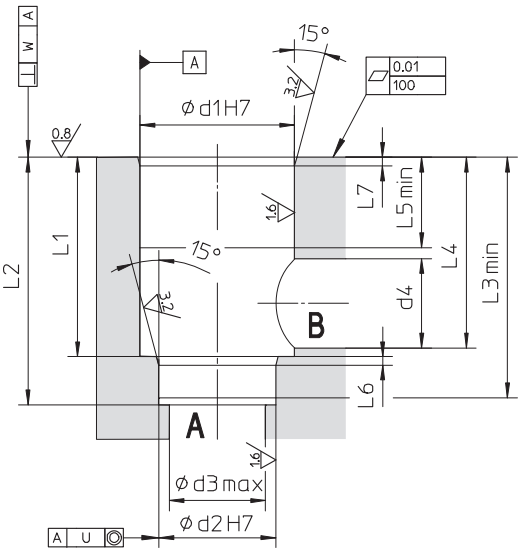
Size 80 and 100





Size	A	B	C	D	E	F	G	L	M	Ø N	P max	R	S min	T	V
16	2	12,5	23	46	48	46	23	65	M8	4	4	20	6	2	48
25	4	13	29	58	62	58	29	85	M12	6	6	30	8	4	62
32	6	18	35	70	76	70	35	102	M16	6	8	38	8	6	76
40	7,5	19.5	42.5	85	92.5	85	42,5	125	M20	6	10	46	8	7.5	92.5
50	8	20	50	100	108	100	50	140	M20	8	10	46	8	8	108
63	12.5	24.5	62.5	125	137,5	125	62.5	180	M30	8	12	66	8	12.5	137.5
80	-	-	-	-	-	Ø200	-	Ø250	M24	10	16	50	10	-	-
100	-	-	-	-	-	Ø245	-	Ø300	M30	10	20	63	10	-	-

5 ISO 7368 CAVITIES DIMENSIONS for 2 WAY CARTRIDGE VALVES [mm]



VALVE TYPE

on off

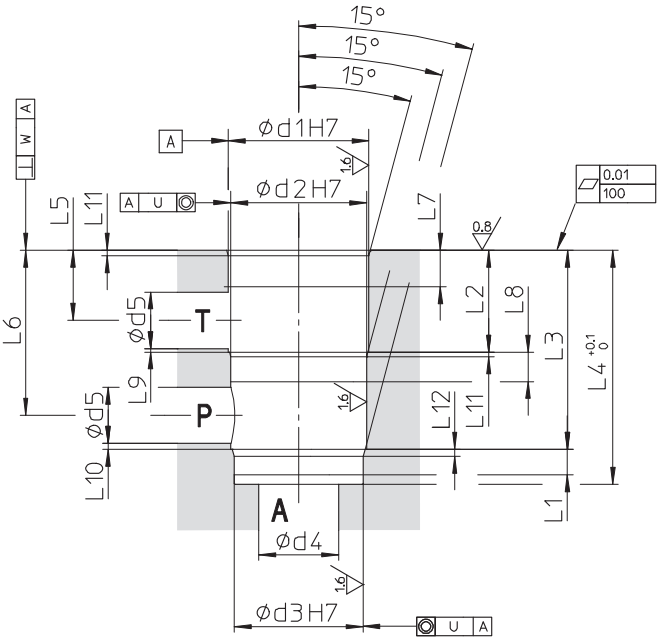
SC LI-*
LIDAS

proportional

LIQZO-T*
LIQZO-L* 2 way
LIQZP-L* 2 way

Size	ød1	ød2	ød3 max	ød4 max	L1	L2	L3	L4	L5	L6	L7	U	W
16	32	25	16	22,5	43 $^{+0,1}_{0}$	56 $^{+0,1}_{0}$	54	42,5	20	2	2	0,03	0,05
25	45	34	25	27	58 $^{+0,1}_{0}$	72 $^{+0,1}_{0}$	70	57	30	2,5	2,5	0,03	0,05
32	60	45	32	38,5	70 $^{+0,1}_{0}$	85 $^{+0,1}_{0}$	83	68,5	30	2,5	2,5	0,03	0,1
40	75	55	40	54,5	87 $^{+0,1}_{0}$	105 $^{+0,1}_{0}$	102	84,5	30	3	3	0,05	0,1
50	90	68	50	62,5	100 $^{+0,1}_{0}$	122 $^{+0,1}_{0}$	117	97,5	35	3	3	0,05	0,1
63	120	90	63	87	130 $^{+0,1}_{0}$	155 $^{+0,1}_{0}$	150	127	40	4	4	0,05	0,2
80	145	110	80	100	175 $^{+0,2}_{0}$	205 $^{+0,2}_{0}$	200	170,5	40	5	5	0,05	0,2
100	180	135	100	120	210 $^{+0,2}_{0}$	245 $^{+0,2}_{0}$	239	205,5	50	5	5	0.05	0.2

6 CAVITIES DIMENSIONS for 3 WAY CARTRIDGE VALVES [mm]



VALVE TYPE

proportional

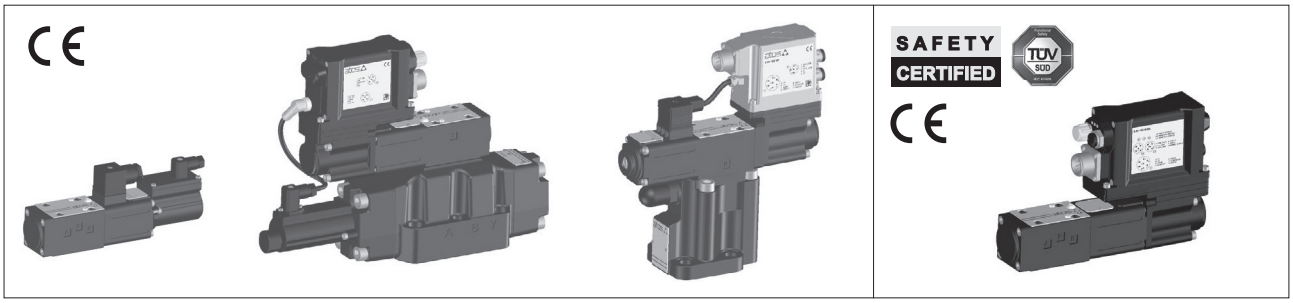
LIQZO-L* 3 way
LIQZP-L* 3 way

Size	ød1	ød2	ød3	ød4	ød5	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	U	W
25	45	43	34	20	20	11,5	56	89	103	45	78	25	15	1	1	2,5	2,5	0,03	0,05
32	60	58	55	32	24	13	43,5	85	100	30	70,5	18	15	1,5	2,5	2,5	2,5	0,03	0,05
40	75	73	55	40	30	15	54	105	125	36	87	21	18	3	3	3	3	0,03	0,05
50	90	87	68	50	35	17	87	143	165	66	122	48	18	3,5	3,5	4	3	0,05	0,05
63	120	116	90	63	48	20	85	165	195	57	137	33	28	4	4	4	4	0,05	0,05
80	145	140	110	80	60	25	125	215	245	90	180	60	25	5	5	5	5	0,05	0,05

Operating and maintenance information for proportional valves

directional, flow, pressure controls
safety valves conforming to Machine Directive 2006/42/EC

This operating and maintenance information applies to Atos proportional directional, flow, pressure control valves and safety proportional valves.
It is intended to provide useful guidelines to avoid risks when the valves are installed in the hydraulic system.
It contains important information on the safe and proper installation, commissioning, operation transport and maintenance of the products.
The prescriptions included in this document must be strictly observed to avoid damages and injury.
The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.
In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
CAUTION	Minor or moderate injury could occur	
NOTICE	Property damage could occur	
SAFETY CERTIFIED	Notes relevant to safety proportional valves	
	Information to be observed	

2 GENERAL NOTES

This document is intended for machine manufacturers, assemblers and system end-users.

WARNING
Personal injury and property damage may be caused by incorrect use of the products!
The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos proportional valves, the following requisites must be met to ensure appropriate use of the products:
- personnel who uses Atos proportional valves must first read and understand the operating and maintenance information, particularly the Safety Notes in section 5.
- the products must remain in their original state, no modifications are permitted
- it is not permitted to decompile software products or alter source codes
- damaged or faulty valves must not be installed or put into operation
- make sure that the products have been installed as described in section 6 and 7

2.1 Warranty

The expiration of warranty results from the following operations:
- incorrect assembly and commissioning
- improper use, see 5.2
- improper handling and storage, see 9.4
- modification of the original condition

3 CERTIFICATION

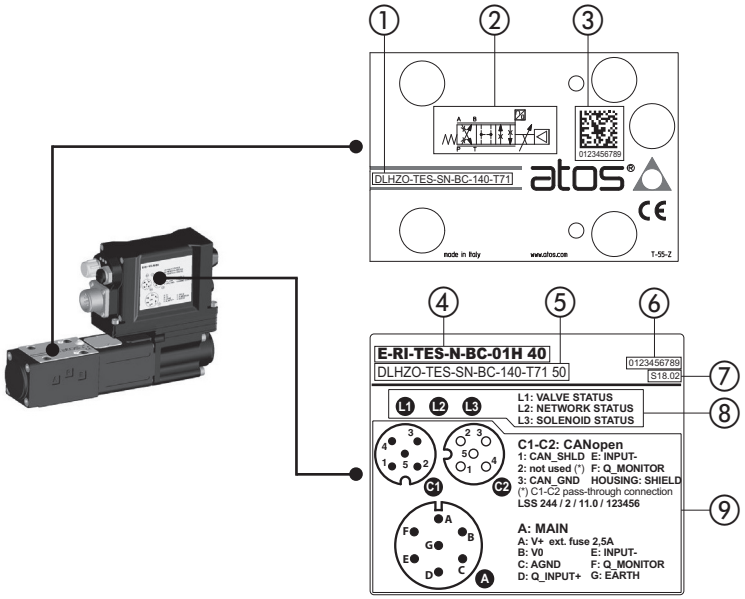
Atos range of proportional directional valves, provides functional safety options **/U** and **/K** .
They are designed to accomplish a safety function, intended to reduce the risk in process control systems.
The valves are **TÜV certified** in compliance with **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

SAFETY CERTIFIED

TÜV SÜD

4 **PRODUCT IDENTIFICATION EXAMPLES** - nameplates

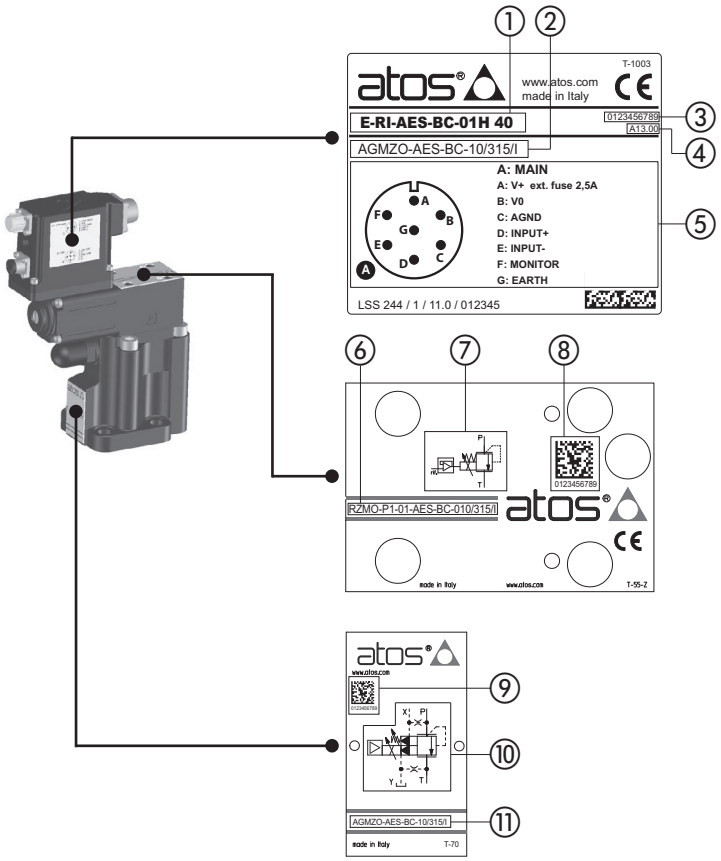
4.1 **Direct valve with on-board driver/axis card** - DLHZO-TES example



① Valve code
② Hydraulic symbol (simplified)
③ Valve serial number

④ Digital driver code
⑤ Valve code
⑥ Digital driver serial number
⑦ Digital driver factory firmware version
⑧ Diagnostic led description
⑨ Connectors pinout

4.2 **Piloted valve with on-board driver** - AGMZO-AES example

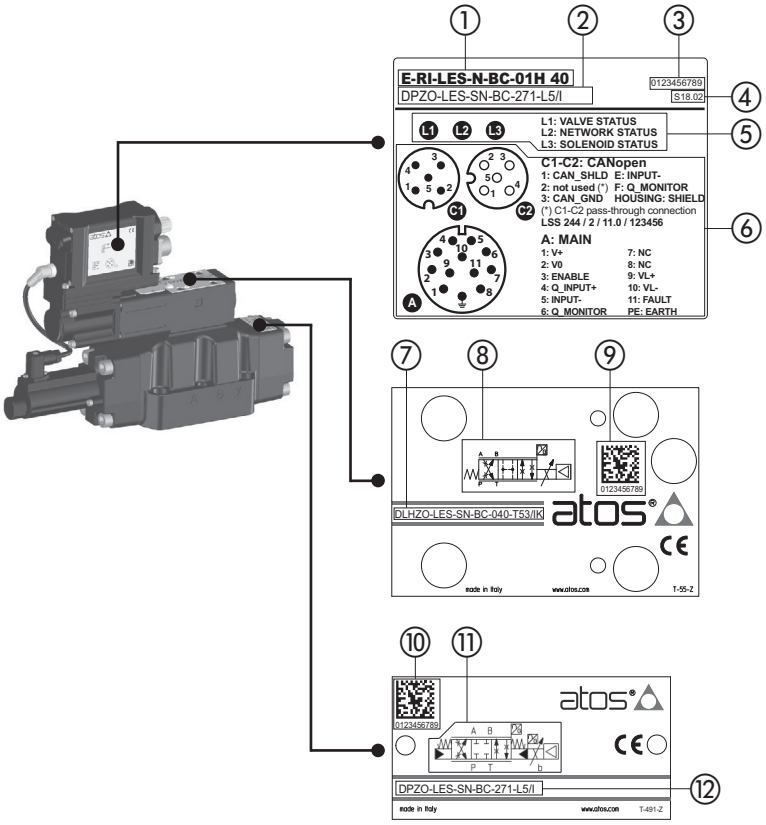


① Digital driver code
② Valve code
③ Digital driver serial number
④ Digital driver factory firmware version
⑤ Connectors pinout

⑥ Pilot valve code
⑦ Pilot hydraulic symbol (simplified)
⑧ Pilot valve serial number

⑨ Valve serial number
⑩ Hydraulic symbol (simplified)
⑪ Valve code

4.3 **Piloted valve with on-board driver/axis card** - DPZO-LES example

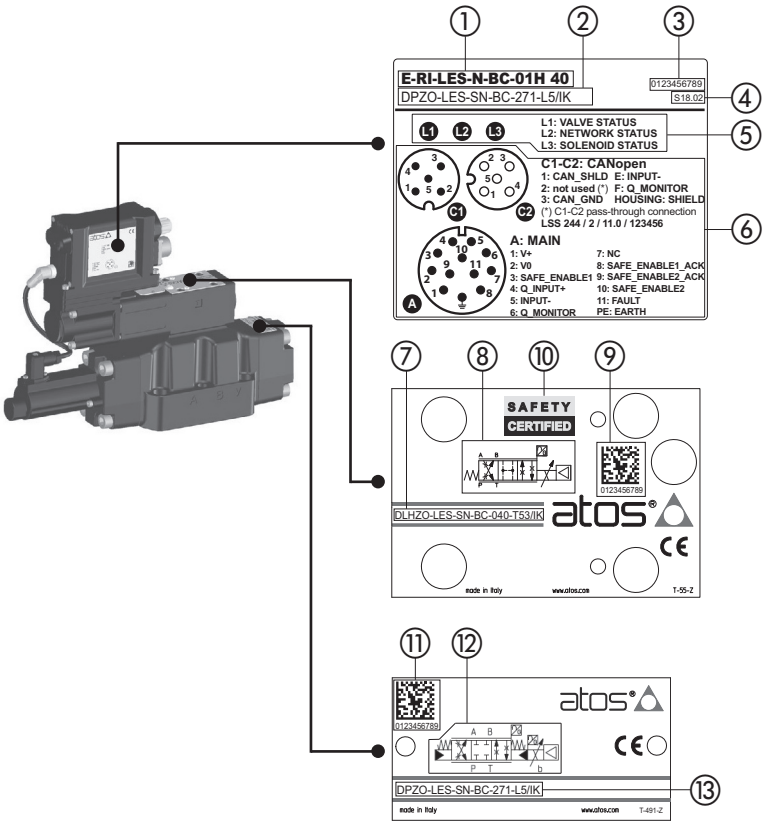


① Digital driver code
② Valve code
③ Digital driver serial number
④ Digital driver factory firmware version
⑤ Diagnostic led description
⑥ Connectors pinout

⑦ Pilot valve code
⑧ Pilot hydraulic symbol (simplified)
⑨ Pilot valve serial number

⑩ Valve serial number
⑪ Hydraulic symbol (simplified)
⑫ Valve code

4.4 **Safety piloted valve with on-board driver/axis card** - DPZO-LES /K example



① Digital driver code
② Valve code
③ Digital driver serial number
④ Digital driver factory firmware version
⑤ Diagnostic led description
⑥ Connectors pinout

⑦ Pilot valve code
⑧ Pilot hydraulic symbol (simplified)
⑨ Pilot valve serial number
⑩ Logo identifying the safety components

⑪ Valve serial number
⑫ Hydraulic symbol (simplified)
⑬ Valve code

5 SAFETY NOTES

5.1 Intended use

Atos proportional valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.

SAFETY CERTIFIED

For safety-relevant applications, use only safety proportional valves /U or /K, indentified by the Safety Certified logo
The superior control logic in connection with the proportional valve, is responsible for the control of the machine's motion sequence and also for its safety-related monitoring.

5.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:

- use in explosive environments
- incorrect storage
- incorrect transport
- lack of cleanliness during storage and installation
- incorrect installation
- use of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

5.3 Installation

Installation must be performed following the recommendations contained in the valves technical tables.

WARNING: non-compliance with functional safety

SAFETY CERTIFIED In case of mechanical or electric failures, risk of death or persons injury could occur.
Functional safety prescriptions according to EN ISO 13849 must be observed in the hydraulic circuit.

WARNING: fixing bolts
For the valve mounting, use only class 12.9 bolts, with dimensions and length reported in the valves technical tables.
Observe the specified tightening torque.
Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.

WARNING: hot surface
The valve considerably heats up during operation. Allow the valve to cool down sufficiently before touching it.
During operation, touch the valve solenoid only by using protective gloves. Please also observe ISO 13732-1 and EN 982.

CAUTION
Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid/driver.
Only use the valve within the specified ambient and fluid temperature range.

CAUTION: pressurized systems
When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), proportional valves may even be pressurized after the hydraulic power supply has been switched off.
During assembly and disassembly works, serious injury may be caused by a powerful leaking of hydraulic fluid jet.
Ensure that the whole hydraulic system is depressurized and the electrical control is de-energized.

CAUTION: missing equipotential bonding
Electrostatic phenomena, an incorrect earthing or missing equipotential bonding may lead to malfunctions or uncontrolled movements at the machine and thus cause injuries.
Provide for correct earthing or proper equipotential bonding.

CAUTION: penetrating water and humidity
In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors or into the valve electronics.
This may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the proportional valve within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

NOTICE
High-pressure water jets could damage the valve seals.
Do not use a high-pressure washer for the valve cleaning.

NOTICE: disconnection and connection of plug-in connectors
Do not plug-in or disconnect the electric connector as long as the voltage supply is ON.

NOTICE: impact
Impact or shock may damage the valves. Never use the valves as step.

NOTICE: dirt and foreign particles
Penetrating dirt and foreign particles lead to wear and malfunctions of the valves.
During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system
Do not use linting fabric for the valve cleaning.

Environmental protection
Hydraulic fluids are harmful to the environment.
Leaking hydraulic fluid may leads to environmental pollution.
In case of fluid leakage immediately act to contain the problem.
Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.
The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber
Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

6 HYDRAULIC AND MECHANICAL INSTALLATION

6.1 Power packs tank and tubes cleaning

The power unit tank has to be accurately cleaned, removing all the contaminants and any extraneous object. Piping has to be cold bended, burred and pickled. When completely assembled an accurate washing of the piping (flushing) is requested to eliminate the contaminants; during this operation the proportional valves have to be removed and replaced with by-pass connections, or on-off valves.

6.2 Hydraulic connections

Flexible hoses are normally used on pressure line between powerpack and proportional valve and on user lines to connect the actuators. If their potential breakage may cause damages to the machine or system or can cause injure to the operator, a proper retenction (as the chain locking at both the pipe-ends) or alternately a protecting carter must be provided.
The proportional valve must be installed as close as possible to the actuator, to assure the maximum stiffness of the circuit and so the best dynamic performances.

6.3 Hydraulic drains and return lines

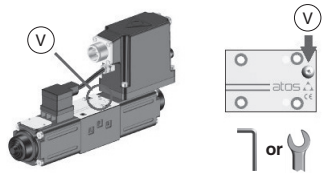
Drain lines must be connected to the tank without counter pressure. The drain pipe must end above the oil level.
Return line has to be sized in order to avoid variable counter pressure peaks caused by instantaneous flow variations.

6.4 Fluid conditioning

A high-performance system must be thermally conditioned to ensure a limited fluid temperature excursion (generically between 40 and 50°C) so that the fluid viscosity remains constant during operation.
The machine working cycle should start after the prescribed temperature has been reached.

6.5 Air bleeds

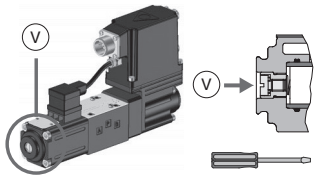
Air in the hydraulic circuits affects the hydraulic stiffness and it is the cause of malfunctioning and vibrations.
Air bleeds are provided in the proportional valves.



Directional valves air bleeding:

- release 2 or 3 turns the air bleed screw **V**
- cycle the valve at low pressure until the oil leaking from the **V** port is exempted from air bubbles
- lock the air bleed screw **V**

Note: to facilitate bleeding operations, apply a light backpressure (0,5 bar) on T port by adding a check valve on T line



Pressure control valves air bleeding:

- release 2 or 3 turns the air bleed screw **V**
- cycle the valve at low pressure until the oil leaking from the **V** port is exempted from air bubbles
- lock the air bleed screw **V**

Following precautions have to be considered:

- at the system start-up all the bleeds must be released to allow removal of air
- untight the connections of the piping
- the system must be bled at first start-up or after maintenance
- a check valve (e.g. 0,5 bar) should be installed on the return line to tank to avoid emptying of the pipes following a long stop of the system

6.6 System flushing

The whole system must be flushed replacing the proportional valves with specific flushing plates or with on-off directional valves.
Make sure that also external pilot lines, if present in the system, are flushed.

In order to obtain the required minimum cleanliness level, the hydraulic system must be flushed for a sufficient time.

A decisive factor for the flushing time is the contamination level of the hydraulic fluid which can only be determined by means of a particle counter.

During the flushing procedure, perform a frequent monitor of the filters clogging indicator, replacing the filter elements when required.

6.7 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.
The hydraulic fluids must be compatible with the selected seals.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s

CAUTION: easily inflammable hydraulic fluid
In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

6.8 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.

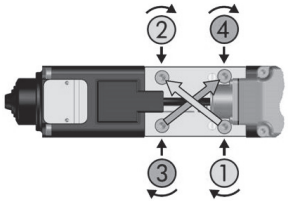
CAUTION
Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet.
In the worst case, this may result in unexpected actuators movements and thus it constitutes a risk of injury.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness class required for the valve.

Max fluid contamination level, see also filter section at www.atos.com or KTF catalog:

- normal operation: ISO4406 class 18/16/13 NAS1638 class 7
- longer life: ISO4406 class 16/14/11 NAS1638 class 5

6.9 Valve fastening

Remove the protection pad located on the valve mounting surface.
Check the correct positioning of the seals on the valve ports.
Verify that the valve mounting surface is clean and free from damages and burrs.
Lock the fastening bolts in cross sequence (like in aside example) at the tightening torque specified in the valve technical table.



7 ELECTRICAL INSTALLATION

7.1 Power supply

The power supply device must be sized in order to generate the correct voltage when all utilities require the max current at same time; in general 50W max power can be considered for each proportional valve.

Following additional notes have to be considered:

- power supply from a battery: overvoltages (typically greater than 34 Volts) damage the electronic circuits; it is recommended the use of suitable filters and voltage suppressors
- the power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers
- a safety fuse is required in series to each power supply: see relevant technical tables for fuses value

7.2 Electrical wiring

The electrical cables must be shielded as indicated in section 8 with shield or cablebraid connected to the ground.

On-board driver/axis card - recommended cables characteristics

Main connector	**Cable**
7 pin - Metallic / Plastic	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
12 pin - Metallic	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)
12 pin - Plastic	LiYCY 10 x 0,14 mm² max 40 m (logic) plus LiYY 3 x 1 mm² max 40 m (power supply)

Off-board driver/axis card - recommended cables characteristics

Driver/axis card	**Cable**
E-BM-AES E-BM-RES E-BM-T*/L* Z-BM-TEZ/LEZ Z-BM-KZ	LiYCY shielded cables: 0,5 mm² max 50 m for logic 1,5 mm² max 50 m for power supply
E-MI-AS-IR	2 poles x 0,5 mm² plus 4 poles x 0,35 mm² - cable lenght 4 m factory wired external diameter 7,4 mm
E-MI-AC	LiYCY shielded cables: 0,5 mm² max 40 m for logic 1 mm² max 40 m for power supply

Note: for transducers wiring cable please consult the transducers datasheet

7.3 Suppression of interferences by electrical noise

When starting the system, it is always advisable to check that feedback, references signal are free from interferences and electrical noise which can affect the characteristics of the signals and generate instability in the whole system.

Electrical noises can be suppressed by shielding and grounding the signal cables, see section 8.

Most of electrical noises are due to external magnetic fields generated by transformers, electric motors, switchboards, etc.

8 SHIELD CONNECTION

The correct shielding of signal cables has to be provided to protect the electronics from electrical noise disturbances, which could affect the valve functioning.

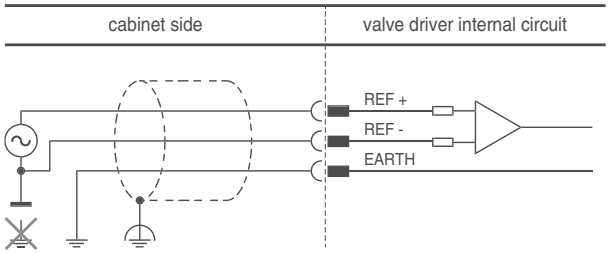
In general following basic rules should be observed:
- power supply cables and signal cables should be routed in separate cable conduits.
- signal cables should be kept far from strong electromagnetic disturbance sources such as electric motor, inverters or transformers.

In the following examples are shown simple shielding criteria to avoid ground loops which may enhance the noise effect and in the worst cases they could cause the driver burning.

Refer to the applicable international standards for details about the shielding criteria.

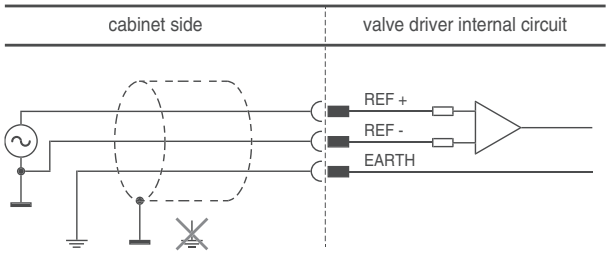
CORRECT SHIELD CONNECTIONS EXAMPLES

OK



Shield connectedto the protected earth

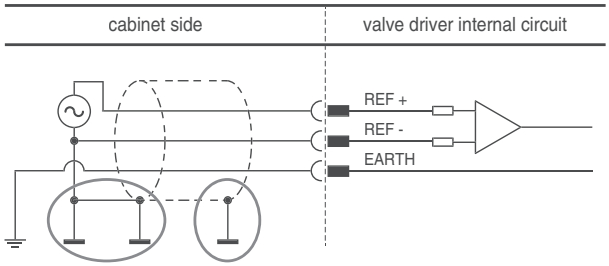
OK



Shield connected to the same power supply GND

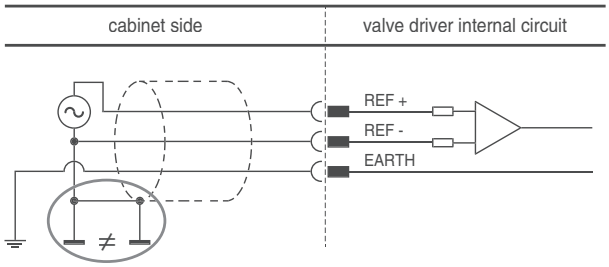
WRONG SHIELD CONNECTIONS EXAMPLES

NO



Never connect the shield on both side

NO



Never connect the shield to the grounding facilities having different potential

standard earth power supply GND protected earth

9 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

9.1 Ordinary maintenance

- The valves does not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

9.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.
Unauthorized opening of the valves during the warranty period invalidates the warranty.

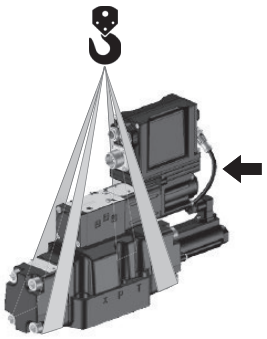
9.3 Transport

Atos proportional valves are high-quality products. In order to prevent damage, the valves have to be transported in the original packaging or with equivalent transport protection.

Observe the following guidelines for transportation of valves:

- before any movement check the valve weight reported in the relevant technical table
- use soft lifting belts to move or lift the heavy valves to avoid damages

WARNING
The valve may fall down and cause damage and injuries, if transported improperly.
Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.



WARNING
Do not lift the valve, using the transducer cable

9.4 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.
The valve surface is protected with a zinc coating, which guarantees a corrosion resistance of over 200 hours in the salt spray test.
Additionally all valves are tested with mineral oil ISO VG 46; the oil film left after testing ensure the internal corrosion protection.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables.
Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

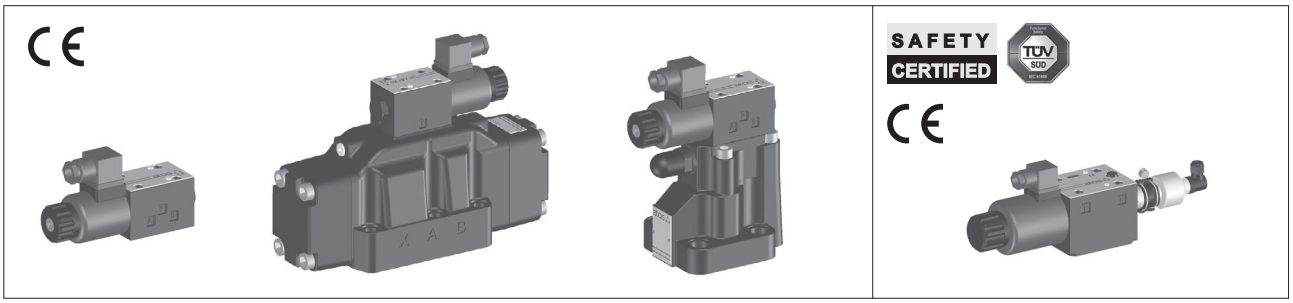
- If there is no specific information in the components technical tables, comply with a storage temperature of –20 °C to +50 °C
- Do not store the valves outdoors
- Protect the valves against water and humidity in case of storage in open air
- Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

Operating and maintenance information for on-off valves

directional, flow, and pressure controls
safety valves with spool position monitor, conforming to Machine Directive 2006/42/EC

This operating and maintenance information applies to Atos on-off directional, flow, pressure control valves and safety valves with spool position monitor.
It is intended to provide useful guidelines to avoid risks when the valves are installed in the hydraulic system.
It contains important information on the safe and proper installation, commissioning, operation, transport, and maintenance of the products.
The prescriptions included in this document must be strictly observed to avoid damages and injury.
The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.
In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
CAUTION	Minor or moderate injury could occur	
NOTICE	Property damage could occur	
SAFETY CERTIFIED	Notes relevant to safety valves	
	Information to be observed	

2 GENERAL NOTES

This document is relevant to the installation, use and maintenance of on-off directional, flow and pressure control valves.
It is intended for machine manufacturers, assemblers and system end-users.

WARNING
Personal injury and property damage may be caused by incorrect use of the products!
The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos valves, the following requirements must be met to ensure the appropriate use of the products:
- personnel who uses Atos valves must first read and understand the operating and maintenance information, particularly the Safety Notes in section 5
- the products must remain in their original state, no modifications are permitted
- damaged or faulty valves must not be installed or put into operation
- make sure that the products have been installed as described in section 6

2.1 Warranty

The expiration of warranty results from the following operations:
- incorrect assembly and commissioning
- improper use, see 5.2
- improper handling and storage, see 6.4
- modification of the original condition

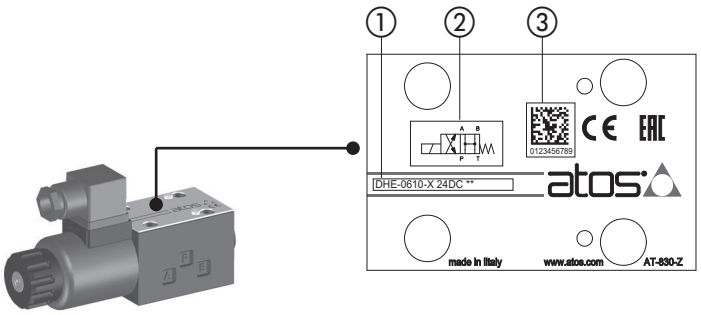
3 CERTIFICATION

Atos safety valves with spool / poppet position monitor are designed to accomplish a safety function intented to reduce the risk in process control systems.
The valves are **TÜV certified** in compliance with Machine Directive 2006/42/EC Annex IX – EC type-examination certificate for safety components (ref. Annex IV – 21) Norms EN ISO13849-1 and EN ISO13849-2
They can be used in applications up to Category 1, PL c in high demand mode.
The spool / poppet position monitor is factory set in conformity to the relevant norms, and their regulation is properly sealed.

Any tampering of the sealing invalidates the certification

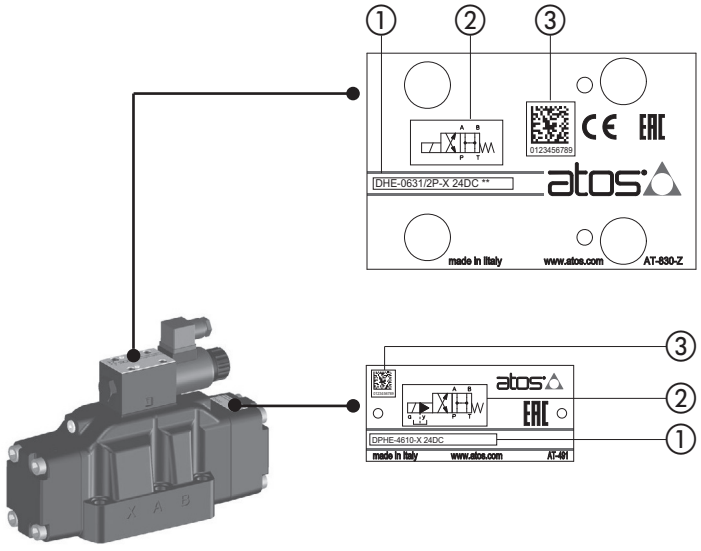
4 PRODUCT IDENTIFICATION EXAMPLES - nameplates

4.1 Directional solenoid valve, direct - DHE example



① Valve code
② Hydraulic symbol (simplified)
③ Valve serial number

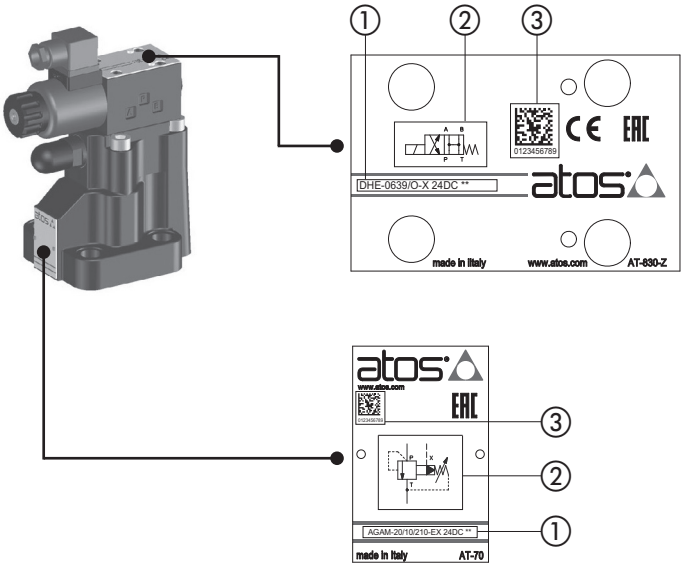
4.2 Directional solenoid valve, piloted - DPHE example



① Pilot valve code
② Pilot valve hydraulic symbol
③ Pilot valve serial number

① Valve code
② Hydraulic symbol (simplified)
③ Valve serial number

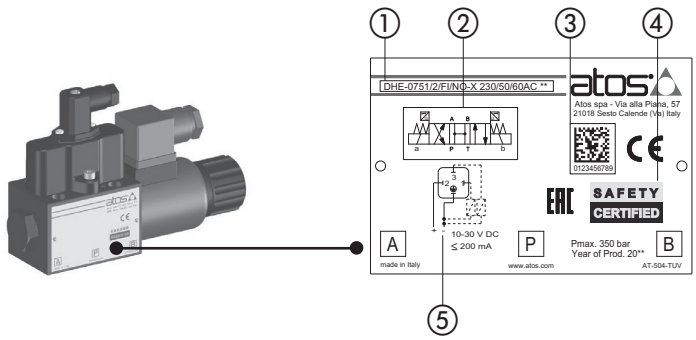
4.3 Pressure relief valve, piloted - AGAM example



① Pilot valve code
② Pilot valve hydraulic symbol
③ Pilot valve serial number

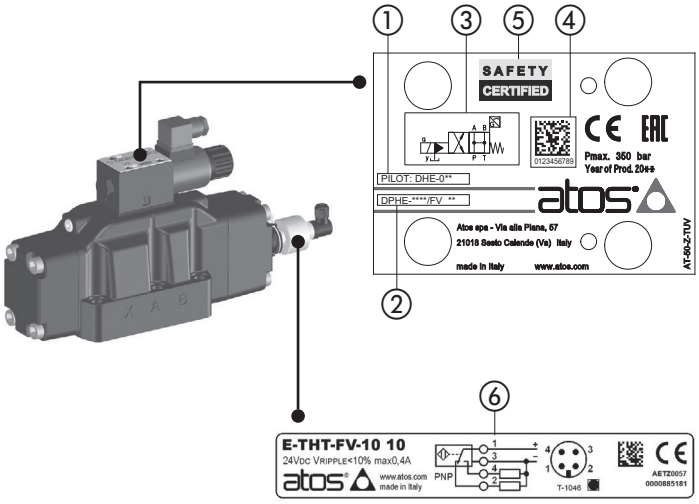
① Valve code
② Hydraulic symbol (simplified)
③ Valve serial number

4.4 Directional solenoid valve, direct - DHE-*/FI example



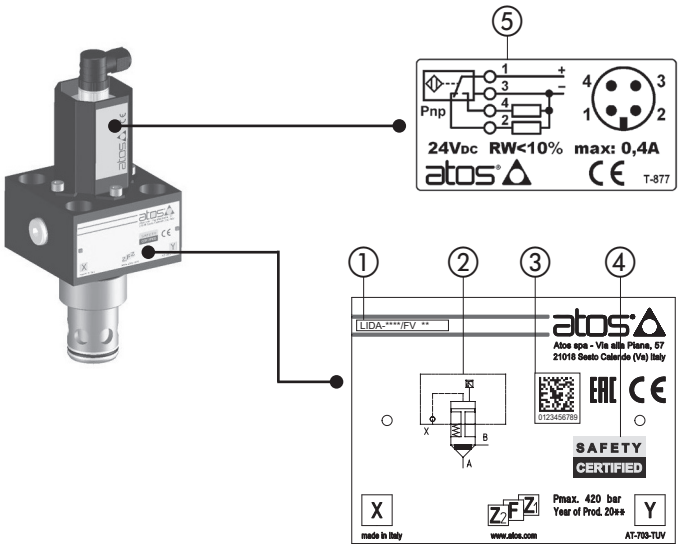
① Valve code
② Hydraulic symbol (simplified)
③ Valve serial number
④ Logo identifying the safety component
⑤ Sensor electric connection

4.5 Directional solenoid valve, piloted - DPHE-*/FV example



① Pilot valve code
② Valve code
③ Valve hydraulic symbol
④ Pilot valve serial number
⑤ Logo identifying the safety component
⑥ Sensor electric connection

4.6 Pressure relief valve, piloted - LIDA-*/FV example



① Valve code
② Valve hydraulic symbol
③ Pilot valve serial number
④ Logo identifying the safety component
⑤ Sensor electric connection

5 SAFETY NOTES

5.1 Intended use

Atos valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.

SAFETY CERTIFIED

For safety-relevant applications, use only on-off safety valves identified by the Safety Certified logo.
The superior control logic in connection with the safety valve, is responsible for the control of the machine's motion sequence and also for its safety-related monitoring.

5.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:

- use in explosive environments
- incorrect storage
- incorrect transport
- lack of cleanliness during storage and installation
- incorrect installation
- use of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

5.3 Installation

Installation must be performed following the recommendations contained in the valves technical tables.

WARNING: non-compliance with functional safety

SAFETY CERTIFIED

In case of mechanical or electric failures, risk of death or persons injury could occur.
Functional safety prescriptions according to EN ISO 13849 must be observed in the hydraulic circuit.

WARNING: fixing bolts

For the valve mounting, use only class 12.9 bolts, with dimensions and length reported in the valves technical tables.
Observe the specified tightening torque.
Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.

WARNING: hot surface

The valve considerably heats up during operation. Allow the valve to cool down sufficiently before touching it.
During operation, touch the valve solenoid only by using protective gloves. Please also observe ISO 13732-1 and EN 982.

CAUTION

Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid.
Only use the valve within the specified ambient and fluid temperature range.

CAUTION: pressurized systems

When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), valves may even be pressurized after the hydraulic power supply has been switched off.
During assembly and disassembly works, serious injury may be caused by a powerful leaking of hydraulic fluid jet.
Ensure that the whole hydraulic system is depressurized and the electrical control is de-energized.

CAUTION: missing equipotential bonding

Electrostatic phenomena, an incorrect earthing or missing equipotential bonding may lead to malfunctions or uncontrolled movements at the machine and thus cause injuries.
Provide for correct earthing or proper equipotential bonding.

CAUTION: penetrating water and humidity

In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors.
This may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the valve within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

NOTICE

High-pressure water jets could damage the valve seals.
Do not use a high-pressure washer for the valve cleaning.

NOTICE: disconnection and connection of plug-in connectors

Do not plug-in or disconnect the electric connector as long as the voltage supply is ON.

NOTICE: impact

Impact or shock may damage the valves. Never use the valves as step.

NOTICE: dirt and foreign particles

Penetrating dirt and foreign particles lead to wear and malfunctions of the valves.
During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system
Do not use linting fabric for the valve cleaning.

Environmental protection

Hydraulic fluids are harmful to the environment.
Leaking hydraulic fluid may leads to environmental pollution.
In case of fluid leakage immediately act to contain the problem.
Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.
The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber
Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

6 HYDRAULIC AND MECHANICAL INSTALLATION

6.1 Power packs tank and tubes cleaning

The power unit tank has to be accurately cleaned, removing all the contaminants and any extraneous object.
When completely assembled an accurate washing of the piping (flushing) is requested to eliminate the contaminants.

6.2 Hydraulic connections

Flexible hoses are normally used on pressure line between powerpack and the valve and on user lines to connect the actuators. If their potential breakage may cause damages to the machine or system or can cause injure to the operator, a proper retenction (as the chain locking at both the pipe-ends) or alternately a protecting carter must be provided.

6.3 Hydraulic drains and return lines

Drain lines must be connected to the tank without counter pressure. The drain pipe must end above the oil level.

Return line has to be sized in order to avoid pressure peaks caused by istantaneous flow variations.

6.4 Fluid conditioning

A high-performance system must be thermally conditioned to ensure a limited fluid temperature excursion (generically between 40 and 50°C) so that the fluid viscosity remains constant during operation.
The machine working cycle should start after the prescribed temperature has been reached.

6.5 Air bleeds

Air in the hydraulic circuits affects the hydraulic stiffness and it causes malfunctioning and vibrations.
Following precautions have to be considered:

- at the system start-up all the bleeds must be released to allow the air removal
- untight the connections of the piping
- the system must be bled at first start-up or after maintenance
- a check valve (e.g. 0,5 bar) should be installed on the return line to tank to avoid emptying of the pipes following a long stop of the system

6.6 System flushing

The whole system must be flushed for a sufficient time in order to obtain the required minimum cleanliness level.
Make sure that also external pilot lines, if present in the system, are flushed.

A decisive factor for the flushing time is the contamination level of the hydraulic fluid which can only be determined by means of a particle counter.

During the flushing procedure, perform a frequent monitor of the filters clogging indicator, replacing the filter elements when required.

6.7 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.
The hydraulic fluids must be compatible with the selected seals.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s

CAUTION: easily inflammable hydraulic fluid
In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

6.8 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.

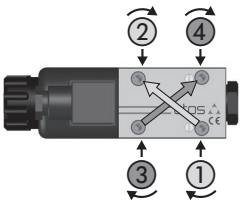
CAUTION
Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet.
In the worst case, this may result in unexpected actuators movements and thus it constitutes a risk of injury.
Ensure an adequate hydraulic fluid cleanliness according to the cleanliness class required for the the valve.

Max fluid contamination level, see also filter section at www.atos.com or KTF catalog:

ISO4406 class 20/18/15 NAS1638 class 9

6.9 Valve fastening

Remove the protection pad located on the valve mounting surface.
Check the correct positioning of the seals on the valve ports.
Verify that the valve mounting surface is clean and free from damages and burrs.
Lock the fastening bolts in cross sequence (like in aside example) at the tightening torque specified in the valve technical table.



7 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

7.1 Ordinary maintenance

- The valves does not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

7.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.
Unauthorized opening of the valves during the warranty period invalidates the warranty.

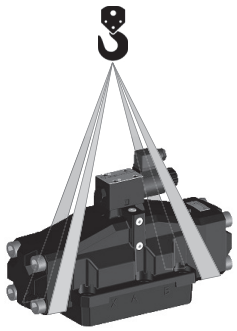
7.3 Transport

In order to prevent damage, the valves have to be transported in the original packaging or with equivalent transport protection.

Observe the following guidelines for transportation of valves:

- before any movement check the valve weight reported in the relevant technical table
- use soft lifting belts to move or lift the heavy valves to avoid damages

WARNING
The valve may fall down and cause damage and injuries, if transported improperly.
Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.



7.4 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.
The valve surface is protected with a zinc coating, which guarantees a corrosion resistance of over 200 hours in the salt spray test.
Additionally all valves are tested with mineral oil ISO VG 46; the oil film left after testing ensure the internal corrosion protection.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables.
Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

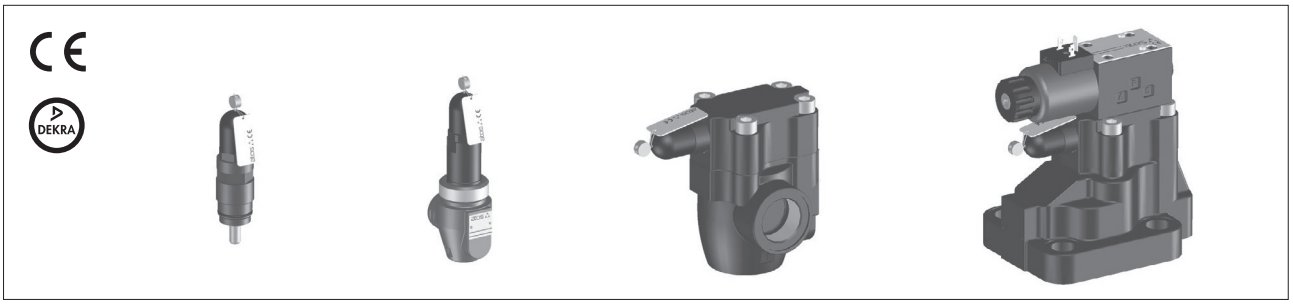
- If there is no specific information in the components technical tables, comply with a storage temperature of –20 °C to +50 °C
- Do not store the valves outdoors
- Protect the valves against water and humidity in case of storage in open air
- Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

Operating and maintenance information

safety PED pressure relief valves, conforming to PED Directive 2014/68/EU

This operating and maintenance information applies to Atos safety pressure relief valves conforming to Pressure Equipment Directive (PED) 2014/68/EU. It is intended to provide useful guidelines on the safe and proper assembly, commissioning, operation, use, maintenance and transport of PED valves. The prescriptions included in this document must be strictly observed to avoid damages and injury.



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.
In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
CAUTION	Minor or moderate injury could occur	
NOTICE	Property damage could occur	
	Information to be observed	

2 GENERAL NOTES

This document is relevant to the installation, use and maintenance of on-off directional, flow and pressure control valves.
It is intended for machine manufacturers, assemblers and system end-users.

WARNING
Personal injury and property damage may be caused by incorrect use of the products!
The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos valves, the following requirements must be met to ensure the appropriate use of the products:
- personnel who uses Atos valves must first read and understand the operating and maintenance information, particularly the Safety Notes in section 5
- the products must remain in their original state, no modifications are permitted
- damaged or faulty valves must not be installed or put into operation
- make sure that the products have been installed as described in section 6

2.1 Warranty

The expiration of warranty results from the following operations:
- incorrect assembly and commissioning
- improper use, see 5.2
- improper handling and storage, see 6.4
- modification of the original condition

3 CERTIFICATION

Safety pressure relief valves are certified by DEKRA, according to Pressure Equipment Directive 2014/68/EU (PED).

They meet the requirements specified in: Module B - EU Type Examination - Production Type (Annex III) of Directive 2014/68/EU - PED category IV

4 COMPONENTS DESCRIPTION

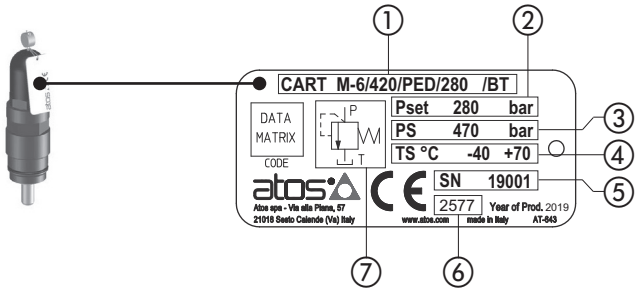
This document applies to direct and pilot operated safety pressure relief valves type CART*/PED, ARE*/PED, ARAM*/PED, AGAM*/PED.
These valves are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the circuit from overpressure.
They are also used as safety valves to protect hydraulic accumulators.

The valves are factory set at the pressure level required by the costumer.
The pressure adjustment screw of the valves is protected with a lead sealed plastic cap to avoid manumission of the factory setting.

⚠ Any tampering of the lead sealing invalidates the certification.

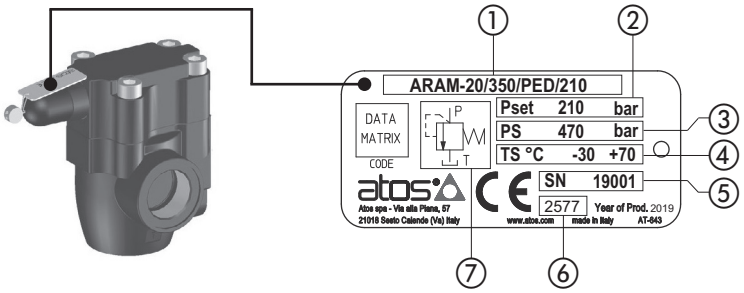
5 PRODUCT IDENTIFICATION EXAMPLES - nameplates

5.1 Screw-in cartridges type CART



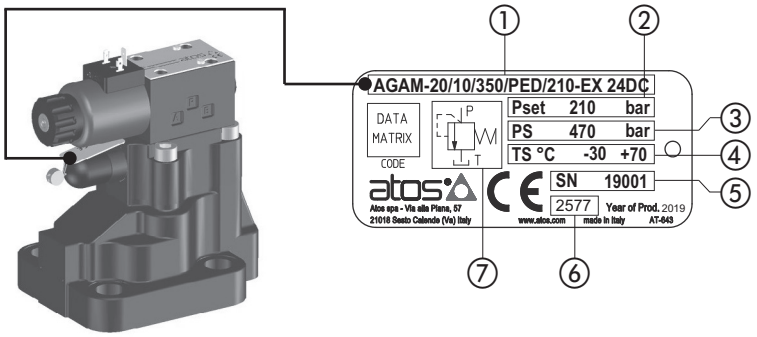
① Valve code
② Factory pressure setting
③ Burst pressure
④ Min ÷ Max fluid or ambient temperature range
⑤ Valve serial number **(1)**
⑥ Notified body reference number
⑦ Hydraulic symbol

5.2 In-line valves type ARE and ARAM



① Valve code
② Factory pressure setting
③ Burst pressure
④ Min ÷ Max fluid or ambient temperature range
⑤ Valve serial number **(1)**
⑥ Notified body reference number
⑦ Hydraulic symbol (simplified)

5.3 Subplate valves type AGAM



① Valve code
② Factory pressure setting
③ Burst pressure
④ Min ÷ Max fluid or ambient temperature range
⑤ Valve serial number **(1)**
⑥ Notified body reference number
⑦ Hydraulic symbol (simplified)

(1) Example for serial number**:**

19	-	001
Year: **19** = 2019		Progressive number

Note: nameplates may not be painted but must be kept in a readable condition

6 SAFETY NOTES

6.1 Intended use

Atos valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.

6.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:
- Wrong installation
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of specified performance limits
- Use outside the specified temperature range
- The safety valves must not be used if the maximum system flow exceeds the value indicated as “max admissible” reported in the relevant technical table
- Manumission of the factory pressure setting
- Incorrect transport

6.3 Installation

Installation must beperformed following the raccomandations contained in the valves technical tables

Any tampering of the lead sealing invalidates the certification.

WARNING: fixing bolts - for AGAM
For the valve mounting, use only class 12.9 bolts, with dimensions and length reported in the valves technical tables.
Observe the specified tightening torque.
Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.

CAUTION
Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid.
Only use the valve within the specified ambient and fluid temperature range.

CAUTION: penetrating water and humidity - for ARAM with solenoid valve
In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors.
This may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:
- only use the valve within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

NOTICE: dirt and foreign particles
Penetrating dirt and foreign particles lead to wear and malfunctions of the valves.
During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system
Do not use linting fabric for the valve cleaning.

Environmental protection
Hydraulic fluids are harmful to the environment.
Leaking hydraulic fluid may leads to environmental pollution.
In case of fluid leakage immediately act to contain the problem.
Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.
The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber
Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

7 HYDRAULIC AND MECHANICAL INSTALLATION

Safety pressure relief valves must be used as supplied by Atos, without unduly opening, division and/or substitution of internal parts.

Oil direction: P→T
Inlet oil port: P
Outlet oil port: T

Pressure on the discharge line T must be close to zero.

Verify that the seals are in good conditions before install the valves in the system.

Screw-in cartridges type CART, must not be removed from their manifold after commissioning, in order to avoid the loosening of internal parts.

The end user must provide proper systems to avoid the cartridge disassembling.

ARE and ARAM in-line valves have to be assembled with proper fittings as per technical table **CY045**.
AGAM subplate valves have to be mounted on proper surfaces, using screws as per technical table **CY066**.

See also section 7.1 for tightening torque.

7.1 Tightening torque - for **CART** and **AGAM**

Valve code			 Class 12.9	Tightening torque (Nm)
CART M-3	22			60
CART M-4	17			25
CART M-5	17			30
CART M-6	27			55
CART ARE-15	27			65
CART ARE-20	36			140
AGAM-10		10	n.4 M12x35	125
AGAM-20		14	n.4 M15x50	300
AGAM-32		17	n.4 M20x60	600

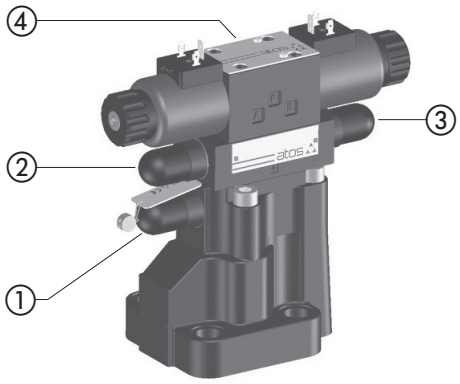
7.2 Application notes for valves ARAM and AGAM with pilot solenoid valve for multiple pressure selection.

The valve main regulation is factory set and lead sealed at the value required by the customer. This regulation corresponds to the max pressure controlled by the valve and it complies with the requirement of PED Directive 2014/68/EU.

The additional second and third pressure settings, selectable by the pilot solenoid valve, are without sealed regulation and they can be adjusted by the end user according to the system requirements.

The second and third pressure setting must be regulated at lower value respect to the lead sealed factory setting.

If the end user tries to adjust the second or third pressure setting at a higher value than the lead sealed factory setting, this last intervenes to limit the pressure according to PED requirements.



① Main pressure regulation - lead sealed factory setting
② Second pressure setting
③ Third pressure setting
④ Pilot solenoid valve

7.3 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.
The hydraulic fluids must be compatible with the selected seals.
Make sure that the working fluid is compatible with gas and dust present in the environment.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s

7.4 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.

Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet.
In the worst case, this may result in unexpected system movements and thus constitute a risk of injury.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the valve over the entire operating range.

Max fluid contamination level:

ISO 4406 class 20/18/15 NAS 1638 class 9

Note: see also filter section at www.atos.com or KTF catalog

8 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

8.1 Ordinary maintenance

Safety pressure relief valves do not require specific maintenance.
A visual inspection is definitely useful to check the integrity of lead sealing and the absence of external oil leakages.
Periodically the external surface of the valve should be cleaned from dirt to allow a clear readability of the identification plate.

8.2 Repairing

Safety pressure relief valves are supplied as single assembled unit: spare parts are not allowed.
In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos which will provide for the reparation.
Only for ARAM and AGAM versions equipped with pilot solenoid valve, the replacement of the pilot solenoid valve with another Atos valve of the same type and with the same function is allowed.

9 TRANSPORT AND STORAGE

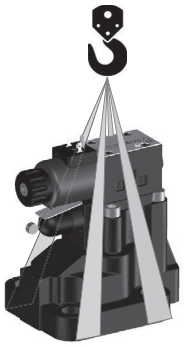
9.1 Transport

Observe the following guidelines for transportation of valves:

- Before any movement check the valve weight reported in the technical table relevant to the specific component
- Use soft lifting belts to move or lift the heavy valves to avoid damages

WARNING
The valve may fall down and cause damage and injuries, if transported improperly.

Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.



9.2 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.
The valve surface is protected with a zinc coating, which guarantees a corrosion resistance of over 200 hours in the salt spray test.
Additionally all valves are tested with mineral oil ISO VG 46; the oil film left after testing ensure the internal corrosion protection.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables.
Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

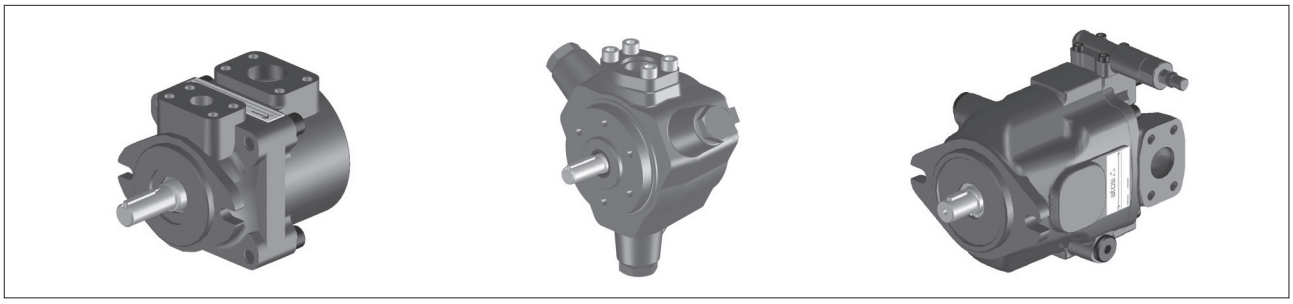
- If there is no specific information in the components technical tables, comply with a storage temperature of –20 °C to +50 °C
- Do not store the valves outdoors
- Protect the valves against water and humidity in case of storage in open air
- Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

Operating and maintenance information for pumps

fixed and variable displacement

This operating and maintenance information apply to ATOS fixed vane, fixed piston and variable piston pumps, is intended to provide useful guidelines to avoid risks when the pumps are installed in a system.
It contains important information on the safe and proper installation, transport, commissioning, operation and maintenance of the products.
The prescriptions included in this document must be strictly observed to avoid damages and injury.
The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.
In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
CAUTION	Minor or moderate injury could occur	
NOTICE	Property damage could occur	
	Information to be observed	

2 GENERAL NOTES

This document is intended for machine manufacturers, assemblers and system end-users.

WARNING
Personal injury and property damage caused by incorrect use of the products!
The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos pumps, the following requisites must be met to ensure appropriate use of the products:

- personnel who uses Atos pumps must first read and understand the operating and maintenance information, particularly the Safety Notes in section 4.
- the products must remain in their original state, no modifications are permitted
- damaged or faulty pumps must not be installed or put into operation
- make sure that the products have been installed as described in the relevant documentation

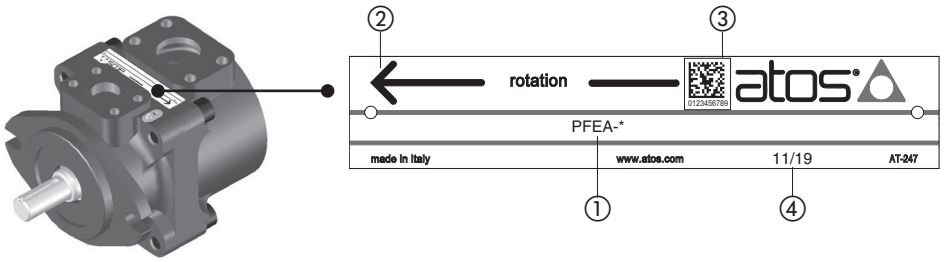
2.1 Warranty

The expiration of warranty results from the following operations:

- incorrect assembly and commissioning
- improper use, see 4.2
- improper handling and storage, see 6.4
- modification of the original condition

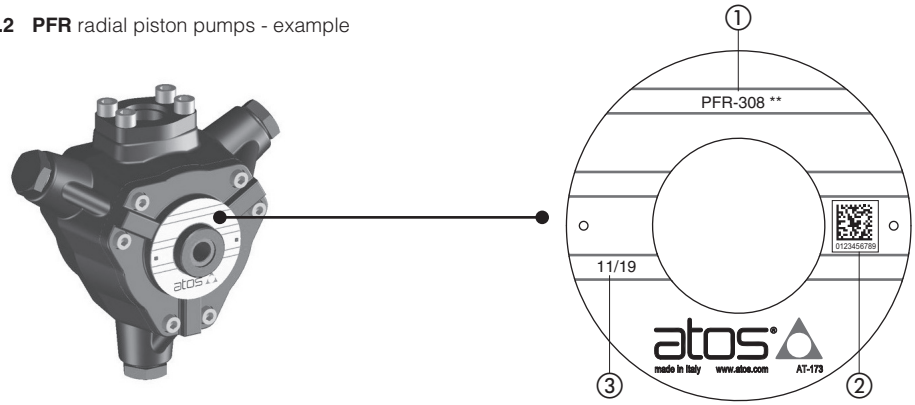
3 PRODUCT IDENTIFICATION EXAMPLES - nameplates

3.1 **PFE** vane pumps - example



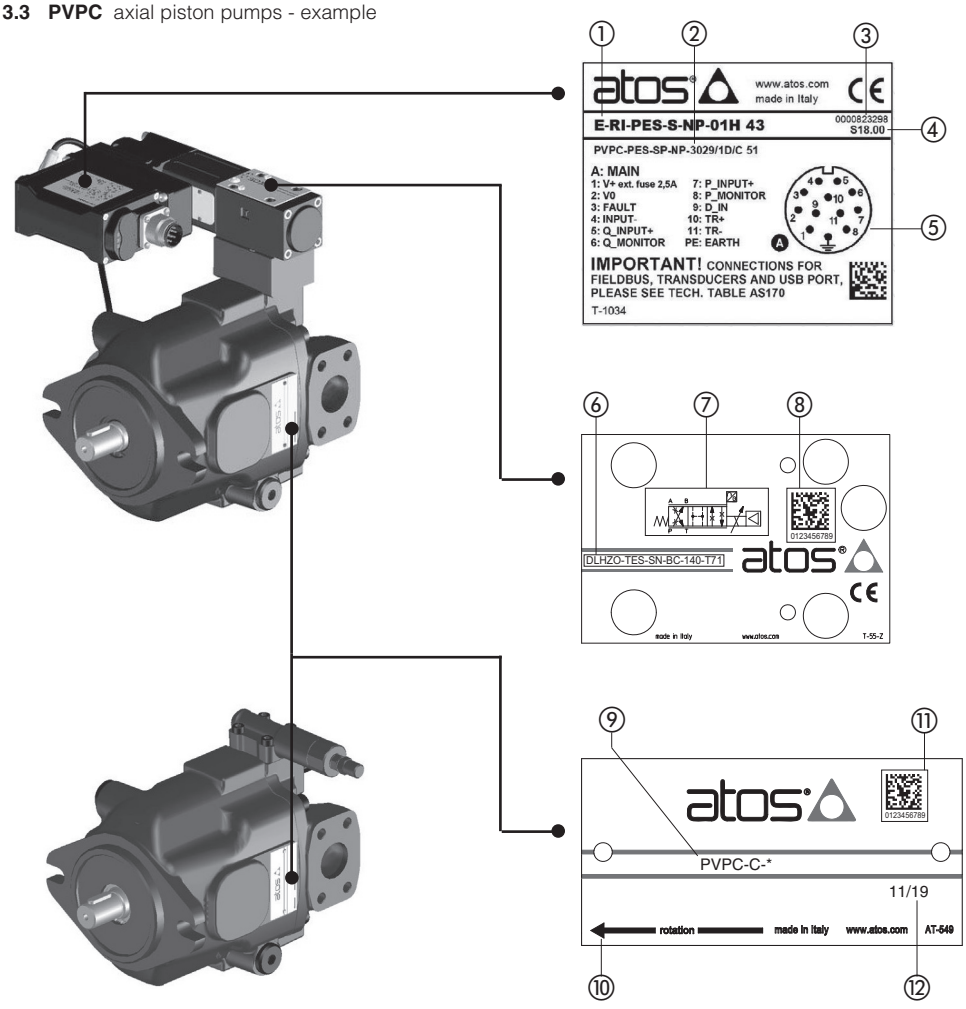
① Pump code
② Pump shaft rotation direction
③ Pump serial number
④ Delivery date

3.2 **PFR** radial piston pumps - example



① Pump code
② Pump serial number
③ Delivery date

3.3 **PVPC** axial piston pumps - example



① Digital driver code
② Pump code
③ Digital driver serial number
④ Digital driver factory firmware version
⑤ Connectors pinout

⑥ Pilot valve code
⑦ Hydraulic symbol (simplified)
⑧ Pilot valve serial number

⑨ Pump code
⑩ Pump shaft rotation direction
⑪ Pump serial number
⑫ Delivery date

4 SAFETY NOTES

4.1 Intended use

Atos pumps are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system.
They may only be operated under the operating condition described in the relevant technical table.

Pumps must be used observing following prescriptions:

- complying with the application and environmental conditions according to the relevat technical tables
- complying with operating conditions and performance limits specified in the relevant technical tables
- use in the original condition, without damage

4.2 Improper use

Any improper use of the pumps is not admissible.
Improper use of the product includes:

- use in explosive environments
- incorrect storage
- incorrect transport
- lack of cleanliness during storage and assembly
- incorrect installation
- use of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use.
The user assumes all risks involved with improper use.

4.3 Installation

Installation must be performed following the recommendations contained in the relevant technical tables and in section 5 of this document.

WARNING: hot surface
The pumps may heats up during operation.
Allow the pump to cool down sufficiently before touching it.
During operation, touch the valve solenoid only by using protective gloves.
Please also observe ISO 13732-1 and EN 982.

CAUTION
Use of the pumps outside the approved temperature range may lead to functional failures like overheating and seizure.
Only use the valve within the specified fluid temperature range.

CAUTION: penetrating water and humidity - for PVPC pumps with proportional controls
In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors or into the valve electronics.
This may lead to malfunctions at the pump and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the pumps within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

NOTICE: impact
Impact or shock may damage the pumps. Never use the pump as step.

NOTICE: dirt and foreign particles
Penetrating dirt and foreign particles lead to wear, malfunction and seizure
During assembly, be careful to prevent foreign particles such as metal chips getting into the pump or into the hydraulic system
Do not use linting fabric for cleaning, it may release contamination.

Environmental protection
Hydraulic fluids are harmful to the environment.
Leaking hydraulic fluid may leads to environmental pollution.
In case of fluid leakage immediately act to contain the problem.
Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.
The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber
Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

5 HYDRAULIC AND MECHANIC INSTALLATION

General:

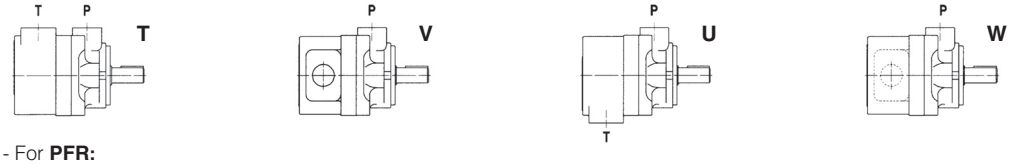
- Before start up make sure that the pump is always filled with the working fluid.
- The pump must never be operated with "OUT" port closed; in order to limit the maximum working pressure a relief valve must be installed on the pressure line.
- Make sure that the maximum working conditions shown in relevant technical tables are not exceed

5.1 Installation position and port orientation

The installation must ensure that the pump remains always filled with the working fluid.

- For **PFE:**

the pump can operate in any position, the available orientation of the oil ports is according to the below pictures. In the ordering code must be specified the selected orientation.



- For **PFR:**

- The pumps can be installed in horizontal or in vertical position. In case of vertical position it is advisable to install on the outlet pipe a proper valve for air bleeding (consult our technical dept.).
- These pumps are not self-priming therefore their installation under oil level is recommended. Installation above oil level requires foot valve on inlet line and pump central point located no more than 150 mm above minimum oil level.
- The shaft of the pump has an eccentric cam which rotates with the shaft generating the stroke of the pistons and thus generating the flow rate. For best functioning a balanced coupling should be provided between the shaft of the motor and the shaft of the pump.

- For **PVPC:**

- The pumps can be installed in horizontal or in vertical position. In case of vertical position the pump shaft must be oriented upward.
- The drain pipe must be oriented so that the pump body always remains filled with the fluid, specially when not working. For this reason the pump is provided with 2 drain connections located in opposite side of the body, so that, depending to the pump orientation, the optimal drain piping can be arranged
- Before the commissioning, the pump body must be filled with the working fluid through one of the drain connections.
- The connection with the electric motor must be performed by means of proper elastic coupling.

5.2 Shaft loads

PFE, PFR: axial and radial loads acting on shaft are not permitted.
PVPC: axial and radial loads acting on shaft are permitted, max permissible loads are indicated in the table A160, section 2 .
The coupling with the electric motor must be sized to absorb the power peaks.
The coupling alignment between the motor and pump shaft must ensured

5.3 Shaft rotation

The direction of shaft rotation (D = clockwise, S = counterclockwaise, viewed from the shaft end) must be the same of the arrow on the nameplate.

5.4 Oil level

Make sure that the pump is always filled with flui. The installer / end user has to provide a level meter to verify the presence of fluid inside the power unit tank.

5.5 Important notes

- A pressure relief valve must be installed on the pressure line near the pump outlet port.
- The piping have to be sized according to the max pressure and max flow rate
- All pipes and surfaces must be cleaned from dirt before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pump IN/OUT ports when connecting the pipes
- Ensure that the pump installation allows an easy acces for maintenance purpose

5.6 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.
The hydraulic fluids must be compatible with the selected seals.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Note: for PVPC the temperature of the fluid contained in the pump body (drain line) is always higher than the tank temperature, specially if the pump is working for long time in null flow conditions and at high pressure.

Fluid viscosity: 10 mm^2/s for short periods at max fluid temperature on drain line
24 to 100 mm^2/s during normal operation
1000 mm^2/s for short periods at cold start-up (800 mm^2/s for PVPC)

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 15 ÷ 100 mm^2/s - max allowed range 2,8 ÷ 500 mm^2/s

CAUTION: easily inflammable hydraulic fluid
In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

5.7 Filtration

The correct fluid filtration ensures a long service life of the pumps and it prevent anomalous wearing or sticking.
Contamination in the hydraulic fluid may cause functional failures e.g. loss of efficiency and increased noise level.
In the worst case, this may result in heavy damages and breakages.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the pumps over the entire operating range.

Max fluid contamination level:

- normal operation: **PFE, PFR** = ISO4406 class 21/19/16 NAS1638 class 10; **PVPC** = ISO4406 class 20/18/15 NAS1638 class 9
- longer life: **PFE, PFR** = ISO4406 class 19/17/14 NAS1638 class 8; **PVPC** = ISO4406 class 18/16/13 NAS1638 class 7

Note: see also filter section at www.atos.com or KTF catalog

6 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics.

6.1 Ordinary Maintenance

Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer over 5 mm
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components
- The pump does not require other maintenance operations except for front shaft seal, and vane cartridge (for PFE)

6.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.
Unauthorized opening of the valves during the warranty period invalidates the warranty.

6.3 Transport

Observe the following guidelines for transportation of pumps:

- Pumps should be transported using a forklift or a lifting gear ensuring a stable position of the pump
- Use soft lifting belts to move or lift the pumps in order to avoid damages
- Before any movement check the pumps weight specified in the rilevant technical table

WARNING
The valve may fall down and cause damage and injuries, if transported improperly.
Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.

6.4 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.
PFE and PFR surface is protected with zinc coating whish guarantees a corrosion resistance over 200h in salt spry test.
PVPC corrosion protection is achieved with surface painting.
Additionally all pumps are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.

For the pumps transporting and storing always observe the environmental conditions specified in the relevant technical tables.
Improper storage may damage the product.

The pumps can be stored for up to 12 months under the following conditions:

- If there is no specific information in the components technical tables, comply with a storage temperature of –20 °C to +50 °C
- Do not store the pumps outdoors
- Protect the pumps against water and humidity in case of storage in open air
- Store the pumps in the shelf or on a pallet
- Store the pumps in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office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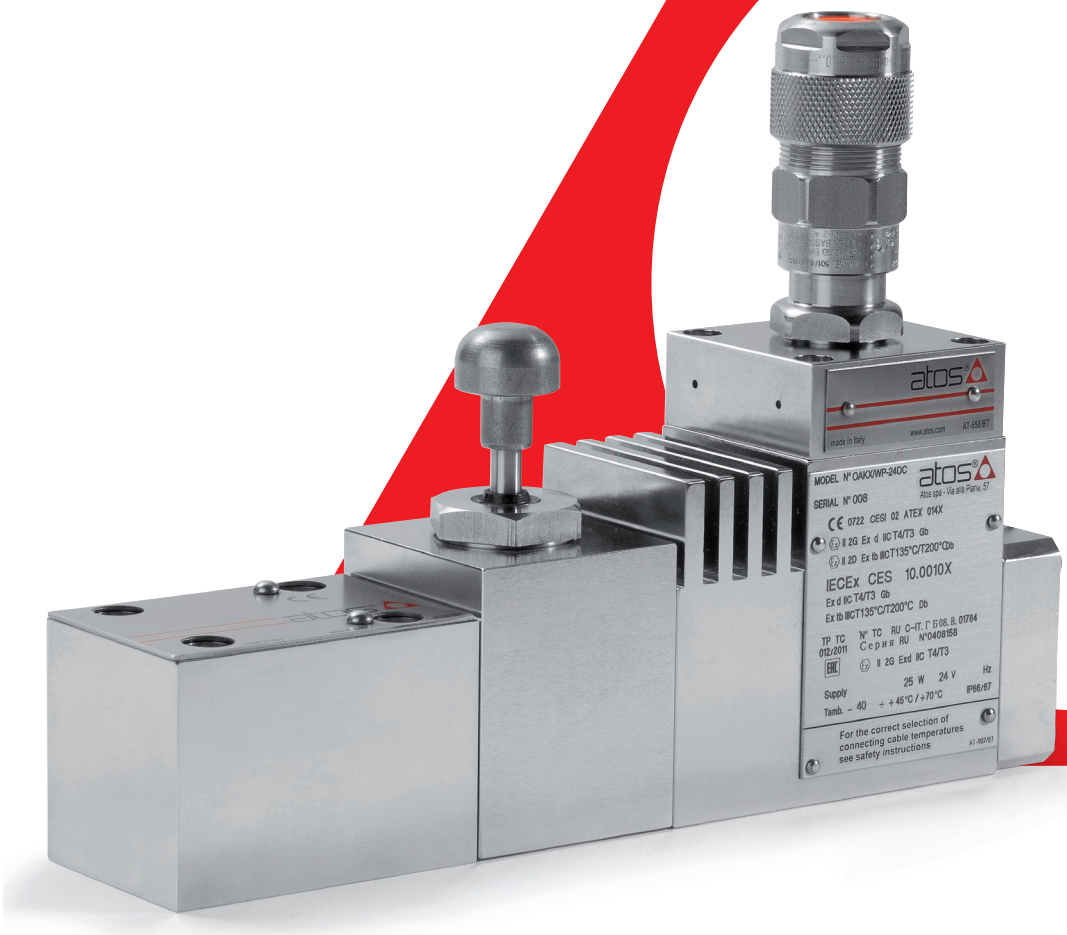
STAINLESS STEEL

ELECTROHYDRAULICS

MASTER CATALOG



atos®

the Italian electrohydraulics

First class facilities
high level of automation
with in-line process control

Know-how
from the design to the production
of the finished product

Full product range
standard, customized, ex-proof,
stainless steel, safety certified

Advanced technology
thanks to long lasting
investments in R&D

Quality first
according to ISO 9001, including
automotive's sector methods

Sales & service
worldwide network of experienced
engineers, oriented to customer care

Professional team
to quickly meet every
customer need

INDEX

STAINLESS STEEL

Supplementary components range available on www.atos.com

Basics for electrohydraulics in corrosive environments

aggressive & explosive atmospheres, water-based fluids

The term "corrosive environments" for fluid power systems refers to environmental conditions in which following situations can separately or contemporary exist. They represent a potential cause of heavy corrosion for all components installed in the system.

- The surrounding atmosphere is so aggressive as to chemically attack the metal surfaces
- The operating fluid contains a high percentage of water to cause oxidation of the metal components in contact with the fluid itself

Corrosion is a natural process that converts metals into a chemically-stable forms such as oxide, hydroxide, or sulfide. It is the irreversible and progressive destruction of materials by chemical and/or electrochemical reaction with their environment.
It is the enemy of any metallic structure and component, being the very common cause of failure.

ATOS has developed a complete line of stainless steel components specifically designed to withstand aggressive atmospheres, ensuring performance and reliability of systems operating with water-based fluids like those of oil-based hydraulics.

X *FULL STAINLESS STEEL* — with all parts made in stainless steel for complete protection to aggressive atmospheres and water-based fluids

XS *EXTERNAL STAINLESS STEEL* — execution with only external parts made in stainless steel to provide the best surface protection to aggressive atmosphere in systems operated with standard mineral oils

XW *INTERNAL STAINLESS STEEL* — execution with only internal parts made in stainless steel, specific for systems operated with water-based fluids

1 AGGRESSIVE ATMOSPHERES

Hydraulic systems are often located in outdoor areas, exposed to rain and atmospheric agents, or in coastal and marine environments. Such critical installations can lead to severe corrosion of the external surfaces, with the consequent risk of breakdowns or in extreme cases structural collapses, which entail higher maintenance costs.

Coastal and marine environments are the worst corrosive conditions for metals because of the quantity of sodium chloride (salt) present in the water and then in the air. The marine atmosphere also includes installations where splashing and heavy sea spray are encountered. The equipment exposed to these splash zones are indeed subjected to the worst conditions of intermittent immersion with wet and dry cycling of the corrosive agent.

However, the above environments are not the only ones prone to accelerated corrosion.
In highly industrial environments, contaminants in the air can contribute to corrosion. Emissions that come from factories, or power plants can potentially weaken the equipment. Gases like sulfur and nitrogen oxide that are emitted into the atmosphere in industrial locations, return in forms of condensation, such as acidic dew or acid rain.

Industrial dust particles can be contaminated with harmful metal oxides, chlorides, sulfates, sulfuric acid, carbon, and carbon compounds. These particles when combined with oxygen, water, or high humidity environments can be highly corrosive.

In applications with aggressive atmospheres, the use of Atos stainless steel valves **X** or **XS** is recommended

1.1 Aggressive & explosive atmospheres

In critical applications the aggressive and even potentially explosive atmospheres can coexist. For example in offshore drilling platforms and oil tankers, the saline environment is combined with the presence of highly flammable gases and vapors. For these reasons Atos solenoid operated stainless steel valves are equipped with ex-proof solenoids manufactured according to protection mode **ex-d** and certified to major international standards.

Following table summaries the main industrial sectors with relevant potential corrosive environments

Sector		Potential cause of corrosion	Suggested Atos stainless steel execution
	Underground mines	Water-based fluids Explosive atmosphere may be present	X
	Oil refineries Power plants	Acid atmospheres Explosive atmosphere may be present	XS
	Steel industry, Die casting Light alloy casting	Water-based fluids, Pure water	X XW (1)
	Offshore & Marine	Salty atmospheres, Heavy sea water spray Explosive atmosphere may be present	XS
	Chemical industry	Acid atmospheres, Corrosive fluids Explosive atmosphere may be present	X
	Pharmaceutical industry Food processing	Pure water	X XW (1)

(1) XW can be used with water-based fluids or pure water, but only in absence of aggressive atmosphere.

1.2 Low temperature

Several hydraulic systems operate in northern areas or artic regions with particularly cold environments. Even if the corrosion rate will be lower in a cold climate than in a temperate one, low temperatures are critical because they induce fragility in the materials and deterioration of the seals.
Atos stainless steel components **X** and **XS** are designed to operate in cold environments up to **-40°C**

For extreme conditions, option **BBT** for full stainless steel components type **X**, is available for ambient temperature up to **-60°C**

2 WATER-BASED FLUIDS

The use of water-based hydraulic fluids derives from two main requirements:

- To guarantee the safety against the risk of fire
- To reduce the degree of environment contamination in the event of accidental leaks

Safety against fire risk: hydraulic systems operate at high pressure levels, in case of accidental pipe breakages, the hydraulic fluid may ignite if coming in contact with hot surfaces.
In order to prevent risk of fire, industrial sectors like steel industry and light alloy casting, often use fire-resistant fluids instead of mineral oils.

Several types of fire-resistant fluids are existing in the market: synthetic types involve toxicological risk with consequent handling problems. For this reason, hydraulic water-based fluids are often preferred due to easy handling, the not toxic characteristics, and lower costs.
These fluids are available in different types depending on the water percentage which can reach up to 98% and they are largely used due to their fire-retardant properties.

Water-based hydraulic systems traditionally have been used in mining applications, in hot-metal areas of steel mill, die casting machines and light alloy foundries.

Eco-compatibility: the environmental impact has strongly influenced the solutions adopted in industrial plants and mobile machinery. Considering the costs associated with preventing and cleaning up environmental contamination, water-based hydraulic systems hold the potential for consistent cost savings.

Since water represents the main component in these fluids (90% or more), the hydraulic systems must be able to operate at low viscosity and must guarantee protection against oxidation by use of selected materials. In fact, despite corrosion protection additives are present in these fluids, materials made of steel, copper, zinc, aluminum, bronze, and brass alloys, as well as combinations of these materials have a higher corrosion tendency in presence of water.

Pure water: applications with severe eco-compatible requirements or production processes where the products must not be contaminated by any trace of oil or other substances, strongly require the use of pure water.

In applications with water-based fluids or pure water, the use of Atos stainless steel valves type **X** or **XW** is recommended

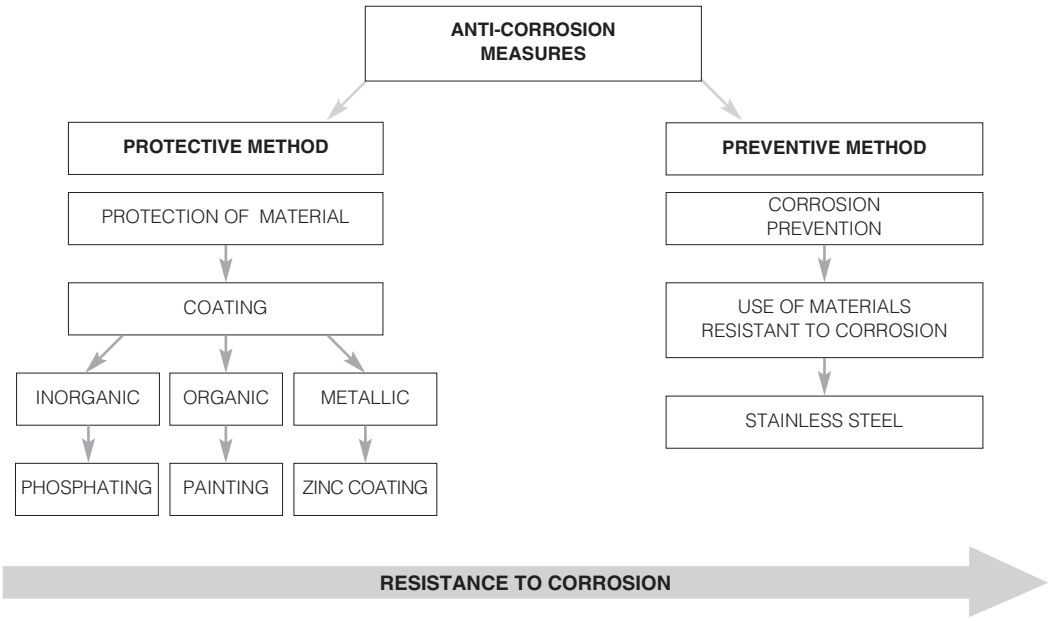
The following table summaries the classification of water-based fluids and their characteristics

Water-based fluids			
Classification to ISO12922	**Fluid characteristics and main applications**	**Corrosiveness**	**Environmental impact**
HFA-E	Oil in water emulsion. Water content > 80% Underground mines, steel plants	High	Low
HFA-S	Synthetic aqueous solution. Water content = 90%-98% Underground mines, steel plants, foundries, metalforming processes	High	Low
HFB	Water in oil emulsion. Water content = 40%-60% Mobile machines As a result of a high mineral oil content up to 60%, for some applications they do not meet the limit values for fire resistant characteristics	Low	High
HFC	Water glycol solution. Water content = 35%-55% Applications: steel plants, die casting as well as other industries, representing approximately 50% of the total fire-resistant hydraulic fluids market.	Low	High
Pure water	100% de-mineralized water Food processing, pharmaceutical industry, any application with severe eco-compatibility requirements	Very high	None

3 ANTI-CORROSION MEASURES

There are several methods to protect the components from corrosion. Among these we can mention **protective** methods and **preventive** methods.

They represent two different approaches, normally selected depending on working conditions of the components and the level of aggressiveness of the environment in which they will operate.



3.1 Protective methods

They are based on protective coatings applied on the surface of steel materials. They offer a good surface protection to aggressive atmospheres but no protection of internal parts in case of water-based fluids. The protection is affected by potential scratches on the surface.

In the following we evidence the most common protective methods:

- **PHOSPHATIZING** offers a medium resistance to corrosive environments; it is not indicated for strong aggressive environments like salty atmospheres. It is a good basic treatment for subsequent painting.
- **PAINTING** is a widely adopted method to protect the surfaces from corrosion. For strong aggressive environments like marine, inorganic zinc paint and specific painting processes as per ISO 12944 are used.
- **GALVANIC ZINC COATING** is one of the best protection methods for steel materials.

Atos has developed for its standard products range an exclusive treatment process named **ECP** that guarantees an excellent surface protection to aggressive environments, see section 5

ECP is a global surface protection combining different type of treatments for the several parts of hydraulic components:

- Parts made in carbon steel or cast iron: zinc coating with black passivation
- Caps and protections made in aluminum: black opaque anodizing
- On-board drivers housing: anodizing
- Aluminum name plates: natural gloss light grey anodizing
- DC coils, external metallic parts: zinc coating (gloss silver)
- Screws: GEOMET 500A treatment
- Other parts such as DIN plugs and nuts: galvanizing + passivation

3.2 Preventive methods

They consist in the use of materials with intrinsic resistance to corrosion. Among these, stainless steel meets the mechanical properties typical of carbon steels, with intrinsic characteristics of noble materials such as the resistance to corrosive phenomena.

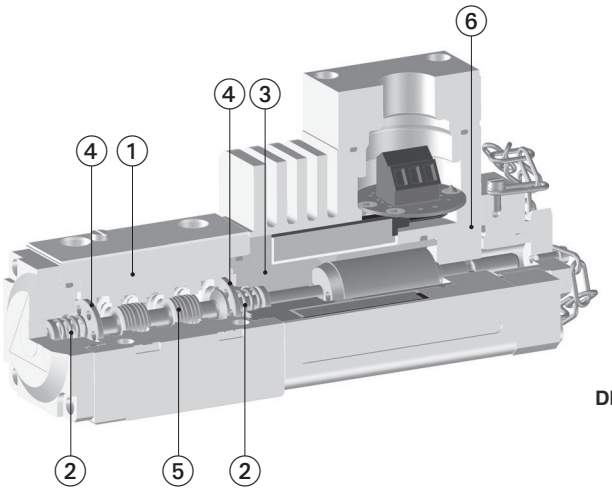
Stainless steel materials offer a higher protection to corrosion with respect to protective coating methods.
The protection is ensured both for external and internal surfaces, then this is the ideal solution in case of water-based fluids.
Moreover, the corrosion protection is not affected by accidental scratches of the component surface.

4 STAINLESS STEEL MATERIALS

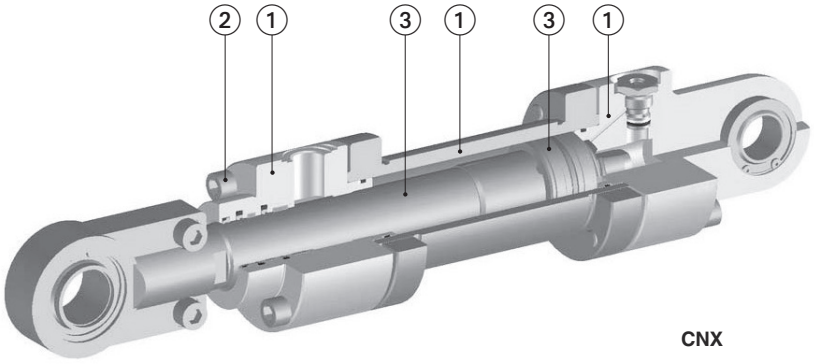
There are several types of stainless steel materials having different mechanical, physical and corrosion resistance characteristics. The most common designation methods in the stainless steel sector is the AISI (American Iron and Steel Institute).

In the following table are reported the stainless steel classification and the specific types used in Atos stainless steel valves

Classification	AISI Series	Characteristics and main applications	Materials used in Atos stainless steel valves
Austenitic	200 300	Best corrosion resistance of all stainless steels because they contain at least 16% chromium. Added nickel and manganese hold the metal in an austenitic microstructure. AISI 316L offers the best resistance to salt and acids AISI 302 steel has excellent mechanical properties and good corrosion resistance.	**AISI 316L** - Valve Body ① Cylinders housing and heads ① **AISI 316 A4** - Cylinders tie rods ② **AISI 302** - Spring ②
Ferritic	400	Ferritic stainless steels contain only chromium in the range of 11% to 30% but they have a lower carbon content than the martensitic ones. AISI430F has moderate resistance to corrosion, which increases with the percentage of chromium. It is ideal for parts to be machined in high speed machine tools. AISI 431 steel is particularly suitable for induction hardening. Among the martensitic steels it reaches the highest corrosion resistance values	**AISI 430F** - Solenoid tube ③ **AISI 431** - Cylinders rod and piston ③
Martensitic	400 500	They contain 12 to 14% chromium, 0.2 to 1% molybdenum, and no significant amount of nickel. It is considered strong and hardenable by heat treatment. AISI420B provides the maximum corrosion resistance in the hardened state and after polishing. AISI440C high hardness steel has good corrosion resistance and excellent wear resistance.	**AISI 420B** - Washer ④ **AISI 440C** - Valve spools ⑤
Precipitation Hardening	17-4PH	PH stainless steels contain around 17% chromium and 4% nickel. AISI 630 steel has excellent resistance to corrosion. Similarly to martensitic stainless steels. The 17-4 PH reaches the optimal resistance to corrosion after heat treatment.	**AISI 630** - Solenoid housing ⑥



DHAX



CNX

5 SPECIFICATIONS TO VERIFY THE CORROSION RESISTANCE

ISO 9227 - the method recognized at European regulatory level, is the accelerated corrosion tests in a salt spray chamber according to UNI EN ISO 9227:2006 Corrosion tests in artificial atmospheres - Salt spray tests

This standard defines the requirements of the equipment and the procedure that must be used to perform the tests in neutral salt spray (NSS), salt-acetic fog (AASS) and cupro acetic salt spray (CASS), to evaluate the resistance to corrosion of metallic materials, with or without permanent or temporary anticorrosive protection.

The salt spray test it is not directly representative of the corrosion protection in real atmospheres, due to the high concentration of chloride and the absence of dry periods. However, this is a practical test, mainly used for the qualification of protection processes. It is a comparative method useful to verify the corrosion resistance of a certain material in comparison with others.

All Atos components are approved with salt spray tests in order to guarantee the best resistance to environmental corrosion

5.1 Resistance in salt neutral spray test (NSS)

Carbon steel with zinc surface treatment

The resistance to corrosion is expressed in hours of performance in neutral salt spray (NSS according to UNI ISO 9227), before white and red oxidization appears on 5% of the total surface of the sample under test.

The white oxidization is the first step of corrosion. It evidences that the protective effect of the zinc passivation is ended, and the salt is going to attack the zinc layer. In this situation the steel material remains integer because it is still protected by the zinc layer.

Once the zinc layer is finished, the corrosion attacks the steel material and then there will be the appearance of red oxidization (red rust), which is the second type of corrosion that must be verified in the salt spray test.

The salt spray resistance of the main Atos components is shown in the following table.

Atos component	Surface treatment type	Resistance in natural salt spray test (hours)
Pumps body PFE and PFR	Phosphatizing	
Small items	Electrolytic galvanizing + passivation	
Valves body	Zinc iron black + post dip	
Valves body **(New)**	Acid Zinc Nickel, black + post dip	
Solenoid housing and tubes	Zinc Nickel + Sealant	
Screws	GEOMET® 500A + Sealant	

Appearance of Zinc Oxide ZnO - White Oxidation

Appearance Iron Oxide ($Fe_2 0_2$) - Red Oxidation

Stainless steel - resistance in salt neutral spray test (NSS)

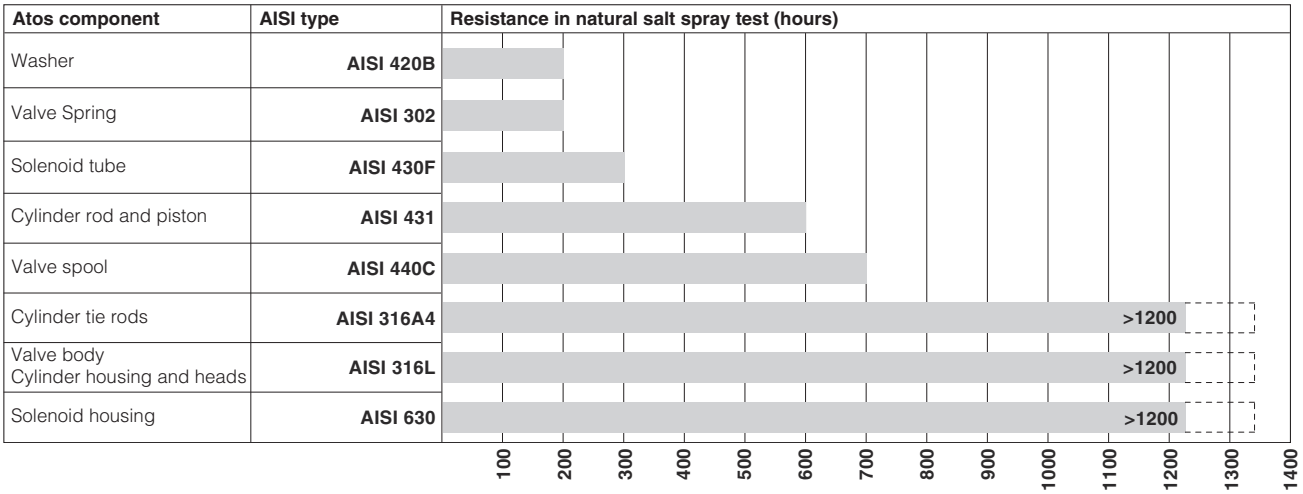
Stainless steels materials offer a corrosion resistance characteristic tipically higher than carbon steels with surface treatments.

The corrosion resistance of stainless steels depend to their type and class and to the aggressive environment to which they are exposed. Corrosion phenomena in many cases are limited to surface oxidation phenomena due to "free iron" and they manly concern to aesthetic factors rather than effective corrosion.

However, in some circumstances, they may present local corrosion attack such as the alveolar corrosion which is the predominant form of stainless steel corrosion.

The salt spray resistance of the main Atos stainless steel components is shown in the following table.

Atos component	AISI type	Resistance in natural salt spray test (hours)
Washer	**AISI 420B**	
Valve Spring	**AISI 302**	
Solenoid tube	**AISI 430F**	
Cylinder rod and piston	**AISI 431**	
Valve spool	**AISI 440C**	
Cylinder tie rods	**AISI 316A4**	**>1200**
Valve body Cylinder housing and heads	**AISI 316L**	**>1200**
Solenoid housing	**AISI 630**	**>1200**



ISO 9223 - this standard establishes a classification system for the corrosiveness of atmospheric environments.
It defines the corrosivity classes of atmospheric environments, based on the corrosion rate detected on standardized metallic samples in one year of exposure.

The corrosion rates are classified in 6 different categories C1, C2, C3, C4, C5, CX calculated on the annual corrosion loss of metals like zinc, copper and carbon steel [µm/year] and it makes possible a rough identification of the corrosivity class based on the knowledge of the local environment.

The standard specifies the key factors in atmospheric corrosion of metals and alloys. These are made up of the combined effect of temperature and humidity and sulfur dioxide pollution and salinity carried by the air.

Classification based on measurement of corrosion rate for Zinc - data are provided for the first year of exposure to the specific environment

Corrosion Category ISO9223	Corrosiveness	Corrosion rate for Zinc layer (µm/year)	Duration of protection (1)	Salt spray test ISO9227	Typical outdoor environment
C1	Very low	<0,1	-	-	Dry or cold zone, atmospheric environment with low pollution
C2	Low	0,1÷0,7	-	-	Temperate zone, atmospheric environment with low pollution (SO2 < 12 µg/m3) Dry or cold zone, atmospheric environment with short time of wetness, e.g. deserts, sub-arctic areas.
C3	Medium	0,7÷2,1	Short Medium Long	120 h 240 h 480 h	Temperate zone, atmospheric environment with medium pollution (SO2: 12÷40 µg/m3) or certain effect of chlorides, coastal areas with low deposit of chlorides
C4	High	2,1÷4,2	Short Medium Long	240 h 480 h 720 h	Temperate zone, atmospheric environment with high pollution (SO2: 40÷80 µg/m3) or substantial effect of chlorides, e.g. polluted urban areas, industrial areas, coastal areas without spray of salt water. Tropical zone, atmosphere with medium pollution
C5	Very high	4,2÷8,4	Short Medium Long	480 h 720 h 1440 h	Temperate zone, atmospheric environment with very high pollution (SO2: 80÷250 µg/m^3) and/or strong effect of chlorides, e.g. industrial areas, coastal and offshore areas with salt spray. Tropical zone, atmosphere with high pollution and/or strong effect of chlorides
CX	Extremely high	>8,4	-	-	Subtropical and tropical zone, very humid period, atmospheric environment with very intense pollution (SO2 above 250 µg/m3) Strong effect of chlorides i.e. coastal and offshore areas, occasional contact with salt spray.

(1) Short = 2-5 years
Medium = 5-15 years
Long = >15 years

Summary of Atos stainless steel components

Atos stainless steel components are electro-hydraulic equipment for industrial and mobile applications, designed to operate in corrosive and potentially explosive environments, such as oil & gas, marine, offshore, etc. and with special fluids HFA-E, HFA-S, HFB, HFC having a high percentage of water or 100% pure water.

1 PRODUCTS RANGE

Atos stainless steel range includes a consistent line of hydraulic valves and actuators among the largest ones used in applications that require high corrosion resistance: directional valves, pressure relief valves, cylinders and servocylinders.

Up to three stainless-steel executions are available to satisfy the most demanding applications:

X *FULL STAINLESS STEEL* — execution with all parts made in stainless steel offers the complete protection for external and internal surfaces. It is the ideal choice for applications combining aggressive atmospheres and water-based fluids.

XS *EXTERNAL STAINLESS STEEL* — execution with only external parts made in stainless steel. It is specifically designed to provide the best surface protection to aggressive atmosphere, while the operating fluid is standard mineral oil, HLP type or similar. All internal parts in contact with the fluid are made in carbon steel to reduce the costs respect to the full stainless steel execution.

XW *INTERNAL STAINLESS STEEL* — execution with only internal parts made in stainless steel, specific for systems operated with water-based fluids but not subjected to aggressive atmosphere. These components are available on request. Technical tables are not present in KTW catalog, but in supplementary components range available on www.atos.com

Valves type **X**, **XS** and **XW** are standard equipped with NBR low temperature seals suitable for temperature range -40 to +70°C
Valves type **X** with option **BBT** are equipped with FMVQ fluorosilicon seales suitable for temperature range -60°C to +70°C

1.1 ON-OFF DIRECTIONAL VALVES

Stainless steel directional valves range includes 4-way spool type valves or 3-way popper type leak free.
Solenoid operated valves are equipped with ex-proof solenoids designed to operate in hazardous environments with presence of flammable liquids, gases, vapors or combustible dust, and certified to major international standards, see section 3
XW execution is available with Ex-proof or standard solenoids

Component	Execution	Solenoid	SIL (1)	Ex-proof certification						Tech. table
				Environment	Multicertification				North American	Marking	
					ATEX	IECEx	EAC	PESO	cULus		
4-way, spool type, direct, solenoid operated	X, XS, XW	Ex-d	●	Gas	●	●	●	●	●	See section 5.1 and 5.2	EW010
				Dust	●	●		-	-		
	XW	standard	-	-	-				-	-	TE135
3-way, poppet type, direct, solenoid operated	X, XS, XW	Ex-d	●	Gas	●	●	●	●	●	See section 5.1 and 5.2	EW020
				Dust	●	●		-	-		
	XW	standard	-	-	-				-	-	TE135
3-way, poppet type, piloted, solenoid operated	X, XS, XW	Ex-d	-	Gas	●	●	●	●	●	See section 5.1 and 5.2	EW050
				Dust	●	●		-	-		
	XW	standard	-	-	-				-	-	TE135
3-way, poppet type, piloted, hydraulic operated	X, XS, XW	-	●	-	-				-	-	EW100

(1) Valves are SIL compliance with IEC 61508 (TÜV certified). They meet the requirements of SC3 (systematic capability) up to SIL 3

1.2 ON-OFF PRESSURE RELIEF VALVES

Stainless steel pressure relief valves range includes screw-in, ISO cartridge and modular executions.
Screw-in type are also available in Safety execution conforming to PED Directive 2014/68/EU.

Component	Execution	PED Directive	Marking	Tech. table
Screw-in cartridges	X, XS			CW010
	X, XS	●	See section 6	CWY010
Modular	X, XS			DW010
ISO functional cover	X, XS			HW010
ISO cartridge	X			

1.3 HYDRAULIC CYLINDERS & SERVOCYLINDERS

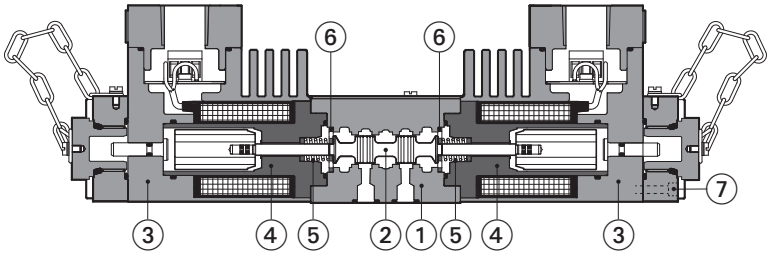
Stainless steel, round heads cylinders and servocylinders with tie-rods.
Servocylinders are equipped with low friction seals and position transducer, magnetosonic or inductive type

Component	Execution	Description	Tech. table
Cylinders	X	round heads	BW500
Servocylinders	X	with built-in magnetosonic transducer	
		with built-in inductive transducer	
		with built-inpotentiometric transducer	

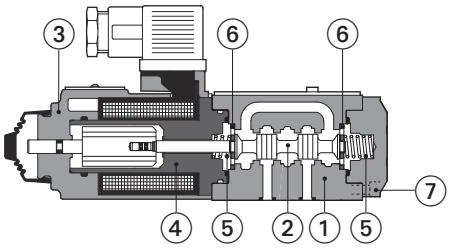
2 STAINLESS STEEL MATERIALS APECIFICATIONS

Atos stainless steel valves are made by selected stainless steel materials coupling the best corrosion resistance to excellent mechanical characteristics. In the following are listed the AISI classification of stainless steel materials used for the main parts of X, XS and XW valves.

2.1 On-off directionl valves



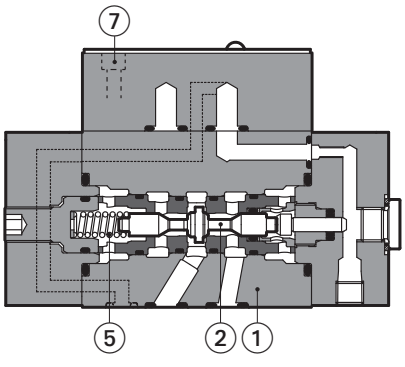
direct, Ex-proof solenoid, X, XS, XW executions
(see Table I)



direct, standard solenoid, XW execution
(see Table I)

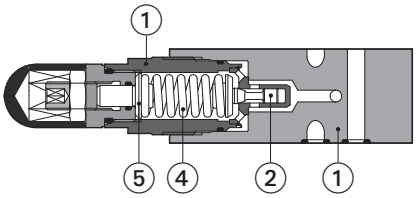
Table I

Item	Component part	Execution		
		X	**XS**	**XW**
1	Body and caps	AISI 316L	AISI 316L	AISI 316L
2	Spool, Poppet	AISI 440C	Carbon steel	AISI 440C
3	Solenoid housing	AISI 630	AISI 630	Carbon steel
4	Solenoid tube	AISI 430F	Carbon steel	AISI 430F
5	Springs	AISI 302	AISI 302	AISI 302
6	Washers	AISI 420B	Carbon steel	AISI 420B
7	Screw	AISI 316	AISI 316	Carbon steel



piloted, X, XS executions
(see Table I)

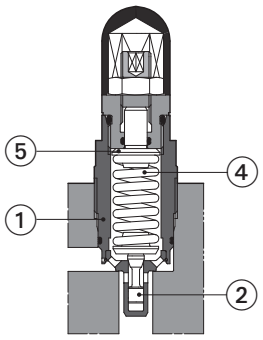
2.2 On-off pressure relief valves



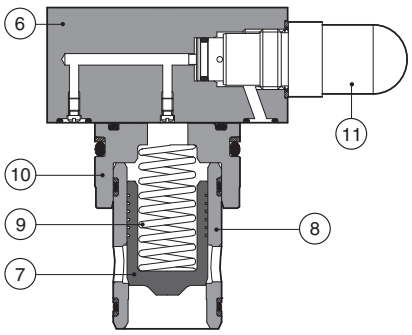
direct, modular, X, XS executions
(see Table II)

Table II

Item	Component part	Execution	
		X	**XS**
1	Body	AISI 316L	AISI 316L
2	Poppet	AISI 440C	Carbon steel
3	Sleeve	AISI 420B	Carbon steel
4	Spring	AISI 302	AISI 302
5	Washer	AISI 420B	AISI 420B



direct, screw-in cartridge,
X, XS executions
(see Table II)

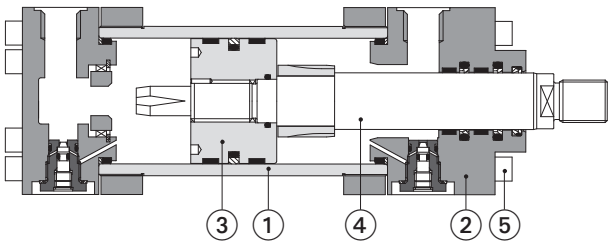


piloted, ISO cartridge X, XS executions
(see Table III)

Table III

Item	Component part	Execution	
		X	**XS**
6	Body	AISI 316L	AISI 316L
7	Poppet	AISI 440C	AISI 440C
8	Sleeve	AISI 420B	AISI 420B
9	Spring	AISI 302	AISI 302
10	Cap	AISI 630	AISI 630
11	Pilot	see above table II	

2.3 Hydraulic cylinders & servocylinders



round heads cylinder X execution
(see Table IV)

Table IV

Item	Component part	Execution
		X
1	Housing	AISI 316L
		AISI 630 17-4 PH **(1)**
2	Heads	AISI 316L
3	Piston	AISI 431
4	Rod	AISI 431
		AISI 630 17-4 PH **(1)**
5	Tie rods	AISI 316 A4

(1) Available on request for heavy duty applications

3 CERTIFIED EXECUTIONS FOR EXPLOSIVE ATMOSPHERES

Atos stainless steel ex-proof valves are equipped with ex-proof solenoids engineered and manufactured according to protection method **Ex-d** (code **Ex-t** for dust environments) and certified by independent notified bodies in conformity to following standards:

3.1 Multicertification: ATEX, IECEx, EAC, PESO standards

It is a great plus offered by Atos ex-proof stainless steel valves, where the same component is provided with the following certifications:

ATEX Directive 2014/34/EU, applicable within the European Union

IECEx International Electrotechnical Commission Explosive, required to access international markets

EAC Eurasian Certification
It is applicable to the Customs Union Territory Including Russia, Kazakhstan, Belarus, Armenia and Kyrgyzstan

PESO Petroleum and Explosive Safety Organization (earlier known as CCoE)
It approves products distributed within Indian territory

3.2 cULus North America standards

c UL us LISTED

This type of UL logo indicates compliance with both Canadian and U.S. requirements.
Atos ex-proof components are marked with cULus Listed logo stating that they have been investigated by UL Underwriters laboratory in accordance with following standards:

-**UL 1203** Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for use in Hazardous (classified) locations
-**UL 429** Standard for Electrically Operated valves
-**CSA C22.2 No. 139-13** Electrically Operated Valves

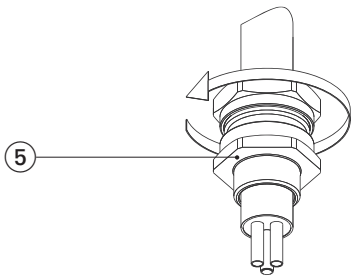
4 FLAMEPROOF ENCLOSURE Ex-d

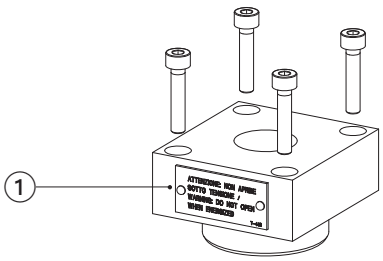
Technical characteristics

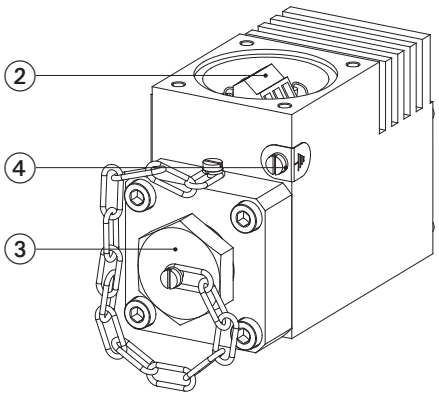
It is characterized by a strong mechanical construction, capable of withstanding the overpressure caused by a potential internal explosion and preventing the spread of flames to the external environment. It permits to dissipate the heat generated by the solenoid, in order to limit the surface temperature within certified classes (T6, T5, etc), to avoid the self-ignition of the surrounding flammable atmosphere.

Internal parts are sealed inside a ruggedized flameproof enclosure, granting high protection to the risk of explosion.

The rugged design of the flameproof enclosure made in AISI 630 (17-4 PH), combined with IP66/67 ingress protection, makes the stainless steel ex-proof valves suited for application in highly corrosive and harsh environments.







Electrical wiring of ex-proof Multicertified solenoids

The electrical wiring to the terminal board of ex-proof solenoids, must be performed using stainless steel ex-proof certified cable glands, see tech. table KX800.
Electric cables must be approved for the specific temperature class reported on the ex-proof component's nameplate, refer to specific tech. table of ex-proof valves for cable temperature.

Electrical wiring of ex-proof solenoids certified cULus

The electrical wiring to the terminal board of ex-proof solenoids must be performed using **UL** certified cable glands, or conduit pipe.
Electric cables must be **UL** approved for the specific temperature class reported on the ex-proof component's nameplate, refer to specific tech. table of ex-proof valves for cable temperature.

① cover with threaded connection for cable gland fitting
② terminal board for cables wiring
③ standard manual override protected by cap
④ screw terminal for additional equipotential grounding (only Multicertified solenoids)
⑤ cable glands (only Multicertified solenoids)

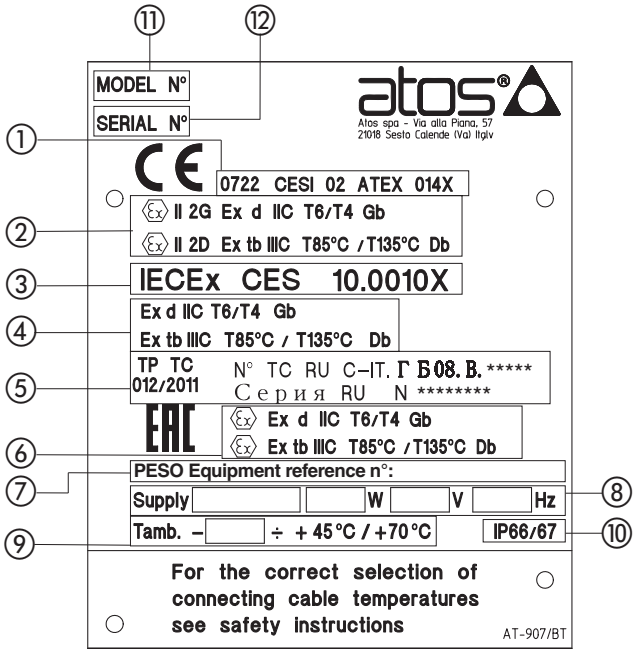
5 NAMEPLATE MARKING FOR EX-PROOF SOLENOIDS

Stainess steel ex-proof valves are provided with a specific nameplate reporting the certificate number, the notified body and the classification according to the relevant certification.
The classification identifies the protection method and the compatibility of the ex-proof component for a specific hazardous environment.
The following sections provide a detailed description of the nameplate marking for component categories.

5.1 Ex-proof solenoid multicertified to ATEX, IECEx, EAC and PESO

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22

① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ EAC notified body and certificate number
⑥ Marking according to EAC
⑦ PESO certificate number
⑧ Power supply characteristics
⑨ Ambient temperature
⑩ Ingress protection:
-IP66 = no dust ingress, protection against heaving seas or powerful jets of water
-IP67 = no dust ingress, protection to water immersion
⑪ Solenoid model code
⑫ Solenoid serial number



ATEX / IECEX / EAC / PESO classification - for Gas group II

II 2 G	Ex	d	IIC	T6 / T4	Gb
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T4** ≤ 135°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone1)

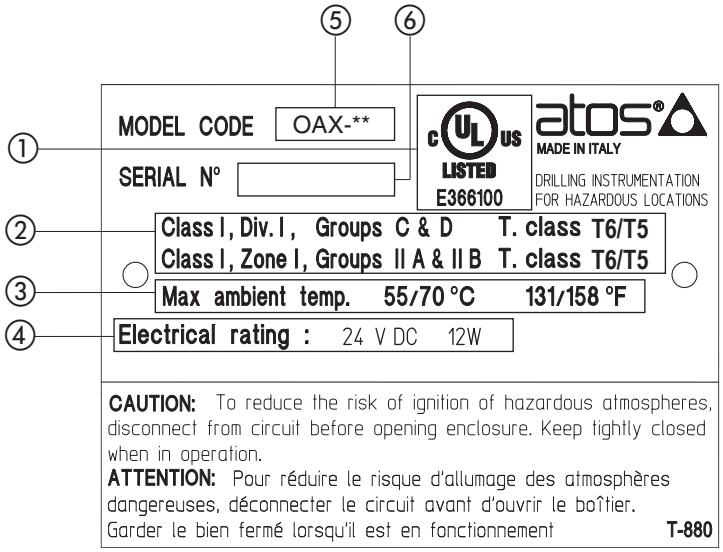
ATEX / IECEx / EAC classification - for Dust

II 2 D	Ex	tb	IIIC	T85 / T135	Db
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **tb** Protection by enclosure	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T85** ≤ 85°C **T135** ≤ 135°C	**Equipment Protection Level** **Db** High protection (Dust, Zone21)

RELATED DOCUMENTATION

EW010 DHAX, DHAXS - on-off, direct, spool type
EW020 DLAHX, DLAHXS, DLAHMX, DLAHMXS - on-off, direct, spool or poppet type
EW050 DLAHPX, DLAHPXS, DLAPX, DLAPXS - on-off, piloted, poppet type leak free

Class I, Division I, Groups C & D
Class I, Zone 1, Groups IIA & IIB



1. cULus marking and certificate number
2. Marking according to NEC 500 and NEC 505 standards
3. Ambient temperature
4. Power supply characteristics
5. Solenoid model code
6. Solenoid serial number

NEC 500 classification

Class I	Division I	Groups C & D	T6/T5
Class I Equipment for flammable Gas and Vapors	**Division I** Explosive substances continuosly or intermittently present in the atmosphere	**Gas Group** **C** Methane, Butane, Petrol, etc. **D** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C

NEC 505 classification

Class I	Zone 1	Groups IIA & IIB	T6/T5
Class I Equipment for flammable Gas and Vapors	**Zone 1** Location where explosive substance are continuosly present	**Gas Group** **IIA** Methane, Butane, Petrol, etc. **IIB** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C

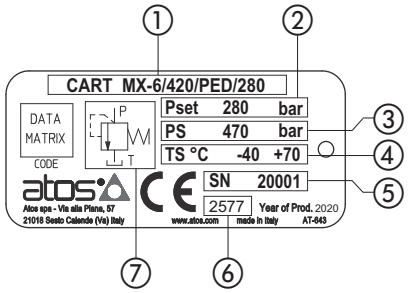
RELATED DOCUMENTATION

EW010 DHAX/UL, DHAXS/UL - on-off, direct, spool type
EW020 DLAHX/UL, DLAHXS/UL, DLAHMX/UL, DLAHMXS/UL - on-off, direct, spool or poppet type
EW050 DLAHPX/UL, DLAHPXS/UL, DLAPX/UL, DLAPXS/UL - on-off, piloted, poppet type leak free

6 NAMEPLATE MARKING FOR PED PRESSURE VALVES

The PED valves are factory set at the pressure level required by the costumer.
The factory pressure setting Pset is marked on the valve nameplate, together with the burst pressure PS and the temperature range

① Valve code
② Factory pressure setting
③ Burst pressure
④ Min ÷ Max fluid or ambient temperature range
⑤ Valve serial number **(1)**
⑥ Notified body reference number
⑦ Hydraulic symbol



(1) Example for serial number**:**

20	-	**001**
Year: **20** = 2020		Progressive number

RELATED DOCUMENTATION

PED pressure relief cartridges
CWY010 CART MX*/PED, CART AREX*/PED - stainless steel safety pressure relief valves

Basics for electrohydraulics in hazardous environments

1 HAZARDOUS ENVIRONMENTS

"Hazardous Environments" are areas where flammable liquids, gases, vapors or combustible dust exist in sufficient quantities to produce explosions or fire.

Oil & gas, chemical, mining and power plants are highly-sensitive environments where the presence of a potentially explosive atmosphere can accidentally or permanently occur.
In these environments an accidental failure or a wrong operation could cause the ignition of the surrounding explosive atmosphere with fatal consequences for human and goods safety, therefore all electrohydraulic equipment operating in these areas must be suitable for hazardous environments and must be certified according to international standards.

The purpose of this document is to provide general information about worldwide certifications for hazardous environments and relevant classifications

Typical hazardous environments can be found in the following sectors:

Presence of Gas and Vapors		**Presence of Combustible Dust**	
	Oil & Gas Offshore drilling		Feed industry Grain handling and storage
	Oil refineries Power plants Chemical plants LNG plants		Chemical & fertilizers Pharmaceutical
	Petroleum & LNG vessels		Wood & paper
	Aerospace industry		Metal processing
	Coal mines		Recycling operations

2 CERTIFICATIONS

Equipment with electrical parts designed for hazardous environments must be certified by third parties (notified bodies) in compliance with international standards for explosion protection.

There are several certifications concerning explosive environments and they are governed by local laws of the countries where they are applied.

In all certifications the basic principles for explosion protection are strictly regulated by severe international standards for explosion protection, as European norms EN60079 or North American NEC500 and 505.
These norms impose specific construction criteria and protection methods for the machinery and components to be used in potentially explosive areas.

ATOS CERTIFICATIONS
see section 3 for details

ATEX Europe

IECEx international

Russia

North America

PESO India

China

Canada

Brazil

Korea

WORLDWIDE CERTIFICATIONS

The following map shows the main certifications with the relative countries where they are most widely applied.
International certification IECEx is recognized worldwide even in countries where local certifications exist.

3 CERTIFICATIONS FOR ATOS EX PROOF AND INTRINSICALLY SAFE COMPONENTS

Atos ex-proof and Intrinsically safe components are certified with major international certifications, as listed in the following.

Note: see technical table of each specific Atos component to verifiy the available certifications

MULTICERTIFICATION

Multicertifications is a great plus offered by Atos, where the same component is provided with the following certifications:

ATEX Directive 2014/34/EU, equipment and protective system intended for use in potentially explosive atmosphere
It defines the manufacturing criteria and the safety requirements of the equipment used in potentially explosive environments for presence of gas or flammable dusts, within the European Union.
The Directive provides the classification and marking of components to EN 60079 harmonized norms.

IECEx International Electrotechnical Commission Explosive
International program for the safety of the equipment installed in a potentially explosive atmosphere, required to access international markets. IECEx provides certification of conformity for electrical equipment and machinery to be used in potential explosive environments and it is based on IEC 60079 standards. The objective of the IECEx is to facilitate international trade of equipment for use in explosive atmospheres.

EAC Eurasian Certification
It is applicable to the Customs Union Territory Including Russia, Kazakhstan, Belarus, Armenia and Kyrgyzstan
It indicates the compliance with the Customs Union Technical Regulation TP TC 012/2011 “safety of equipment intended for use in explosive atmospheres” and it acknowledges the whole ATEX Directive 2014/34/EU.

PESO Petroleum and Explosive Safety Organization (earlier known as CCoE)
It approves products distributed within Indian territory for suitability in usage at petroleum or in any place with potentially explosive atmosphere. It is based on harmonized norms and international standards under ATEX and IECEx.
Atos multicertified ex-proof valves for gas group II are also certified Peso.

cULus North American Certification
It is a widely recognized certification across North America (US and Canada).
It provides certification of conformity for equipment and machinery installed in locations where explosion or fire hazards exist due to the presence of flammable gases, combustible dust, or ignitable fibers. It is based on NEC standards

MA safety certificate of approval for mining products
Chinese authority for certification of components operating in chinese coal mines.
It acknowledges the harmonized norms and international standards under ATEX and IECEx.

The following sections describe the various classifications related to hazardous environments according to certifications available for Atos components.
The classification is marked on the nameplate of each certified component to state its conformity to the specific hazardous environment and explosive atmosphere.

See section 4 for classifications to **ATEX, IECEx, EAC, PESO**

See section 5 for classifications to **cULus**

4 CLASSIFICATIONS TO ATEX, IECEx, EAC, PESO

The classifications reported in the following sections are those established by the EN and IEC standards related to ATEX and IECEx.
EAC and PESO certifications acknowledge the same classification system of ATEX and IECEx.
An example of classification present on the component nameplate iso shown in the following:

environment				atmosphere		environment
II	**2 G**	**Ex**	**d**	**IIC**	**T6/T5/T4**	**Gb**
Group see sect. 4.1	**Category** see sect. 4.3	**Mark of Explosion Proof**	**Protection Method** see sect. 4.7	**Gas Group** see sect. 4.4	**Temperature Class** see sect. 4.6	**Equipment Protection Level (EPL)** see sect. 4.3

Once the user has classified the area in which the component is intended to be placed, he will be able to define the level of protection of the component.

The evaluation of the risk and consequentially the level of protection required by the equipment passes through two main classifications:

A- Environment: the classification is referred to the location in which the product is intended to be placed
Environment is further classified in **Group** and **Zone**.

B- Atmosphere: the classification is referred to the type of explosive substance present in the atmosphere
Atmosphere is further classified in **Gas Group**, **Dust Group** and **Temperature**.

A- ENVIRONMENT

4.1 Group classification

Explosive environments are classified into: **Group I** for underground mines or for surface equipments connected to mines
Group II for surface areas

4.2 Zone classification - The Zone classification is not reported on the component nameplate
Explosive environments are classified into **Zone**, identified **0, 1, 2** for **Gas**, and **20, 21, 22** for **Dust**, depending on the time and frequency the explosive substance is present: Zone 2 and 22 are less dangerous than 0, 1 or 20, 21.
Components certified for Zone 0 (or 20) may also be used in Zone 1, 2 (or 21, 22).

4.3 Safety level required: Category and EPL

The Zone is directly linked with the safety level required; a zone with higher risk requires a higher safety level. There are two different classifications: **Category** and **EPL**

Category: ATEX classifies the safety required level into **Category 1, 2, 3** accompanied with letter **G** for gas and letter **D** for Dust: Category 1G (or 1D) are safer than 2G, 3G (or 2D, 3D).
Components certified for Category 1 may also be used where Category 2 or 3 is needed.
For Group I the classification is **Category M1** or **M2** with M1 safer than M2.

EPL: IECEx classifies the safety level required into **Equipment Protection Level (EPL) a, b, c** anticipated by letter **G** for gas and **D** for dust depending on the safety level required: Category Ga (or Da) are safer than Gb, Gc (or Db, Dc).

Components certified for EPL Ga (or Da) may also be used where EPL Gb, Gc (or Db, Dc) is needed.

Environment classification

Explosive Atmosphere	Group see 4.1	Zone see 4.2	Safety level required see 4.3		Atos component	
			Category	EPL		
Gas / Dust (mining)	I	-	M1	-		HIGHER PROTECTION
	I	-	M2		① ③	
Gas (surface)	II	0	1G	Ga	④	HIGHER PROTECTION
		1	2G	Gb	② ⑤ ⑥	
		2	3G	Gc	② ⑤ ⑥	
Dust (surface)	II	20	1D	Da		HIGHER PROTECTION
	II	21	2D	Db	② ⑤ ⑥	
		22	3D	Dc	② ⑤ ⑥	

① Atos ex-proof (mining) ② Atos ex-proof (gas & dust) ③ Atos intrinsically safe (mining) ④ Atos intrinsically safe (gas)

⑤ Pumps and cylinders ⑥ Atos stainless steel ex-proof

4.4 Gas Group classification

The classification is based on the minimum ignition energy of the explosive atmosphere in which a component may be installed.
The **Gas Groups** are identified **IIA, IIB, IIC** depending on the dangerousness of the substances: group IIA is less dangerous than group IIB and IIC. Components certified for Gas Group IIC may also be used in less dangerous Groups IIB and IIA

4.5 Dust group classification

The classification is based on nominal dimensions and electrical resistivity of particles.
The **Dust Groups** are identified **IIIA, IIIB** and **IIIC**, depending on the dangerousness of the substances: group IIIC contains smaller and less electrically resistive substances than group IIIB and IIIA. Components certified for Dust Group IIIC may also be used in less dangerous Groups IIIB and IIIA.

4.6 Temperature class

Based on their maximum surface temperature, the components are classified into **Temperature Classes T1** to **T6** for Gas, whereas for Dust the max surface temperature is directly reported in **°C**. The maximum surface temperature of the component must be lower than the ignition temperature of the surrounding explosive atmosphere.
Components certified with Temperature Class T6 may also be used in lower Classes T5 to T1

Atmosphere and Temperature class

Gas Group	Gas type					
IIC	Hydrogen	Acetylene				Carbon disulphide
IIB	City gas Acrylic Nitrile	Ethylene	Ethyl glycol Carbon hydrogen	Ethyl ether		
IIA	Ammonia Methane Ethane Propane	Ethanol n-Butane	Petrol Diesel fuel Fuel oil n-Hexane	Acetal-dehyde		
Temperature class	**T1** < 450°C	**T2** < 300°C	**T3** < 200°C	**T4** < 135°C	**T5** < 100°C	**T6** < 85°C

HIGHER PROTECTION

HIGHER PROTECTION

Note: the Temperature class may change depending on the max ambient temperature where the component is installed. In this case two or three different T are reported on the components nameplate (i.e. T6/T5/T4). See technical table of each specific Atos component for Temperature class.

Dust Group	Dust type
IIIC	Conductive dust
IIIB	Non conductive dust
IIIA	Flammable fibers

HIGHER PROTECTION

For dust explosion proof, the max surface temperature is directly shown (e.g. T85°C)

4.7 Protection method

The ignition of the surrounding explosive atmosphere can be prevented adopting for the component a proper protection method.
The protection method is directly linked to the design and manufacturing characteristics of the component.
The table below reports the **Code** related to the protection method adopted along with the relative **Zone** of application.

HIGHER PROTECTION ← HIGHER PROTECTION

Protection principle	Protection method	Code		Zone						Atos component
				Gas			Dust			
				0	1	2	20	21	22	
Prevents transmission of the explosion outside	Flameproof enclosure	Ex	da	X	X	X	X	X	X	
			db		X	X				① ② ⑥
			dc			X				
Dust explosion proof	Protection by enclosure	Ex	ta				X	X	X	
			tb					X	X	② ⑥
			tc						X	
Low current / voltage supply	Intrinsically safe	Ex	ia	X	X	X				③ ④
			ib		X	X				
			tc			X				
Non-electrical	Construction safety Control of igniction sources Protection by liquid immersion	Ex	c b k		X	X		X	X	⑤

① Atos ex-proof (mining) ② Atos ex-proof (gas & dust) ③ Atos intrinsically safe (mining) ④ Atos intrinsically safe (gas)

⑤ Pumps and cylinders ⑥ Atos stainless steel ex-proof

4.8 Painting

According to EN60079-0 the valves can be coated with a non-metallic material (i.e. painting), observing the maximum thickness:

Group IIC < 0,2 mm max
Group IIB < 0,3 mm max
Group IIA < 0,3 mm max

5 CLASSIFICATIONS TO cULus

The classification of explosive environments in cULus certification is regulated by NEC Standards (National Electric Code) and it is based on NEC 500 and NEC 505 articles.

NEC 500 covers the requirements for the classification system in Classes I, II, II and Divisions 1 and 2.

NEC 505 covers the requirements for the classification system in Zones (Zone 0, 1, and 2) as alternative to the NEC 500.

An example of classification present on the component nameplate is shown in the following:

NEC 500

Class I	Division I	Groups C & D	T6/T5
see sect. 5.1	see sect. 5.3	**Gas Groups** see sect. 5.2	**Temperature Class** see sect. 5.5

NEC 505

Class I	Zone I	Groups IIA & IIB	T6/T5
see sect. 5.1	see sect. 5.4	**Gas Groups** see sect. 5.2	**Temperature Class** see sect. 5.5

5.1 Class classification - NEC 500 and NEC 505

Location where explosive substances are present in the atmosphere are classified as:
Class I where flammable vapors and gases may be present
Class II and **Class III** where combustible dust and easily ignitable fibers may be present

5.2 Group classification

NEC 500: based on the ignition temperatures and explosion pressure, NEC 500 classifies gases and dust into Groups, identifying **Group A, B, C, D** for **Gases** and **Group E, F, G** for **Dusts**. Group D (or G) is less dangerous than Groups A, B, C (or E, F).
Components certified with Group A (or E) may also be used in lower Group B to D (or F to G).

NEC 505: the Gas Groups have the same classifications as per IECEx, as reported in the following table for comparison with NEC 500.

Explosive atmosphere	Typical hazard material	Class	Group		Atos component
			NEC 500	NEC 505	
Gases, vapors and liquids	Acetylene	Class I	A	IIC	
	Hydrogen, Butadiene, Ethylene Oxide, Propylene Oxide	Class I	B	IIC or IIB+H2	
	Ethylene, Formaldehyde, Cyclopropane, Ethyl Ether, etc	Class I	C	IIB	①
	Methane, Butane, Petrol, Natural gas, Propane, Gasoline	Class I	D	IIA	
Dusts	Metallic dusts (conductive and explosive)	Class II	E	IIIC	
	Coal dusts (some are conductive and all are explosive)	Class II	F	IIIC	
	Grain dust	Class II	G	IIIB	
Solid combustible, fibres and particles	Textile products, wood, paper, cotton processing (easily flammable, but does not risk to be explosive)	Class III	-	IIIA	

HIGHER PROTECTION

HIGHER PROTECTION

① Atos ex-proof /UL and Atos stainless steel ex-proof /UL

5.3 Division classification – only for NEC 500 Standard

Each of the three Classes described in section 5.1 is further subdivided into two Divisions:

Division 1 includes explosive substances that are continuously, intermittently or periodically present in the atmosphere.
The ignitable concentrations of above substances exist under normal conditions or it is caused by frequent maintenance or by equipment failure.

Division 2 includes explosive substances present under "unusual" circumstances.
Above substances are normally contained into sealed containers or into closed systems from which they can only escape through accidental rupture or breakdowns of such containers.

The installation and requirements for **Division 1** are more restrictive than for **Division 2**.
Components certified with Division 1 may also be used when Division 2 is required.

5.4 Zone classification – only for NEC 505 Standard

NEC 505 Standard introduces the Zone classification:

Zone 0 defines locations in which an explosive gas is present continuously or for long periods during normal operation.

Zone 1 defines locations in which ignitable concentrations of gas exist under normal operation or it is caused by frequent maintenance or equipment failure.

Zone 2 defines the area in which an explosive gas is not likely to occur or it will exist only for a short time

Component certified with Zone 0 may be used when Zone 1 is required.

The following table reports a comparison between Division classification to NEC 500 and Zone classification to NEC 505 Standards.

	Continuous Hazard	**Intermittent hazard**	**Hazard under abnormal conditions**
NEC 500	Division 1 ①		Division 2
NEC 505	Zone 0 (Zone 20 dust)	Zone 1 (Zone 21 dust) ①	Zone 2 (Zone 22 dust)

① Atos ex-proof /UL and Atos stainless steel ex-proof /UL

5.5 Temperature classes

The temperature classes designate the maximum operating temperatures of the equipment surface which must not exceed the ignition temperature of the surrounding atmosphere.
The temperature class is marked on the component nameplate.

Products certified with temperature class T6 may also be used in lower classes T5 to T1

Code	**Max surface Temperature**		**Atos component**
	[°C]	**[°F]**	
T6	85	185	①
T5	100	212	②
T4A	120	248	
T4	135	275	③
T3C	160	320	
T3B	165	329	
T3A	180	356	
T3	200	392	④ ⑤
T2D	215	419	
T2C	230	446	
T2B	260	500	
T2A	280	536	
T2	300	572	
T1	450	842	

HIGHER PROTECTION

Note:

the Temperature class may change depending on the max ambient temperature where the component is installed. In this case two different T are reported on the components nameplate (i.e. T6/T5).
See technical table of each specific Atos component for Temperature Class.

① Atos ex-proof ON-OFF - Tamb up to +55°C
Atos stainless steel with ex-proof solenoid type OAX, OAXS

② Atos ex-proof ON-OFF - Tamb from +55°C to +70°C
Atos stainless steel with ex-proof solenoid type OAX, OAXS

③ Atos ex-proof proportionals - Tamb up to +55°C

④ Atos ex-proof proportionals - Tamb from +55°C to +70°C

⑤ Atos stainless steel with ex-proof solenoid type OAKX, OAKXS

6 ATEX vs. cULus (NEC)

The following tables report a comparison between ATEX and cULus (NEC) classification systems.

Note: due to the different nature Atex and cULus systems, the direct comparison is not fully applicable.
The comparison is just to be used as a general reference for transition from one system to the other.

6.1 Comparison concerning the classification of hazardous environments due to the presence of Gas or Dust

Gas

ATEX	Zone 0	Zone 1	Zone 2
cULus (NEC 505)	Zone 0	Zone 1	Zone 2
cULus (NEC 500)	Class I, Division I		Class I, Division 2

Dust

ATEX	Zone 20	Zone 21	Zone 22
cULus (NEC 505)	Zone 20	Zone 21	Zone 22
cULus (NEC 500)	Class II, Division I		Class II, Division 2

6.2 Comparison concerning the classification of Gas Groups

	Gas type			
	Propane	**Ethylene**	**Hydrogen**	**Acetylene**
ATEX	IIA	IIB	IIC	IIC
cULus (NEC 505)	IIA	IIB	IIC	IIC
cULus (NEC 500)	D	C	B	A

Note: the direct comparison concerning Dust Group is not possible since the classification criteria between ATEX and cULus are consistently different

6.3 Comparison concerning the Temperature Classes for Gas Group II

ATEX	**cULus (NEC 505)**	**cULus (NEC 500)**	**Max surface temperature [°C]**	**Max surface temperature [°F]**
T6	T6	T6	85	185
T5	T5	T5	100	212
		T4A	120	248
T4	T4	T4	135	275
		T3C	160	320
		T3B	165	329
		T3A	180	356
T3	T3	T3	200	392
		T2D	215	419
		T2C	230	446
		T2B	260	500
		T2A	280	536
T2	T2	T2	300	572
T1	T1	T1	450	842

7 ATOS COMPONENTS EXEMPTED FROM CERTIFICATION AND MARKING

Atos hydraulic components made only by mechanical parts and not equipped with electrical functions are exempted from certification because their functioning does not generate dangerous conditions for the explosive environment.

The safe application of these components in hazardous environments is justified by following analysis:

- All the internal parts of the components are separated and insulated from the external environment by means of pressure-proof seals. The internal volumes are filled by the hydraulic fluid, thus there are no volumes which can be saturated by the external explosive atmosphere.
- The operation of mechanical parts does not produce potential sources of ignition of the explosive gas mixture.
- The functioning of the mechanical parts does not create conditions as overheating which may cause the explosion of the surrounding atmosphere.

The following components are included in this range:

- On-off pressure control valves (without solenoid pilot) type CART-*, ARE, ARAM, AGAM, AGIR, AGIS, AGIU, REM
- Flow control valves type QV, AQFR
- Check valves type DB, DR, ADR, ADRL, AGRL, AGRLE
- Modular valves type HMP, HM, KM, HS, KS, HG, KG, JPG, HC, KC, JPC, HQ, KQ,JPQ,HR, KR, JPR (modular fast/slow valves type DHQ and pressure switch type MAP, cannot be used in potentially explosive atmosphere)
- On off Mechanical, Hydraulic, Pneumatic operated valves
- On-off ISO cartridges, type SC LI and ISO functional covers without solenoid pilot valve.

8 INGRESS PROTECTION (IP)

The “Ingress Protection” identifies the environmental protection of a device defined in IEC Standard 60529.
The IP classification system designates, by means of two digits, the degree of protection provided by a device against ingress of dust and water.

FIRST	DEGREE OF PROTECTION AGAINST SOLID OBJECTS	SECOND	DEGREE OF PROTECTION AGAINST WATER	Atos component
0	Non-protected	**0**	Non-protected	
1	Protected against a solid object with diameter greater than 50 mm	**1**	Protected against water dripping vertically, such as condensation	
2	Protected against a solid object with diameter greater than 12 mm	**2**	Protected against dripping water when tilted up to 15°	
3	Protected against a solid object with diameter greater than 2.5 mm	**3**	Protected against water spraying at an angle of up to 60°	
4	Protected against a solid object with diameter greater than 1.0 mm	**4**	Protected against water splashing from any direction	
5	Dust-protected. Prevents ingress of dust sufficient to cause harm	**5**	Protected against jets of water from any direction	
6	Dust tight. No dust ingress	**6**	Protection against heavy seas or powerful jets of water	① ② ③
		7	Protected against harmful ingress of water when immersed between a depth of 150 mm to 1 meter	① ③
		8	Protected against submersion. Suitable for continuous immersion in water	

① Atos ex-proof multicertification (mining / surface) = IP66/67 ② Atos intrinsically safe = IP66

③ Atos stainless steel ex-proof = IP66/67

The ingress protection of cULus certified components is “Raintight enclosure, UL approved”

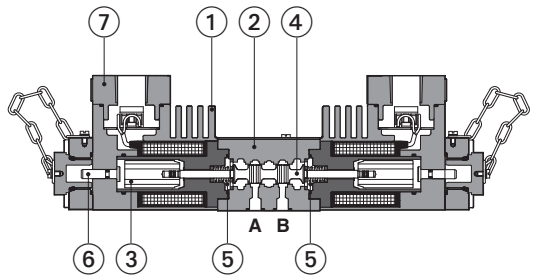
8.1 Comparison between IEC and NEMA standards

An equivalent classification of the enclosures degrees of protection, for the USA market, is defined according to NEMA Standard.
Note: the direct comparison is not possible since the classification criteria are consistently different between IEC and NEMA.
The comparison is just to be used as a general reference for transition from one system to another.

NEMA	1	2	3	3X	3R	3RX	3S	3SX	4	4X	5	6	6P	12	12K	13
IEC (IP)	20	22	55		24		55		66		53	67	68	54		

Stainless steel ex-proof solenoid directional valves

on-off, direct, spool type - **ATEX, IECEx, EAC, PESO** or **cULus**



DHAX(S)4-07*

① ex-proof solenoid
② valve body
③ solenoid plunger
④ spool
⑤ spring
⑥ manual override pin
⑦ cable entrance

DHAX, DHAXS

Ex-proof, spool type, directional solenoid valves made in two different stainless steel executions for corrosive environments and fluids.

- **X** full stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **XS** stainless steel only for external parts to withstand extreme and corrosive environmental conditions.

Ex-proof stainless steel solenoids are provided, with **ATEX, IECEx, EAC, PESO Multicertification** or **cULus** North American certification, see section [8] .

DHAX and DHAXS are **SIL** compliance with IEC 61508 (TÜV certified)

Size: **06** - ISO 4401
4/3 and 4/2 way
Max flow: up to **70 l/min**
Max pressure: **350 bar**

[1] MODEL CODE

DHA	X	4	/	*	-	0	63	1/2	/	M	/	V	24DC	*	/	*	/	*

DHA — Ex-proof solenoid directional valve, direct, spool type

X — Stainless steel executions **(1)**
X = full stainless steel
XS = stainless steel only external parts

4 — **Solenoid power and Temperature class,** see also certification data in section [8] **(2)**:
Multicertification
4 = 25W, class **T4/T3**
6 = 8W, class **T6/T4** (only XS execution)
cULus
4 = 33W, class **T3**
6 = 12W, class **T6/T5**

***** — **Certification type**:
- = omit for **Multicertification** (Group II)
North American Certification:
UL = cULus

0 — **Valve size** (ISO 4401):
0 = 06

63 — **Configuration,** see section [2]:
61, **63**, **71**, **75**

1/2 — **Spool type** - see section [2]

M — **Solenoid threaded connection** for cable gland fitting:
M = M20x1,5 for **Multicertification**
NPT = 1/2" NPT for **/UL**

V — **Options,** see section [13] for possible combined option:
A = solenoid at side of port B
O = horizontal cable entrance
V = with handweel manual override

24DC — **Voltage code,** see section [5]

***** — Series number

***** — **Seals material,** see section [6]:
- = NBR low temp. -40°C
PE = FKM
BBT = FVMQ fluorosilicon -60°C **(4)**

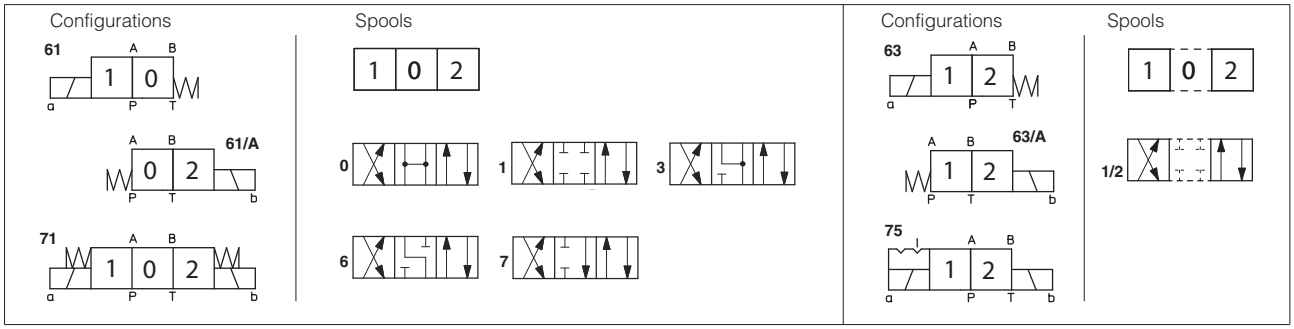
***** — **Test fluid,** only for X execution **(3)**:
H = mineral oil
W = pure water

(1) See section [6] for materials specification.
(2) **6** and **4** versions differ only for the coil power, see power consumption at section [5] and operating limits at section [15]..
(3) DHAX valves in full stainless steel execution are factory tested with mineral oil or pure water in order to avoid the contamination of the end user system. At the end of each valve model code must be specified the type of fluid to be used in the valve's testing: "**H**" for hydraulic oil or "**W**" for pure water.
(4) Only for Multicertified valves in full stainless steel "**X**" execution (not available for valves with UL certification)

1.1 Summary of available models

Valve execution		Multicertification		cULus		Max flow (l/min)	Max pressure (bar)
X	XS	Tclass	Power	Tclass	Power		
DHAX4	**DHAXS4**	T4, T3	25W	T3	33W	70	350
-	**DHAXS6**	T6, T4	8W	T6, T5	12W	60	

2 CONFIGURATIONS AND SPOOLS (representation according to ISO 1219-1)



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BBT** option = -60°C ÷ +70°C
Storage temperature range	**Standard** = -40°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BBT** option = -60°C ÷ +80°C
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" SIL to IEC 61508: 2010, see section 9 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Max operating pressure	Ports P,A,B: **350** bar; Port T **210** bar
Rated flow	See diagrams Q/Δp at section 14
Max flow	DHAX4 = **70 l/min** DHAXS4 = **70 l/min** DHAXS6 = **60 l/min** See operating limits at section 15

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

5 ELECTRICAL CHARACTERISTICS

Valve type	DHAX4 DHAXS4	DHAXS6	DHAX4**/UL** DHAXS4**/UL**	DHAXS6**/UL**
Voltage code **(1)** VDC ±10%	**12DC, 24DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**	
VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**	
Power consumption at 20°C	25W	8W	33W	12W
Coil insulation	class H			
Protection degree with relevant cable gland	IP66/67 to DIN EN60529		raintight enclosure, UL approved	
Duty factor	100%			

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid.
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

6 MATERIALS SPECIFICATION

Valve code	Solenoid housing	Valve body	Internal parts	Spring	Seals		
					std	/PE	/BBT
DHAX	AISI 630	AISI 316L	AISI 316L, 420B, 440C, 430F	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
DHAXS	AISI 630	AISI 316L	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature **(1)**	NBR low temp. seals (standard) = -40°C ÷ +60°C FKM seals (/PE option) = -20°C ÷ +80°C FVMQ seals (/BBT option) = -60°C ÷ +60°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s min = 0,9 mm²/s for X full stainless steel execution with pure water		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR low temp., FKM, FVMQ	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM, FVMQ	HFDU, HFDR	ISO 12922
Flame resistant with water **(2)**	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

(1) The operating temperature of the fluid must be compatible with the maximum viscosity range allowed for the valve

(2) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

8 CERTIFICATION DATA

8.1 Certification data for ambient temperature range -40 ÷ +70°C

Valve type	DHAX4 DHAXS4		DHAXS6		DHAX4**/UL** DHAXS4**/UL**	DHAXS6**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**				North American **cULus**		
Solenoid certified code	**OAKX/WP** **OAKXS/WP**		**OAXS/WP**		**OAKX/EC/WP** **OAKXS/EC/WP**	**OAXS/EC/WP**	
Temperature class	**T4**	**T3**	**T6**	**T4**	**T3**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 85 °C	≤ 135 °C	≤ 200 °C	≤ 85 °C	≤ 100 °C
Ambient temperature	-40 ÷ +45 °C	-40 ÷ +70 °C	-40 ÷ +45 °C	-40 ÷ +70 °C	-40 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C

8.2 Certification data for ambient temperature range -60 ÷ +70°C (valves with option /BBT)

Valve type	DHAX4 **/BBT**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**	
Solenoid certified code	**OABKX/WP**	
Temperature class	**T4**	**T3**
Surface temperature	≤ 85 °C	≤ 135 °C
Ambient temperature	-60 ÷ +45 °C	-60 ÷ +70 °C

8.3 Certificates and applicable standards

Certifications	Multicertification Group II **ATEX IECEx EAC PESO**	North American **cULus**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P391133/1	20170324 - E366100
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex db IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Exd IIC T6/T4/T3 Gb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB
Applicable standards	EN 60079-0 IEC 60079-0 EN 60079-1 IEC 60079-1 EN 60079-31 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13
Cable entrance:	M20x1,5	1/2" NPT ANSI/ASME B46.1

(1) The type examinator certificates can be downloaded from www.atos.com

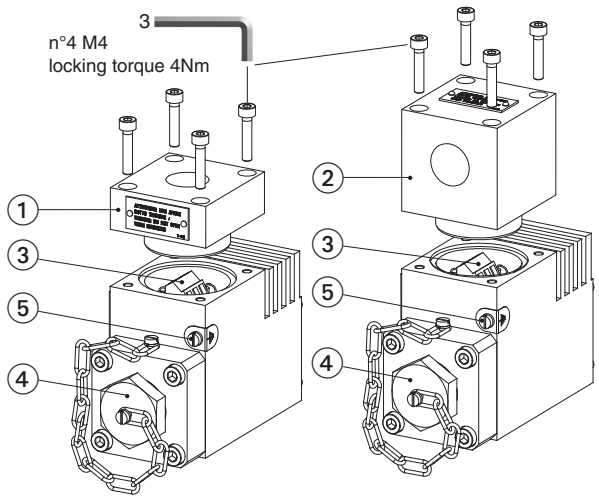
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

9 SIL compliance with IEC 61508: 2010

DHAX and DHAXS meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

10 EX PROOF SOLENOIDS WIRING

Multicertification



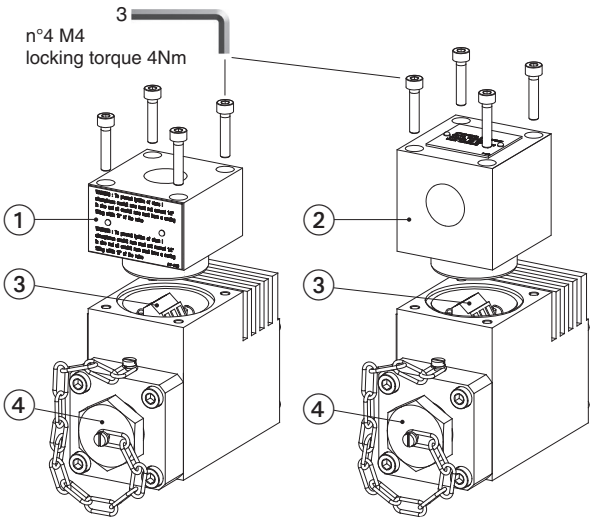
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override protected by cap
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

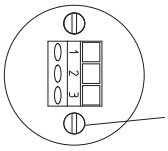
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override protected by cap



⚠ **Pay attention to respect the polarity**

1 = Coil **+** PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 11 note 1
2 = GND
3 = Coil **-**

alternative GND screw terminal connected to solenoid housing

11 CABLE SPECIFICATION AND TEMPERATURE

Multicertification

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -40°C to +110°C

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Solenoid code	Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
OA(B)X OA(B)XS	45 °C	T6	85 °C	not prescribed
	70 °C	T4	135 °C	90 °C
OA(B)KX OA(B)KXS	45 °C	T4	85 °C	100 °C
	50 °C	T3	200 °C	100 °C
	60 °C	T3	200 °C	120 °C
	70 °C	T3	200 °C	130 °C

cULus certification

Solenoid code	Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
OAX/EC OAXS/EC	55 °C	T6	85 °C	100 °C
	70 °C	T5	100 °C	100 °C
OAKX/EC OAKXS/EC	55 °C	T3	200 °C	115 °C
	70 °C	T3	200 °C	140 °C

12 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 OPTIONS

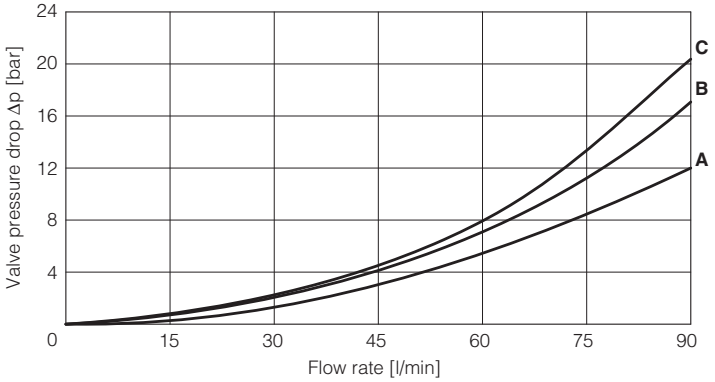
A = solenoid at side of port B (for single solenoid valves)
O = horizontal cable entrance , to be selected in case of limited verical space
V = with handweel manual override

13.1 Possible combined options

AO, AV, OV, AOV

14 Q/Δp DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

Flow direction / Spool type	P→A	P→B	A→T	B→T	P→T
0	A	A	B	B	C
1	C	B	B	B	
3	C	C	A	A	
1/2	C	C	C	C	
6, 7	C	C	C	C	

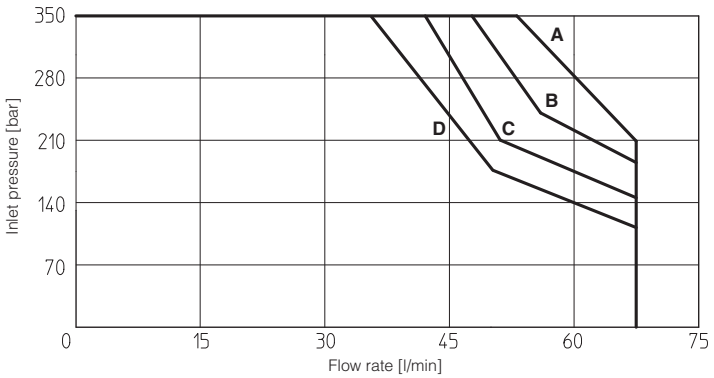


15 OPERATING LIMITS (based on mineral oil ISO VG 46 at 50°C)

The diagram have been obtained with warm solenoids and power supply at lowest value (V_{nom} -10%). The curves refer to application with symmetrical flow through the valve (i.e. P → A and B → T). In case of asymmetric flow the operating limits must be reduced.

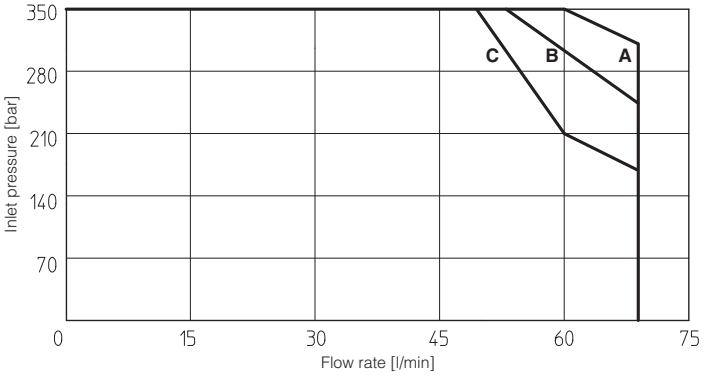
Valve type	Curve	Spool type
DHAX4	A	0 , 1
	B	3
	C	1/2
	D	6, 7

DHAX4



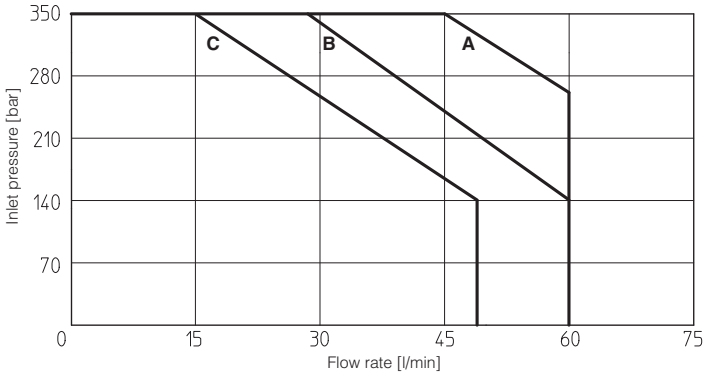
Valve type	Curve	Spool type
DHAXS4	A	0, 1, 3
	B	1/2
	C	6, 7

DHAXS4



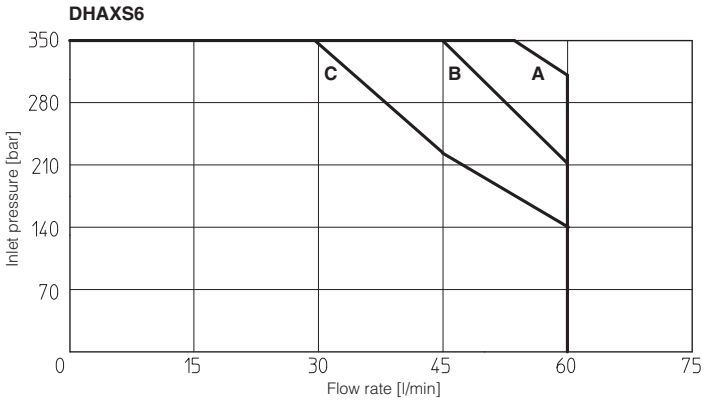
Valve type	Curve	Spool type
DHAX6	A	0
	B	1, 1/2
	C	3, 6, 7

DHAX6

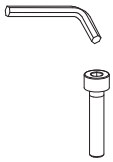


Valve type	Curve	Spool type
DHAXS6	A	0
	B	1, 1/2
	C	3, 6, 7

DHAXS6



16 FASTENING BOLTS AND SEALS

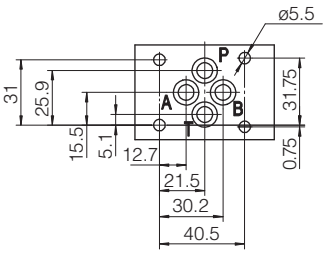
	DHAX, DHAXS
	**Fastening bolts:** 4 socket head screws M5x50-A4-70 Tightening torque = 5,5 Nm
	**Seals:** 4 OR 108; Diameter of ports P, A, B, T: Ø 7,5 mm (max)

17 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

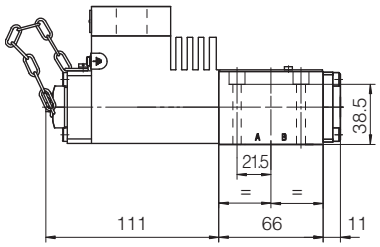
Mass [kg]	
DHAX(S)**-06*	2,9
DHAX(S)**-06*/V	3
DHAX(S)**-07*	4,6
DHAX(S)**-07*/V	4,8
Option /O	+0,35

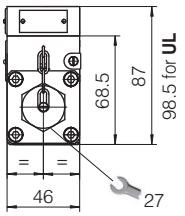
valve's bottom view



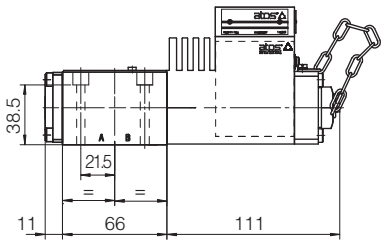
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

DHAX(S)-06***

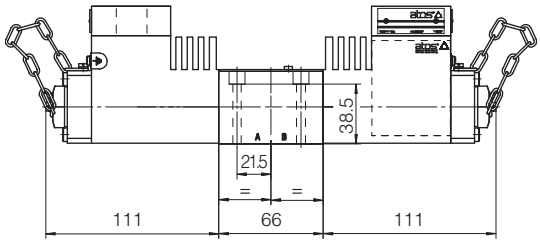


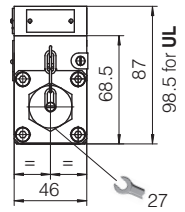


DHAX(S)-06*/A**



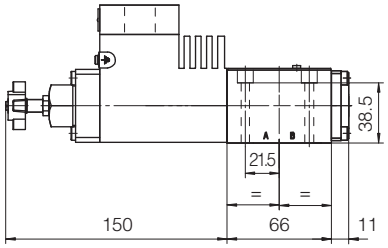
DHAX(S)-07***

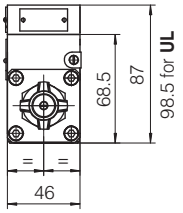




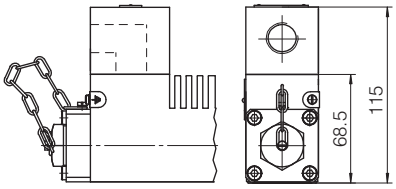
handweel manual override option **/V**

DHAX(S)-06*/V**

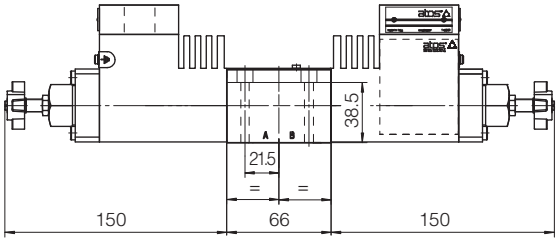


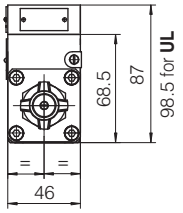


horizontal cable entrance option **/O**



DHAX(S)-07*/V**



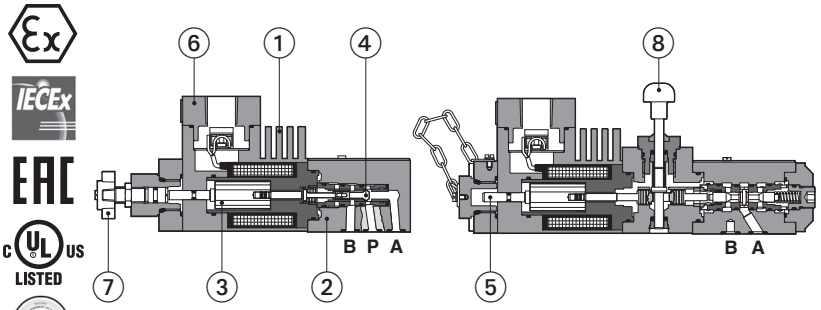


18 RELATED DOCUMENTATION

W010	Basics for electrohydraulics in corrosive environments	**X010**	Basics for electrohydraulics in hazardous environments
W020	Summary of Atos stainless steel components	**KX800**	Cable glands for ex-proof valves
EW900	Operating and maintenance information for stainless steel on-off valves		

Stainless steel ex-proof solenoid directional valves

on-off, direct, poppet type leak free - **ATEX, IECEx, EAC, PESO** or **cULus**



DLAHX(S)6-3A/M/V **DLAHMX(S)4-3A/M/R**

① ex-proof solenoid
② valve body
③ solenoid plunger
④ poppet
⑤ manual override pin
⑥ cable entrance
⑦ handwheel manual override, option V
⑧ manual reset, option R

DLAHX, DLAHXS, DLAHMX, DLAHMXS

Ex-proof, poppet type, directional solenoid valves made in two different stainless steel executions for corrosive environments and fluids.

- **X** full stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **XS** stainless steel only for external parts to withstand extreme and corrosive environmental conditions.

Ex-proof stainless steel solenoids are provided with **ATEX, IECEx, EAC, PESO Multicertification** or **cULus** North American certification, see section [8].

DLAHX and DLAHXS are **SIL** compliance with IEC 61508 (TÜV certified)

DLAHX(S):
Size: **06** - ISO 4401
3/2 way
Max flow: **12 l/min**
Max pressure: **350 bar**

DLAHMX(S):
Size: **06** - ISO 4401
3/2 way
Max flow: **30 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DLAH	X	6	/	*	-	3	A	/	M	/	V	24DC	*	/	*	/	*

DLAH = Ex-proof solenoid directional valve, leak free, max flow 12 l/min
DLAHM = max fow 30 l/min

Stainless steel executions **(1)**:
X = full stainless steel
XS = stainless steel only external parts

Solenoid power and Temperature class, see also certification data in section [8] **(2)**:
Multicertification
4 = 25W, class **T4/T3**
6 = 8W, class **T6/T4**
cULus
4 = 33W, class **T3**
6 = 12W, class **T6/T5**

Certification type:
- = omit for **Multicertification** (Group II)
/UL = cULus certification

3 = three way

Valve configuration - see section [2]:
A = A to T in rest position
C = P to A in rest position - P to B for DLAHX(S)

Solenoid threaded connection for cable gland fitting:
M = M20x1,5 for **Multicertification**
NPT = 1/2" NPT for **/UL**

Options - see section [13] for possible combined options:
O = horizontal cable entrance
R = solenoid manual reset (not combinable with **V**)
V = handweel manual override (not combinable with **R**)

Voltage code - see section [5]

Series number

Seals material, see section [6]:
- = NBR low temp. -40°C
PE = FKM
BBT = FVMQ fluorosilicon -60°C **(4)**

Test fluid, only for X execution **(3)**:
H = mineral oil
W = pure water

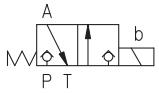
(1) See section [6] for materials specification.
(2) **6** and **4** versions differ only for the coil power, see power consumption at section [5] and operating limits at section [15].
(3) The "X" valves in full stainless steel execution are factory tested by Atos with mineral oil or pure water in order to avoid the contamination of the end user system. At the end of each valve model code must be specified the type of fluid to be used in the valve's testing: "**H**" for hydraulic oil or "**W**" for pure water.
(4) Only for Multicertified valves in full stainless steel "**X**" execution (not available for valves with UL certification)

1.1 Summary of available models

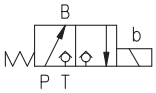
Valve execution		Multicertification		cULus		Max flow (l/min)	Max pressure (bar)
X	XS	Tclass	Power	Tclass	Power		
DLAHX4	**DLAHXS4**	T4, T3	25W	T3	33W	12	350
DLAHX6	**DLAHXS6**	T6, T4	8W	T6, T5	12W	10	315, 350
DLAHMX4	**DLAHMXS4**	T4, T3	25W	T3	33W	25, 30	315
-	**DLAHMXS6**	T6, T4	8W	T6, T5	12W	25	250

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

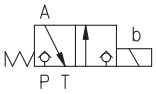
DLAHX(S)-3A



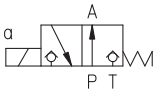
DLAHX(S)-3C



DLAHMX(S)-3A



DLAHMX(S)-3C



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BBT** option = -60°C ÷ +70°C
Storage temperature range	**Standard** = -40°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BBT** option = -60°C ÷ +80°C
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" SIL to IEC 61508: 2010, see section 9 (only for DLAHX and DLAHXS) RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Valve type		**DLAHX4 DLAHXS4**	**DLAHX6**	**DLAHXS6**	**DLAHMX4**	**DLAHMXS4**	**DLAHMXS6**
Valve size		06	06		06		06
Max operating pressure:	ports P, A, B [bar]	350	315	350	315		250
	port T [bar]	110					
Rated flow		see diagrams Q/Δp at section 14					
Max flow **(1)**	[l/min]	12	10		25	30	25
Internal leakage	[cm³/min]	less than 5 drops/min (0,36 cm³/min) at max pressure					

(1) see diagram at section 15

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

5 ELECTRICAL CHARACTERISTICS

Valve type		**DLAHX4 DLAHXS4 DLAHMX4 DLAHMXS4**	**DLAHX6 DLAHXS6 DLAHMXS6**	**DLAHX4/UL DLAHXS4/UL DLAHMX4/UL DLAHMXS4/UL**	**DLAHX6/UL DLAHXS6/UL DLAHMXS6/UL**
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**	
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**	
Power consumption at 20°C		25W	8W	33W	12W
Coil insulation		class H			
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved	
Duty factor		100%			

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid.
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

6 MATERIALS SPECIFICATION

Valve code	**Solenoid housing**	**Valve body**	**Internal parts**	**Spring**	**Seals**		
					std	**/PE**	**/BBT**
DLAHX	AISI 630	AISI 316L	AISI 316L, 420B, 440C, 430F	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
DLAHXS	AISI 630	AISI 630	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-
DLAHMX	AISI 630	AISI 630	AISI 316L, 420B, 440C, 430F	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
DLAHMXS	AISI 630	AISI 630	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature **(1)**	NBR seals (standard) = -40°C ÷ +60°C FKM seals (/PE option) = -20°C ÷ +80°C FVMQ seals (/BBT option) = -60°C ÷ +60°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s min = 0,9 mm²/s for X full stainless steel execution with pure water		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR low temp., FKM, FVMQ	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM, FVMQ	HFDU, HFDR	ISO 12922
Flame resistant with water **(2)**	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

(1) The operating temperature of the fluid must be compatible with the maximum viscosity range allowed for the valve

(2) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

8 CERTIFICATION DATA

8.1 Certification data for ambient temperature range -40 ÷ +70°C

Valve type	DLAHX4, DLAHXS4 DLAHMX4, DLAHMXS4		DLAHX6, DLAHXS6 - , DLAHMXS6		DLAHX4**/UL**, DLAHXS4**/UL** DLAHMX4**/UL**, DLAHMXS4**/UL**	DLAHX6**/UL**, DLAHXS6**/UL** - , DLAHMXS6**/UL**	
Certifications	Multicertification **ATEX IECEx EAC PESO**				North American **cULus**		
Solenoid certified code	**OAKX/WP OAKXS/WP**		**OAX/WP OAXS/WP**		**OAKX/EC/WP OAKXS/EC/WP**	**OAX/EC/WP OAXS/EC/WP**	
Temperature class	**T4**	**T3**	**T6**	**T4**	**T3**	**T6**	**T5**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 85 °C	≤ 135 °C	≤ 200 °C	≤ 85 °C	≤ 100 °C
Ambient temperature	-40 ÷ +45 °C	-40 ÷ +70 °C	-40 ÷ +45 °C	-40 ÷ +70 °C	-40 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C

8.2 Certification data for ambient temperature range -60 ÷ +70°C (valves with option /BBT)

Valve type	DLAHX4 **/BBT** DLAHMX4 **/BBT**		DLAHX6 **/BBT**	
Certifications	Multicertification **ATEX IECEx EAC PESO**			
Solenoid certified code	**OABKX/WP**		**OABX/WP**	
Temperature class	**T4**	**T3**	**T6**	**T4**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 85 °C	≤ 135 °C
Ambient temperature	-60 ÷ +45 °C	-60 ÷ +70 °C	-60 ÷ +45 °C	-60 ÷ +70 °C

8.3 Certificates and applicable standards

Certifications	Multicertification Group II **ATEX IECEx EAC PESO**	North American **cULus**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P391133/1	20170324 - E366100
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex db IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Exd IIC T6/T4/T3 Gb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB
Applicable standards	EN 60079-0 IEC 60079-0 EN 60079-1 IEC 60079-1 EN 60079-31 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13
Cable entrance:	M20x1,5	1/2” NPT ANSI/ASME B46.1

(1) The type examinator certificates can be downloaded from www.atos.com

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

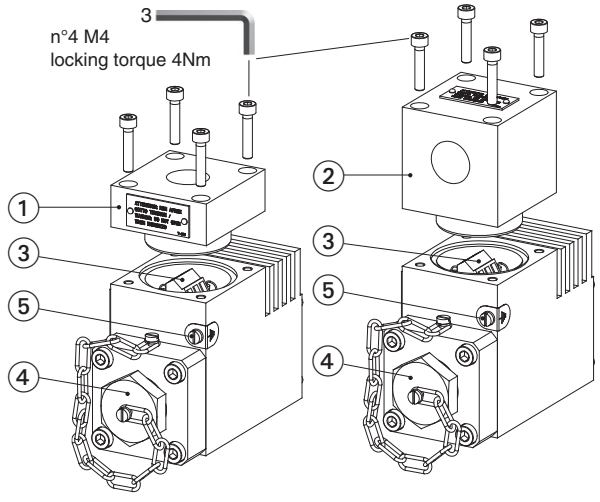
9 SIL compliance with IEC 61508: 2010 - only DLAHX and DLAHXS

DLAHX and DLAHXS meet the requirements of:

- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

10 EX PROOF SOLENOIDS WIRING

Multicertification



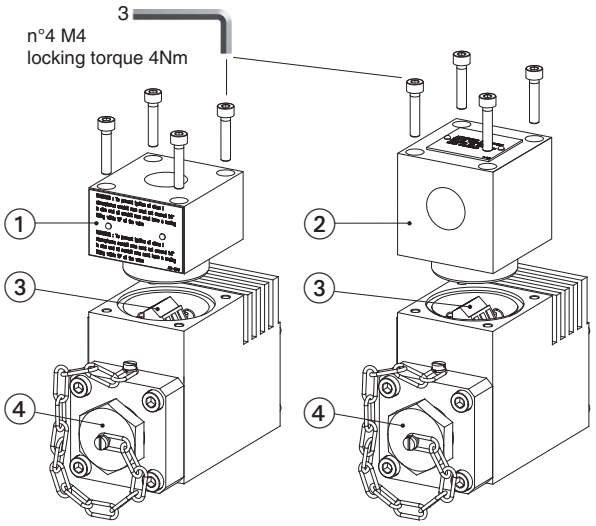
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override protected by cap
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

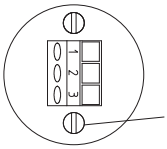
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override protected by cap



⚠ **Pay attention to respect the polarity**

1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 11 note 1

alternative GND screw terminal connected to solenoid housing

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -40°C to +110°C

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of the products.

Multicertification

Solenoid code	Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
OA(B)X OA(B)XS	45 °C	T6	85 °C	not prescribed
	70 °C	T4	135 °C	90 °C
OA(B)KX OA(B)KXS	45 °C	T4	85 °C	100 °C
	50 °C	T3	200 °C	100 °C
	60 °C	T3	200 °C	120 °C
	70 °C	T3	200 °C	130 °C

cULus certification

Solenoid code	Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
OAX/EC OAXS/EC	55 °C	T6	85 °C	100 °C
	70 °C	T5	100 °C	100 °C
OAKX/EC OAKXS/EC	55 °C	T3	200 °C	115 °C
	70 °C	T3	200 °C	140 °C

12 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 OPTIONS

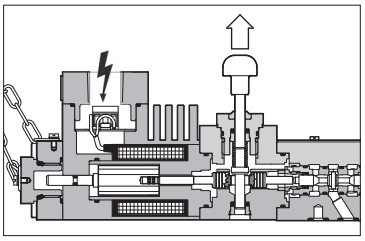
O = horizontal cable entrance , to be selected in case of limited verical space

R = the R device operates as a security (not combinable with /V).
When the valve is electrically energized, the manual reset knob must be manually lifted at the same time in order to permit the poppet to move from the rest position to the switched position.
The return of the valve to the rest position does not require lifting the manual reset knob.

V = with handweel manual override (not combinable with /R)

Option /R

Lift to permit the valve switching



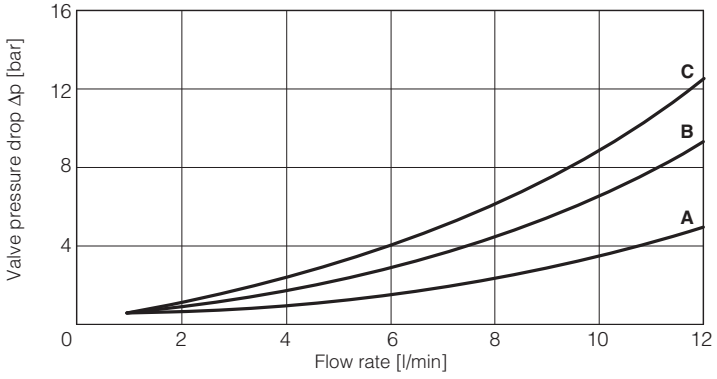
13.1 Possible combined options

OR, OV

14 Q/Δp DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

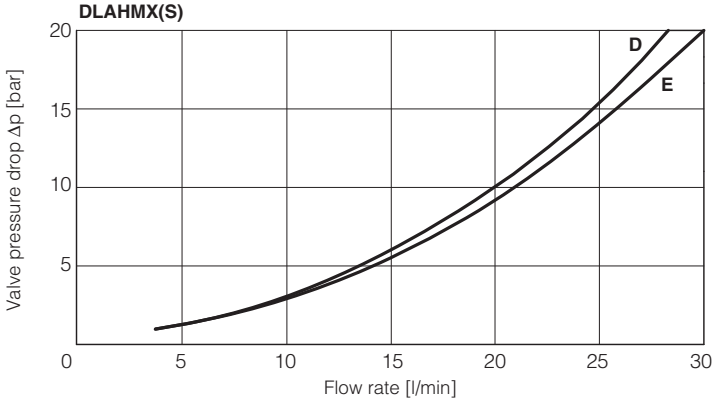
Valve type	Curve	Flow direction
DLAHX(S)-3A	C	P-A, P-B
	B	A-T, B-T
DLAHX(S)-3C	B	P-A, P-B
	A	A-T, B-T

DLAHX(S)



Valve type	Curve	Flow direction
DLAHMX(S)-3A	E	P-A, P-B
	D	A-T, B-T
DLAHMX(S)-3C	E	P-A, P-B
	D	A-T, B-T

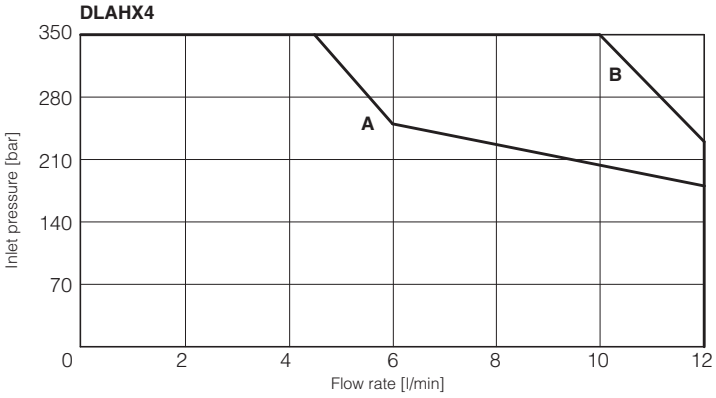
DLAHMX(S)



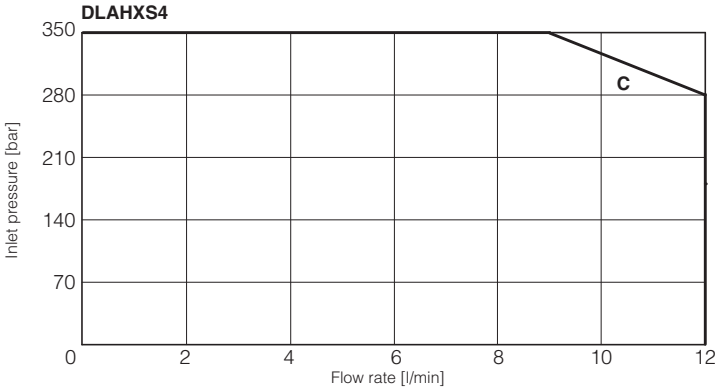
15 **OPERATING LIMITS** (based on mineral oil ISO VG 46 at 50°C)

The diagram have been obtained with warm solenoids and power supply at lowest value (V_{nom} -10%).

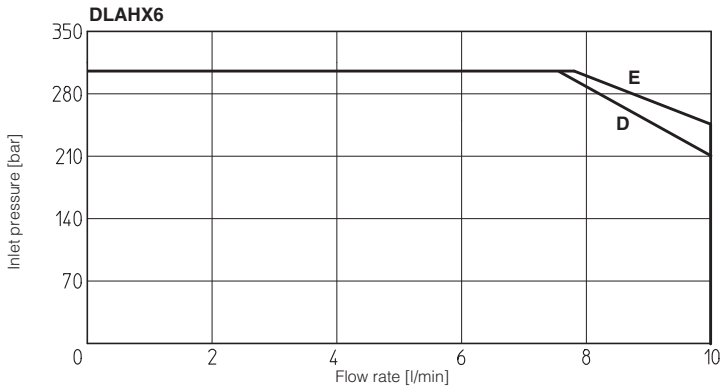
Valve type	Curve	Configuration
DLAHX4	A	3C
	B	3A



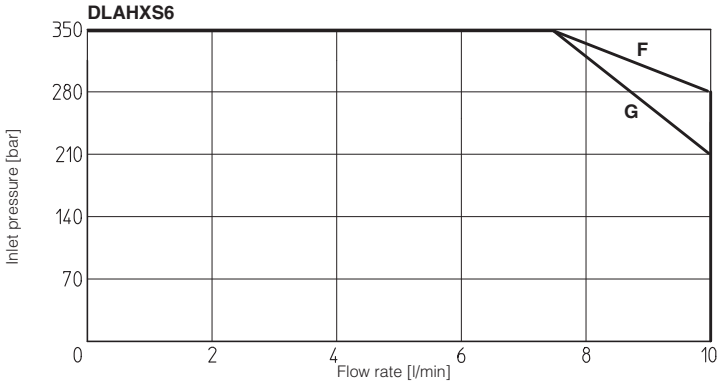
Valve type	Curve	Configuration
DLAHXS4	C	3A , 3C



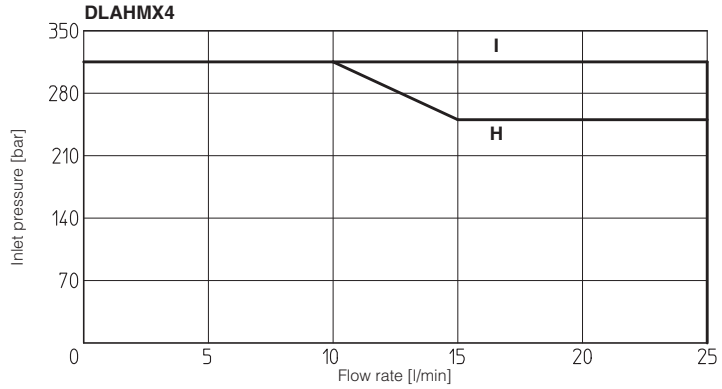
Valve type	Curve	Configuration
DLAHX6	D	3A
	E	3C



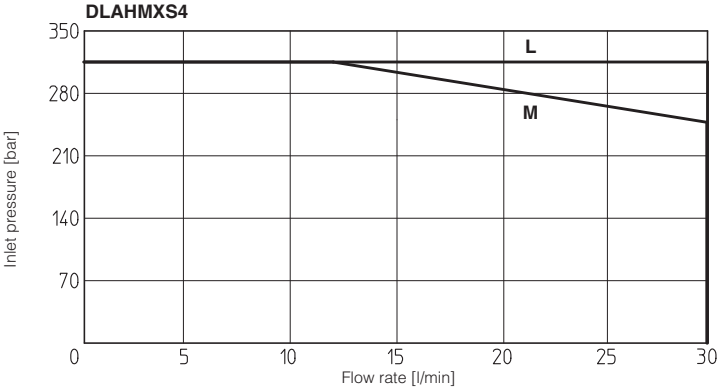
Valve type	Curve	Configuration
DLAHXS6	F	3A
	G	3C



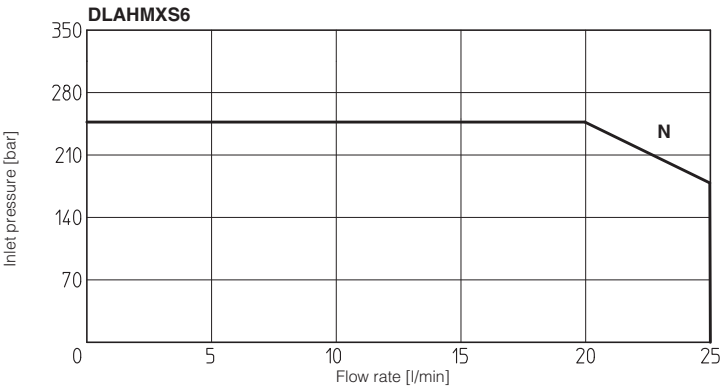
Valve type	Curve	Configuration
DLAHMX4	H	3C
	I	3A



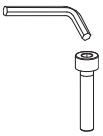
Valve type	Curve	Configuration
DLAHMXS4	L	3A
	M	3C



Valve type	Curve	Configuration
DLAHMXS6	N	3A , 3C



16 FASTENING BOLTS AND SEALS



Fastening bolts:
4 socket head screws M5x50-A4-70
Tightening torque = 5,5 Nm

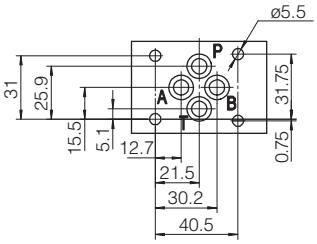
Seals:
4 OR 108;
Diameter of ports P, A, B, T: Ø 7,5 mm (max)

17 INSTALLATION DIMENSIONS [mm]

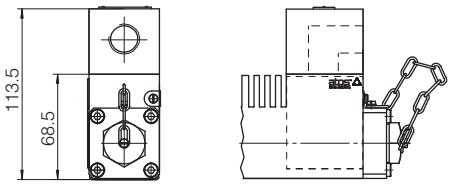
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

Mass [kg]	
DLAHX(S)*-3A/M/V	3
DLAHX(S)*-3C/M	2,9
DLAHMX(S)*-3A/M/R	3,8
DLAHMX(S)*-3C/M	2,9
Option /O	+0,35

valve's bottom view

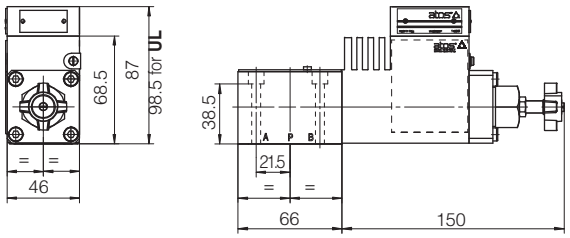


horizontal cable entrance option **/O**

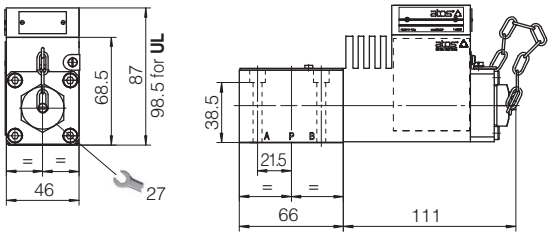


P = PRESSURE PORT
A = USE PORT (not used for -3C version)
B = USE PORT (not used for -3A version)
T = TANK PORT

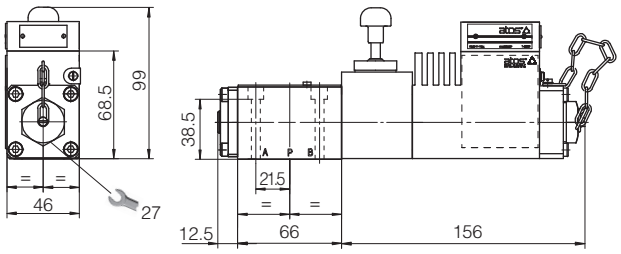
DLAHX(S)*-3A/M/V



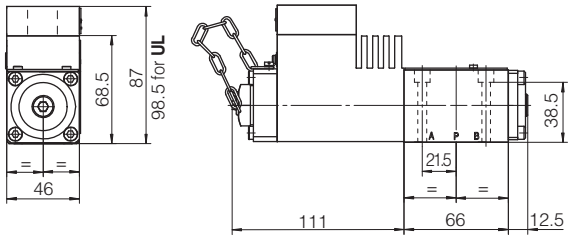
DLAHX(S)*-3C/M



DLAHMX(S)*-3A/M/R



DLAHMX(S)*-3C/M

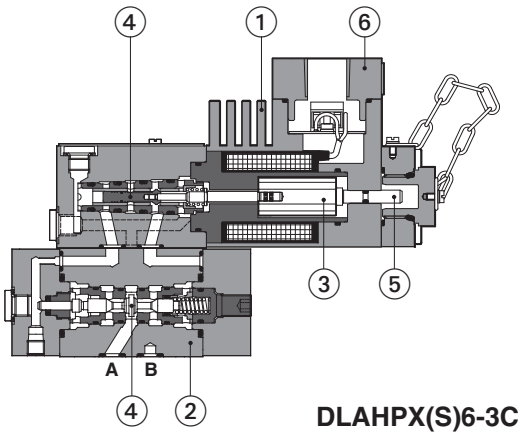


18 RELATED DOCUMENTATION

W010	Basics for electrohydraulics in corrosive environments	**X010**	Basics for electrohydraulics in hazardous environments
W020	Summary of Atos stainless steel components	**KX800**	Cable glands for ex-proof valves
EW900	Operating and maintenance information for stainless steel on-off valves		

Stainless steel ex-proof solenoid directional valves

on-off, piloted, poppet type leak free - **ATEX, IECEx, EAC, PESO** or **cULus**



DLAHPX(S)6-3C

① ex-proof solenoid
② main stage valve body
③ solenoid plunger
④ spool / poppet
⑤ manual override pin
⑥ cable entrance

DLAHPX, DLAHPXS
DLAPX, DLAPXS

Ex-proof, poppet type, piloted solenoid valves made in two different stainless steel executions for corrosive environments and fluids.

- **X** full stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **XS** stainless steel only for external parts to withstand extreme and corrosive environmental conditions.

Ex-proof stainless steel solenoids are provided with **ATEX, IECEx, EAC, PESO Multicertification** or **cULus** North American certification, see section [8].

DLAHPX(S):
Size: **06** - ISO 4401
3/2 way
Max flow: **40 l/min**
Max pressure: **315 bar**

DLAPX(S):
Size: **16** - not ISO
3/2 way
Max flow: **220 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DLAHP	X	6	/	*	-	3	A	/	M	/	V	24DC	*	/	*	/	*

Ex-proof solenoid directional valve, leak free
DLAHP = ISO size 06 max flow 40 l/min
DLAP = size 16 not ISO max flow 220 l/min

Stainless steel executions **(1)**
X = full stainless steel
XS = stainless steel only external parts

Solenoid power and Temperature class, see also certification data in section [8]:
Multicertification
6 = 8W, class **T6/T4**
cULus
6 = 12W, class **T6/T5**

Certification type:
- = omit for **Multicertification** (Group II)
/UL = cULus certification

3 = three way

Valve configuration - see section [2]:
A = A to T in rest position
C = P to A in rest position

Solenoid threated connection for cable gland fitting:
M = M20x1,5 UNI-4535 (6H/6g) for **Multicertification**
NPT = 1/2" NPT ANSI/ASME B46.1 (tapered) for **/UL**

Options - see section [12] for possible combined options:
D = internal drain - only for DLAPX(S)
E = external pilot pressure - only for DLAPX(S)
O = horizontal cable entrance
R = solenoid manual reset (not combinable with **V**)
V = handweel manual override (not combinable with **R**)

Voltage code - see section [5]

Series number

Seals material, see section [6]:
- = NBR low temp. -40°C
PE = FKM
BBT = FVMQ fluorosilicon -60°C **(3)**

Test fluid, only for X execution **(2)**:
H = mineral oil
W = pure water

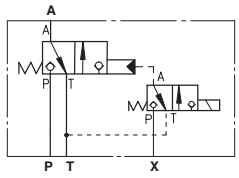
(1) See section [6] for materials specification.
(2) The "X" valves in full stainless steel execution are factory tested by Atos with mineral oil or pure water in order to avoid the contamination of the end user system. At the end of each valve model code must be specified the type of fluid to be used in the valve's testing: "**H**" for hydraulic oil or "**W**" for pure water.
(3) Only for Multicertified valves in full stainless steel "**X**" execution (not available for valves with UL certification)

1.1 Summary of available models

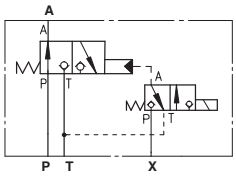
Valve execution		Multicertification		cULus		Max flow (l/min)	Max pressure (bar)
X	XS	Tclass	Power	Tclass	Power		
DLAHPX6	**DLAHPXS6**	T6, T4	8W	T6, T5	12W	40	315
DLAPX6	**DLAPXS6**	T6, T4	8W	T6, T5	12W	220	

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

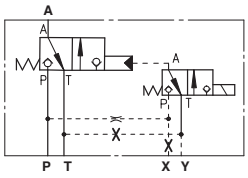
DLAHPX(S)6-3A



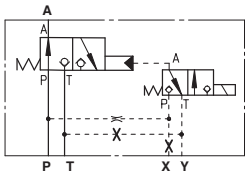
DLAHPX(S)6-3C



DLAPX(S)6-3A



DLAPX(S)6-3C



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	75 years; for further details see technical table P007
Ambient temperature	**Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BBT** option = -60°C ÷ +70°C
Storage temperature range	**Standard** = -40°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BBT** option = -60°C ÷ +80°C
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Valve type		**DLAHPX6 DLAHPXS6**	**DLAPX6 DLAPXS6**
Valve size		06	not ISO standard
Max operating pressure:	ports P, A, B [bar]	315	315
	port T [bar]	110	
Pilot pressure:	Max [bar]	315	315
	Min [bar]	90	see diagram at section 14
Max flow	[l/min]	40	220
Internal leakage	[cm³/min]	less than 5 drops/min (0,36 cm³/min) at max pressure	

⚠ For DLAHPX(S) and for DLAPX(S) with internal drain (option /D) the pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

5 ELECTRICAL CHARACTERISTICS

Valve type		**DLAHPX6 DLAHPXS6**	**DLAPX6 DLAPXS6**	**DLAHPX6/UL DLAHPXS6/UL**	**DLAPX6/UL DLAPXS6/UL**
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**	
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**	
Power consumption at 20°C		8W		12W	
Coil insulation		class H			
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved	
Duty factor		100%			

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid.
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

6 MATERIALS SPECIFICATION

Valve type	**Solenoid housing**	**Valve body**	**Internal parts**	**Spring**	**Seals**		
					std	**/PE**	**/BBT**
DLAHPX	AISI 630	AISI 630	AISI 316L, 420B, 440C, 430F	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
DLAHPXS	AISI 630	AISI 630	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-
DLAPX	AISI 630	AISI 630	AISI 316L, 420B, 440C, 430F	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
DLAPXS	AISI 630	AISI 630	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature **(1)**	NBR seals (standard) = -40°C ÷ +60°C FKM seals (/PE option) = -20°C ÷ +80°C FVMQ seals (/BBT option) = -60°C ÷ +60°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s min = 0,9 mm²/s for X full stainless steel execution with pure water		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR low temp., FKM, FVMQ	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM, FVMQ	HFDU, HFDR	ISO 12922
Flame resistant with water **(2)**	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

(1) The operating temperature of the fluid must be compatible with the maximum viscosity range allowed for the valve

(2) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

8 CERTIFICATION DATA

8.1 Certification data for ambient temperature range -40 ÷ +70°C

Valve type	DLAHPX6, DLAHPXS6 DLAPX6, DLAPXS6		DLAHPX6**/UL**, DLAHPXS6**/UL** DLAPX6**/UL**, DLAPXS6**/UL**	
Certifications	Multicertification **ATEX IECEx EAC**		North American **cULus**	
Solenoid certified code	**OAX/WP** **OAXS/WP**		**OAX/EC/WP** **OAXS/EC/WP**	
Temperature class	**T6**	**T4**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C

8.2 Certification data for ambient temperature range -60 ÷ +70°C (valves with option /BBT)

Valve type	DLAHPX6, DLAPX6	
Certifications	Multicertification **ATEX IECEx EAC PESO**	
Solenoid certified code	**OABX/WP**	
Temperature class	**T6**	**T4**
Surface temperature	≤ 85 °C	≤ 135 °C
Ambient temperature **(2)**	-60 ÷ +45 °C	-60 ÷ +70 °C

8.3 Certificates and applicable standards

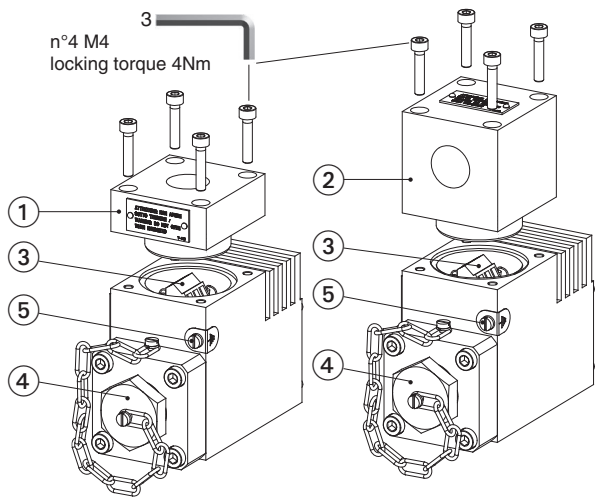
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		North American **cULus**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P391133/1		20170324 - E366100
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex db IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Exd IIC T6/T4/T3 Gb		• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31	IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13
Cable entrance:	M20x1,5		1/2" NPT ANSI/ASME B46.1

(1) The type examinator certificates can be downloaded from www.atos.com

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

9 EX PROOF SOLENOIDS WIRING

Multicertification



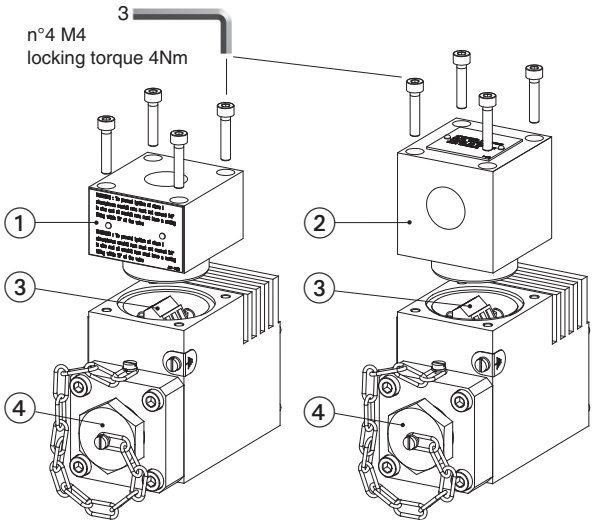
Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override protected by cap
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

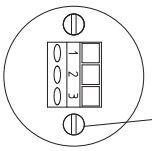
PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override protected by cap



⚠ **Pay attention to respect the polarity**

1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -40°C to +110°C

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Solenoid code	Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
OA(B)X	45 °C	T6	85 °C	not prescribed
OA(B)XS	70 °C	T4	135 °C	90 °C

cULus certification

Solenoid code	Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
OAX/EC	55 °C	T6	85 °C	100 °C
OAXS/EC	70 °C	T5	100 °C	100 °C

11 CABLE GLANDS - only **Multicertification**

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 OPTIONS

O = horizontal cable entrance , to be selected in case of limited verical space
R = solenoid manual reset (not combinable with /V)
V = with handweel manual override (not combinable with /R)

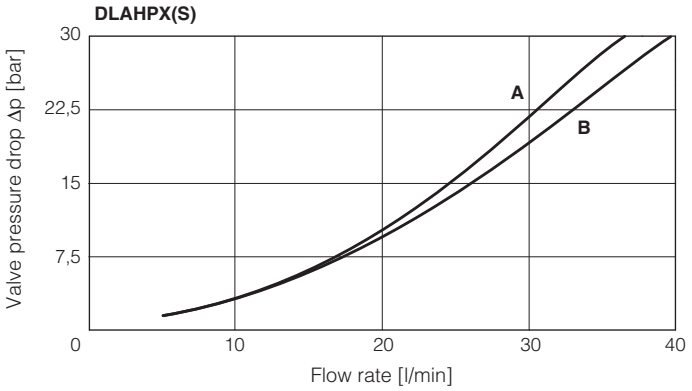
Only for DLAPX(S)
D = internal drain
E = external pilot pressure

12.1 Possible combined options

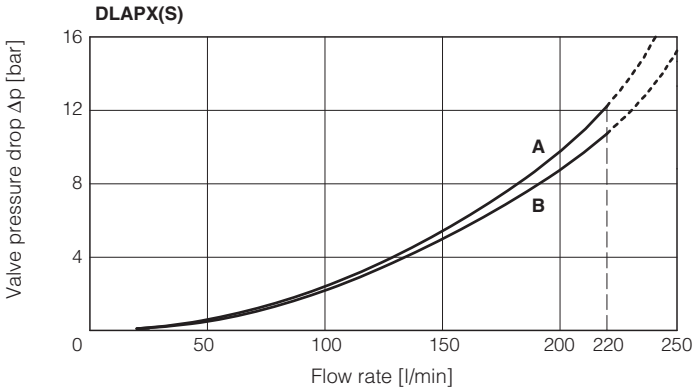
DLAHPX(S): OR, OV
DLAPX(S): DE, DO, DR, DV, EO, ER, EV, OR, OV, DEO, DER, DEV, DOR, DOV, EOR, EOV

13 Q/Δp DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

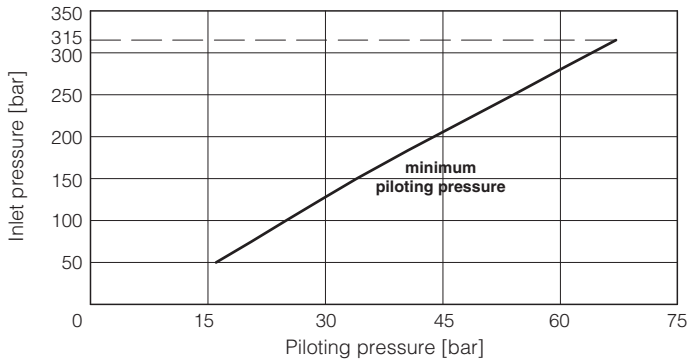
Valve type	Curve	Flow direction
DLAHPX DLAHPXS	A	P-A, P-B
	B	A-T, B-T



Valve type	Curve	Flow direction
DLAPX DLAPXS	A	A-T
	B	P-A



14 MINIMUM PILOT PRESSURE FOR DLAPX(S)



15 FASTENING BOLTS AND SEALS

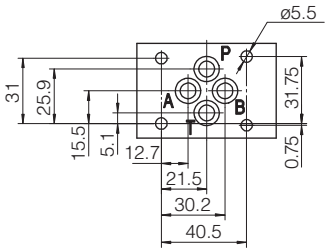
Type	Size	Fastening bolts	Seals
DLAHPX(S)	**06**	4 socket head screws M5x75-A4-70 Tightening torque = 5,5 Nm	4 OR 108 Diameter of ports P, A, B, T: Ø 7,5 mm (max)
DLAPX(S)	no ISO standards	4 socket head screws M10x70-A4-70 Tightening torque = 40 Nm	3 OR 3081 Diameter of ports P, A, T: Ø 16 mm (max) 2 OR 108 Diameter of ports X, Y: Ø 7 mm (max)

16 INSTALLATION DIMENSIONS OF DLAHPX(S) [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

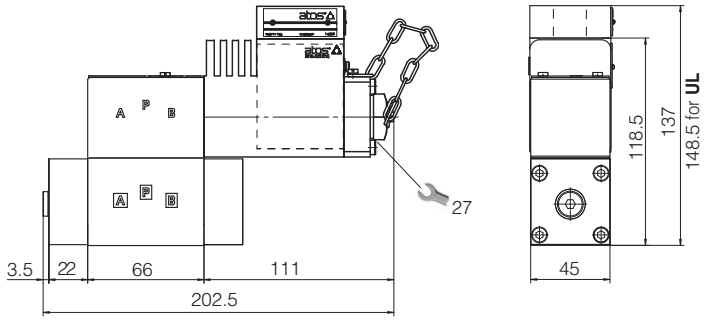
Mass [kg]	
DLAHPX(S)-3A	7,8
DLAHPX(S)-3C	7,5
Option /O	+0,35
Option /V	+0,35

valve's bottom view

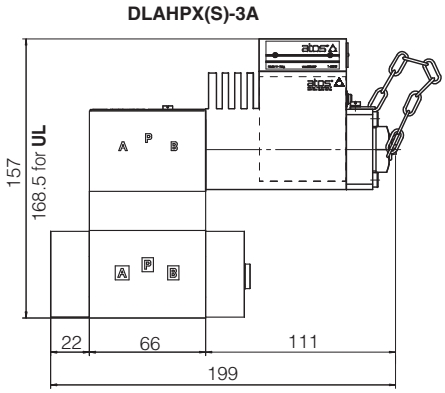


P = PRESSURE PORT
A = USE PORT
B = not used
T = TANK PORT
X = PILOT PORT

DLAHPX(S)-3C



DLAHPX(S)-3A

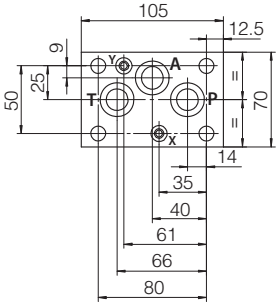


17 INSTALLATION DIMENSIONS OF DLAPX(S) [mm]

Mounting surface not ISO standard

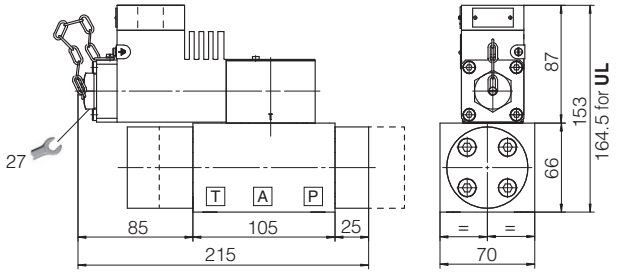
Mass [kg]	
DLAPX(S)6-3A	8,5
DLAPX(S)6-3C	8,5
Option /O	+0,35
Option /V	+0,35

valve's bottom view

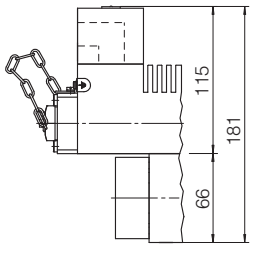


P = PRESSURE PORT
A = USE POR
T = TANK PORT
X = PILOT PORT
Y = DRAIN PORT

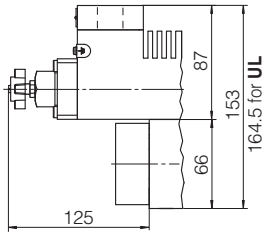
DLAPX(S)6-3C/M
DLAPX(S)6-3A/M (dotted line)



option **/O**



option **/V**

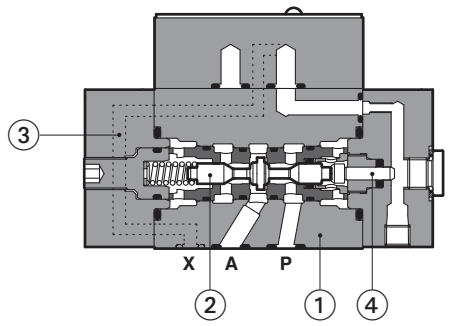


18 RELATED DOCUMENTATION

W010	Basics for electrohydraulics in corrosive environments	**X010**	Basics for electrohydraulics in hazardous environments
W020	Summary of Atos stainless steel components	**KX800**	Cable glands for ex-proof valves
EW900	Operating and maintenance information for stainless steel on-off valves		

Stainless steel hydraulic operated directional valves

on-off, poppet type leak free



DLHPX-3A

① valve body
② poppet
③ piloting line
④ piloting actuator

DLHPX, DLHPXS
DLPX, DLPXS

Poppet type, hydraulic operated directional valves made in two different stainless steel executions for corrosive environments:

- **•X** stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **•XS** stainless steel for external parts to withstand extreme and corrosive environmental conditions.

DLPX and DLPXS are **SIL** compliance with IEC 61508 (TÜV certified)

DLHPX(S):	**DLPX(S)**:
Size: **06** - ISO 4401	Size: **16** - not ISO
3/2 way	3/2 way
Max flow: **40 l/min**	Max flow: **220 l/min**
Max pressure: **315 bar**	Max pressure: **315 bar**

1 **MODEL CODE**

DLHP	**X**	-	**3**	**A**	*	/	*	/	*

Hydraulic operated directional valves
DLHP = ISO size 06, max flow 40 l/min
DLP = Size 16 not ISO, max flow 220 l/min

Stainless steel executions **(1)**:
X = full stainless steel
XS = stainless steel only external parts

3 = three way

Valve configuration - see section **2** :
A = A to T in rest position
C = P to A in rest position

Series number

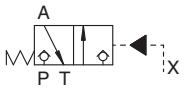
Test fluid, only for X execution **(2)**:
H = mineral oil
W = pure water

Seals material, see section **5**:
- = NBR low temp. -40°C
PE = FKM
BBT = FVMQ fluorosilicon -60°C **(3)**

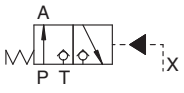
(1) See section **5** for materials specifications:
(2) The "X" valves in full stainless steel execution are factory tested by Atos with mineral oil or pure water in order to avoid the contamination of the end user system. At the end of each valve model code must be specified the type of fluid to be used in the valve's testing: "**H**" for hydraulic oil or "**W**" for pure water.
(3) Only for full stainless steel "**X**" execution

2 **CONFIGURATIONS AND HYDRAULIC SYMBOLS** (representation according to ISO 1219-1)

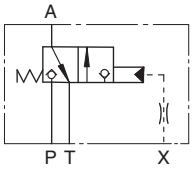
DLHPX(S)*-3A



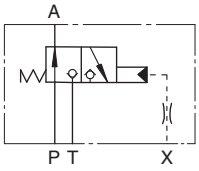
DLHPX(S)*-3C



DLPX(S)-3A



DLPX(S)-3C



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years for direct operated; for further details see technical table P007
Ambient temperature	**Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BBT** option = -60°C ÷ +70°C
Storage temperature range	**Standard** = -40°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BBT** option = -60°C ÷ +80°C
Compliance	SIL to IEC 61508: 2010, see section 7 (only for DLPX and DLPXS) RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Valve type		**DLHPX DLHPXS**	**DLPX DLPXS**
Valve size		06	not ISO standard
Max operating pressure:	ports P, A, X [bar]	315	
	port T [bar]	110	
Pilot pressure	max [bar]	315	315
	min [bar]	90	see diagram at section 9
Max flow	[l/min]	40	220
Internal leakage	[cm³/min]	Less than 5 drops/min (0,36 cm³/min) at max pressure	

5 MATERIALS SPECIFICATION

Valve code	**Solenoid housing**	**Valve body**	**Internal parts**	**Spring**	**Seals**		
					std	**/PE**	**/BBT**
DLHPX	AISI 630	AISI 630	AISI 316L, 420B, 440C, 430F	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
DLHPXS	AISI 630	AISI 630	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-
DLPX	AISI 630	AISI 630	AISI 316L, 420B, 440C, 430F	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
DLPXS	AISI 630	AISI 630	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature **(1)**	NBR seals (standard) = -40°C ÷ +60°C FKM seals (/PE option) = -20°C ÷ +80°C FVMQ seals (/BBT option) = -60°C ÷ +60°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s min = 0,9 mm²/s for X full stainless steel execution with pure water		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR low temp., FKM, FVMQ	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM, FVMQ	HFDU, HFDR	ISO 12922
Flame resistant with water **(2)**	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

(1) The operating temperature of the fluid must be compatible with the maximum viscosity range allowed for the valve

(2) **Performance limitations in case of flame resistant fluids with water:**
-max operating pressure = 210 bar -max fluid temperature = 50°C

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

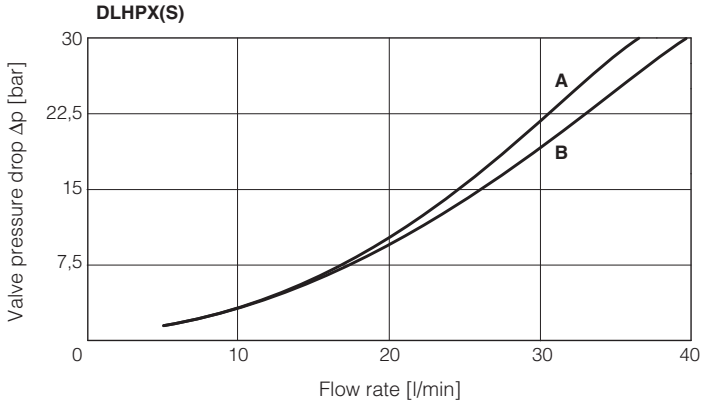
7 SIL compliance with IEC 61508: 2010 - only DLPX and DLPXS

DLPX and DLPXS meet the requirements of:

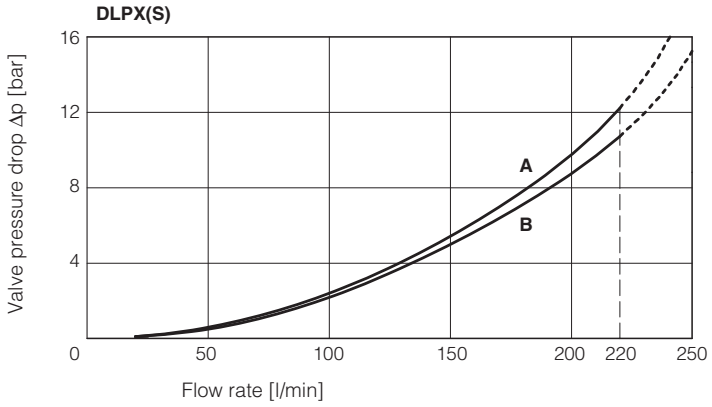
- **SC3** (systematic capability)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

8 Q/Δp DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

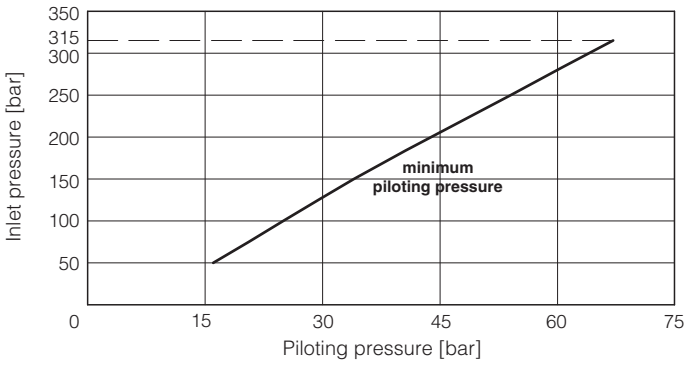
Valve type	Curve	Flow direction
DLHPX DLHPXS	A	P-A, P-B
	B	A-T, B-T



Valve type	Curve	Flow direction
DLPX DLPXS	A	A-T
	B	P-A



9 MINIMUM PILOT PRESSURE FOR DLPX(S)



10 FASTENING BOLTS AND SEALS

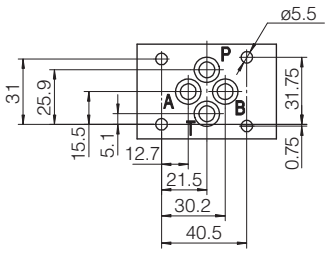
Type	Size	Fastening bolts	Seals
DLHPX(S)	**06**	4 socket head screws M5x75-A4-70 Tightening torque = 5,5 Nm	4 OR 108; Diameter of ports P, A, B, T: Ø 7,5 mm (max)
DLPX(S)	no ISO standards	4 socket head screws M10x70-A4-70 Tightening torque = 40 Nm	3 OR 3081; Diameter of ports P, A, T: Ø 16 mm (max) 2 OR 108; Diameter of ports X, Y: Ø 7 mm (max)

11 INSTALLATION DIMENSIONS OF DLHPX(S) [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05

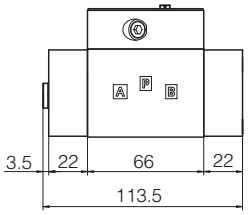
Mass [kg]	
DLHPX(S)	5

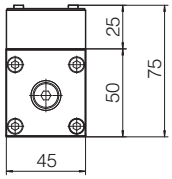
valve's bottom view



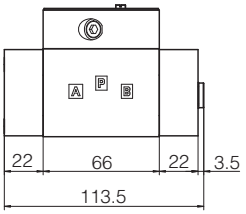
P = PRESSURE PORT
A = USE PORT
B = not present
T = TANK PORT
X = PILOT PORT

DLHPX(S)-3C





DLHPX(S)-3A

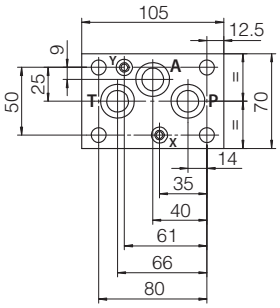


12 INSTALLATION DIMENSIONS OF DLPX(S) [mm]

Mounting surface not ISO standard

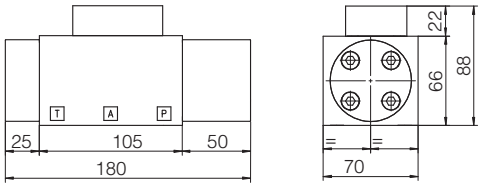
Mass [kg]	
DLPX(S)	6

valve's bottom view

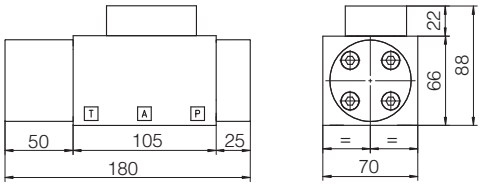


P = PRESSURE PORT
A = USE POR
T = TANK PORT
X = PILOT PORT
Y = DRAIN PORT

DLPX(S)-3A



DLPX(S)-3C

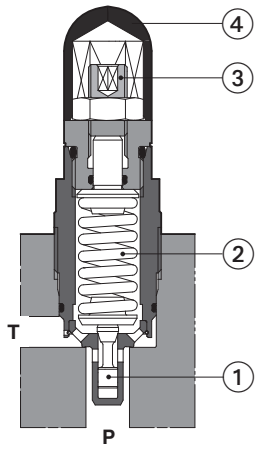


13 RELATED DOCUMENTATION

W010	Basics for electrohydraulics in corrosive environments
W020	Summary of Atos stainless steel components
EW900	Operating and maintenance information for stainless steel on-off valves

Stainless steel pressure relief valves

direct, screw-in cartridges



① Poppet
② Spring
③ Pressure adjustment screw
④ Plastic cap

CART MX-6

CART-MX(S), CART-AREX(S)

Screw-in, direct operated pressure relief valves used to limit the max pressure in the hydraulic systems or to protect part of the circuit from overpressure.
The cartridge design reduces the dimension of blocks and manifolds, without penalizing the functional characteristics.
They are available in three sizes and in two different stainless steel executions for corrosive environments and fluids.

- **•X** full stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **•XS** stainless steel only for external parts to withstand extreme and corrosive environmental conditions.

Size: **G1/2" ÷ M35**
Max flow: **2,5 ÷ 120 l/min**
Max pressure: up to **420 bar**

1 MODEL CODE OF SCREW-IN VALVES

CART	AREX-20	/	350	/	R	*	/	*	/	*

CART: Screw-in pressure relief cartridge

AREX-20: Size and stainless steel execution **(1)**:
MX-3, MXS-3 = G1/2"
MX-6, MXS-6 = M33x1,5
AREX-20, AREXS-20 = M35x1,5

350: **Max pressure settings**:
see hydraulic characteristics in section 4

R = reduced leakage for special applications only for CART AREX-20 and CART AREXS-20 **(2)**

***** (Series number)

***** (**Seals material,** see section 5):
- = NBR low temp. -40°C
PE = FKM
BBT = FVMQ fluorosilicon -60°C **(4)**

***** (**Test fluid**, only for X execution: **(3)**)
H = mineral oil
W = pure water

For **PED** safety version see technical table CWY010

(1) **X** = Full stainless steel
XS = Stainless steel only for external parts

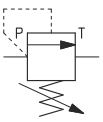
See section 5 for material specification

(2) Code **R** must be always reported in the model code of CART AREX-20 and CART AREXS-20

(3) CART MX and CART AREX in full stainless steel execution are factory tested with mineral oil or pure water in order to avoid the contamination of the end user system. At the end of each valve model code must be specified the type of fluid to be used in the valve's testing: "**H**" for hydraulic oil or "**W**" for pure water.

(4) Only for full stainless steel "**X**" execution

2 HYDRAULIC SYMBOLS



CART-*X

CART-*XS

3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Cavity	See section 8
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BBT** option = -60°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BBT** option = -60°C ÷ +80°C
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULICS CHARACTERISTICS

Valve model		**CART MX-3 CART MXS-3**	**CART MX-6 CART MXS-6**	**CART AREX-20 CART AREXS-20**
Max pressure setting	[bar]	50, 100, 210, 350, 420	50, 100, 210, 350, 420	50, 100, 210, 315, 400
Pressure range **(1)**	[bar]	4÷50, 6÷100, 7÷210, 8÷350, 15÷420	2÷50, 3÷100, 8÷210, 15÷350, 15÷420	3÷50, 5÷100, 6÷210, 8÷315, 10÷400
Max flow	[l/min]	2,5	40	120

(1) The values correspond to the min and max regulation of the valve's craking pressure

5 MATERIALS SPECIFICATION

Valve code	**Valve type**	**Valve body**	**Internal parts**	**Spring**	**Seals**		
					std	**/PE**	**/BBT**
CART-*X	Screw-in	AISI 316L	AISI 316L, 420B, 440C	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
CART-*XS	Screw-in	AISI 316L	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-

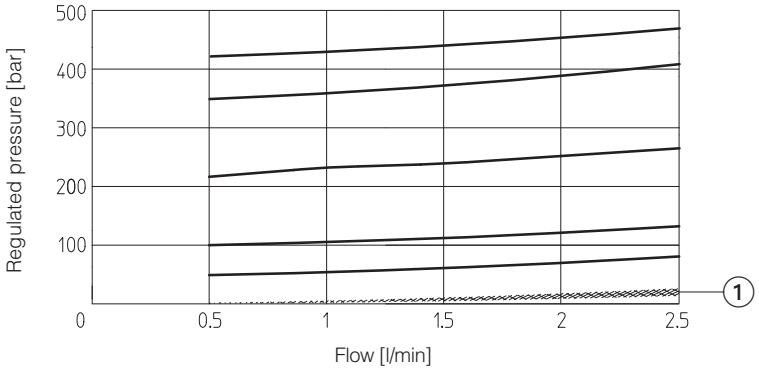
6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature **(1)**	NBR seals (standard) = -40°C ÷ +60°C FKM seals (/PE option) = -20°C ÷ +80°C FVMQ seals (/BBT option) = -60°C ÷ +60°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s min = 0,9 mm²/s for X full stainless steel execution with pure water		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR low temp., FKM, FVMQ	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM, FVMQ	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

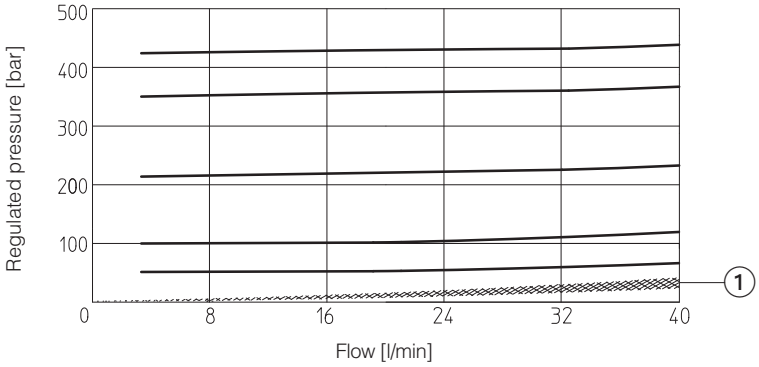
(1) The operating temperature of the fluid must be compatible with the maximum viscosity range allowed for the valve

7 REGULATED PRESSURE VS FLOW DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

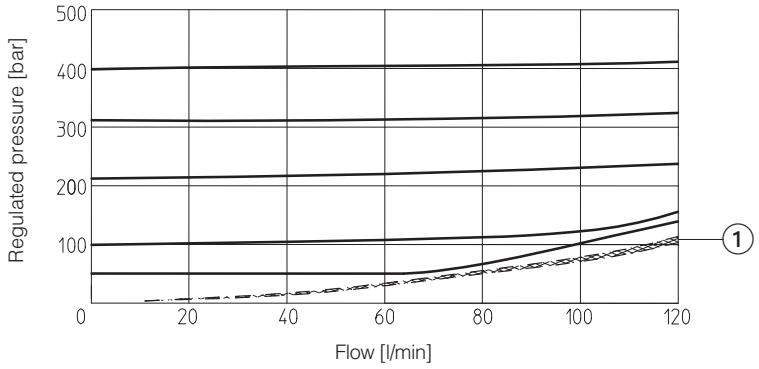
CART MX(S)-3



CART MX(S)-6



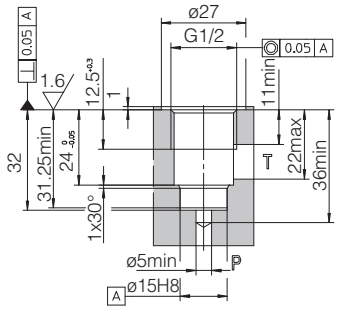
CART AREX(S)-20 **/R

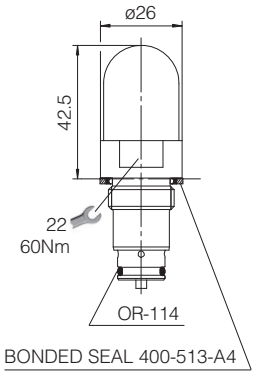


(1) Minimum pressure with the adjustment screw fully unscrewed

8 CAVITY AND INSTALLATION DIMENSIONS [mm]

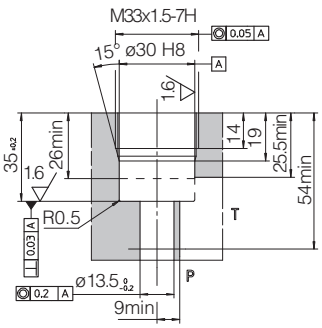
CART MX(S)-3

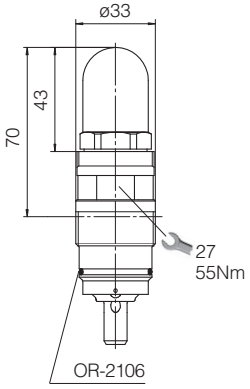




Mass [kg]	0,12

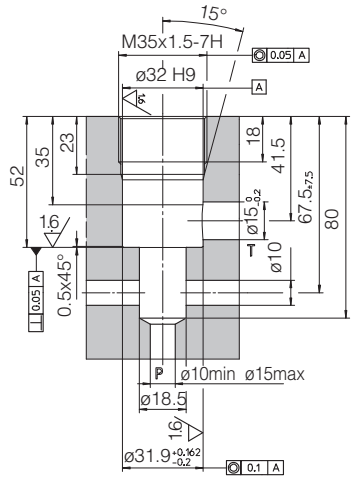
CART MX(S)-6

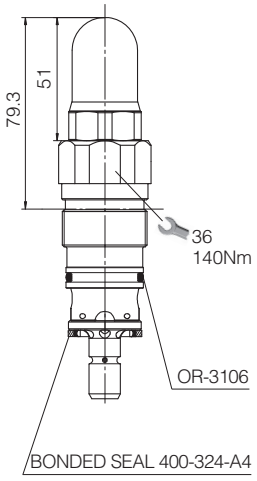




Mass [kg]	0,37

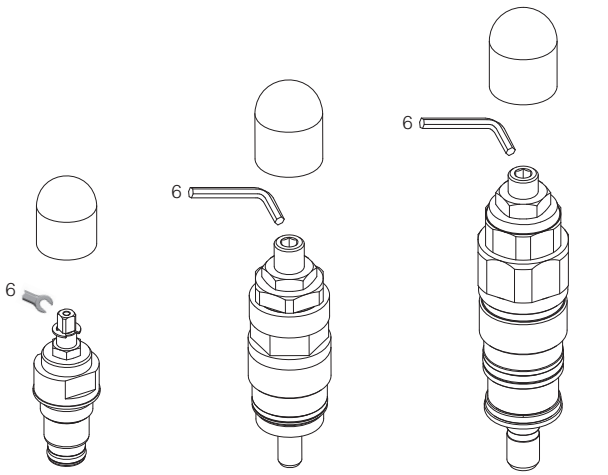
CART AREX(S)-20





Mass [kg]	0,6

Pressure adjustment screw



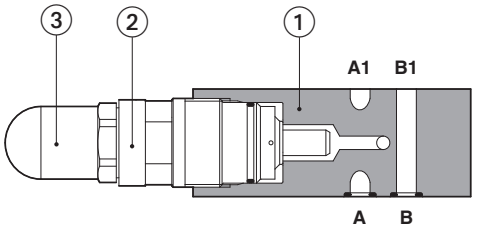
CART MX(S)-3 **CART MX(S)-6** **CART AREX(S)-20**

9 RELATED DOCUMENTATION

W010	Basics for electrohydraulics in corrosive environments
W020	Summary of Atos stainless steel components
EW900	Operating and maintenance information for stainless steel on-off valves

Stainless steel pressure relief valves

direct, modular



HMPX(S)-011

① modular body
② relief cartridge
③ pressure adjustment screw protected by plastic cap

HMPX, HMPXS

Pressure relief valves made in modular execution for stack mounting with stainless steel directional valves ISO size 06. They are made in two different stainless steel executions for corrosive environments and fluids:

- **•X** stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **•XS** stainless steel for external parts to withstand extreme and corrosive environmental conditions.

Size: **06** - ISO 4401
Max flow: up to **35 l/min**
Max pressure: up to **350 bar**

1 MODEL CODE OF MODULR VALVES

HMP	X	-	011	/	350	**	/	*	/	*

HMP: Modular pressure relief valve ISO 4401 size 06

X = Stainless steel execution for all parts
XS = Stainless steel execution for external parts

Configuration, see section 2
011 **013** **014**

Pressure range:
50 = 50 bar
100 = 100 bar
210 = 210 bar
350 = 350 bar

Series number

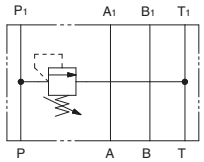
Seals material, see section 4:
- = NBR low temp. -40°C
PE = FKM
BBT = FVMQ fluorosilicon -60°C **(1)**

Test fluid, only for X execution:
H = mineral oil
W = pure water

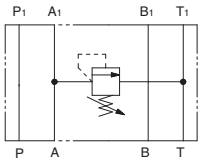
(1) Only for full stainless steel "**X**" execution

2 HYDRAULIC SYMBOLS

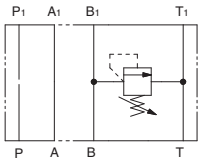
HMPX(S)-011/*



HMPX(S)-013/*



HMPX(S)-014/*



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BBT** option = -60°C ÷ +70°C
Storage temperature range	**Standard** = -40°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BBT** option = -60°C ÷ +80°C
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 MATERIALS SPECIFICATION

Valve code	Valve type	Valve body	Internal parts	Spring	Seals		
					std	/PE	/BBT
HMPX	Modular	AISI 316L	AISI 316L, 420B, 630	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
HMPXS	Modular	AISI 316L	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature **(1)**	NBR seals (standard) = -40°C ÷ +60°C FKM seals (/PE option) = -20°C ÷ +80°C FVMQ seals (/BBT option) = -60°C ÷ +60°C		
Recommended viscosity	115÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s min = 0,9 mm²/s for X full stainless steel execution with pure water		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR low temp., FKM, FVMQ	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM, FVMQ	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

(1) The operating temperature of the fluid must be compatible with the maximum viscosity range allowed for the valve

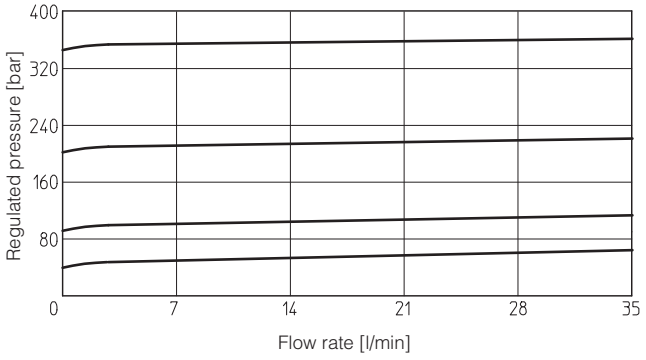
6 HYDRAULICS CHARACTERISTICS

Valve model		**HMPX** **HMPXS**
Max pressure	[bar]	Ports P, A, B = 350; Port T = 50
Max pressure setting	[bar]	50, 100, 210, 350
Pressure range **(1)**	[bar]	2÷50, 3÷100, 10÷210, 15÷350
Max flow	[l/min]	35

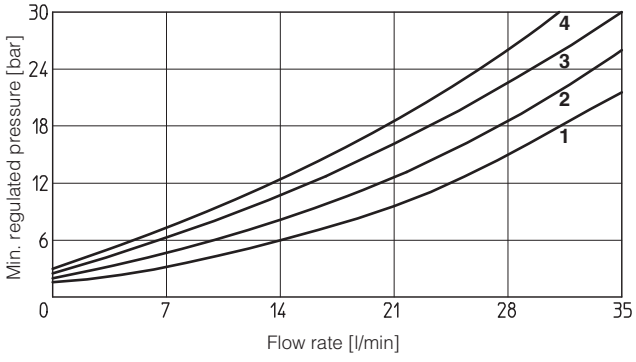
(1) The values correspond to the min and max regulation of the valve's craking pressure

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

7.1 Regulated pressure versus flow diagram



7.2 Minimum pressure versus flow diagram



1 = HMPX(S)-*/50
2 = HMPX(S)-*/100
3 = HMPX(S)-*/210
4 = HMPX(S)-*/350

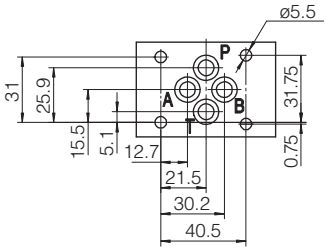
8 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
HMPX	06 (ISO 4401)	n°4 M5xL-A4-70 Tightening torque = 5,5Nm	n°4 OR-108
HMPXS	06 (ISO 4401)	n°4 M5xL-A4-70 Tightening torque = 5,5Nm	n°4 OR-108

9 INSTALLATION DIMENSIONS OF MODULAR VALVES

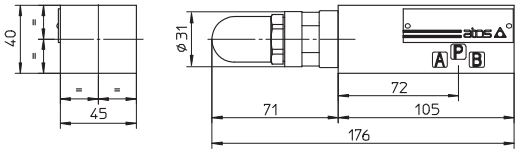
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: M5x**-A4-70
Tightening torque = 5,5 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

valve's bottom view



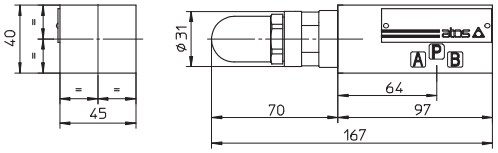
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

HMPX(S)-011/*



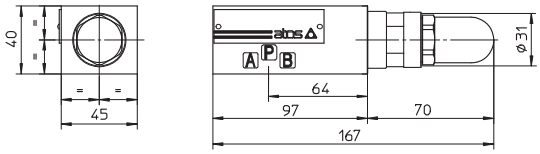
Mass [kg]	1,4

HMPX(S)-013/*



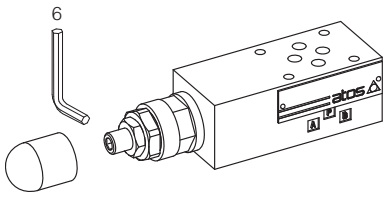
Mass [kg]	1,2

HMPX(S)-014/*



Mass [kg]	1,2

Pressure adjustment screw

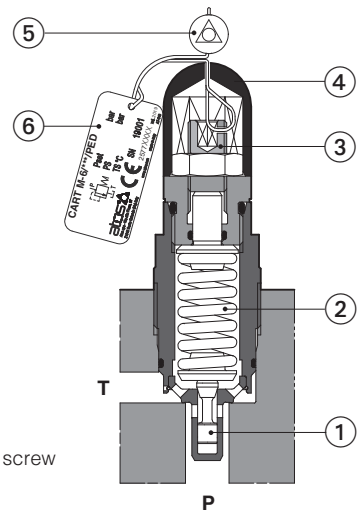


10 RELATED DOCUMENTATION

W010	Basics for electrohydraulics in corrosive environments
W020	Summary of Atos stainless steel components
EW900	Operating and maintenance information for stainless steel on-off valves

Stainless steel safety pressure relief valves

direct, screw-in cartridges, conforming to PED Directive 2014/68/EU - certified by DEKRA



① Poppet
② Spring
③ Pressure adjustment screw (lead sealed)
④ Plastic cap
⑤ Lead sealing
⑥ Nameplate with factory pressure setting

CART MX-6/*/PED**

CART /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are made in two different stainless steel executions for corrosive environments and fluids:

- **•X** full stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **•XS** stainless steel only for external parts to withstand extreme and corrosive environmental conditions.

Size: **G1/2" ÷ M35**
Max flow: **2,5 ÷ 150 l/min**
Max pressure: up to **420 bar**

1 MODEL CODE

CART	MX-3	/	420	/	PED	/	*	*	/	*	/	*

CART: Screw-in pressure relief cartridge

MX-3: Size and stainless steel executions **(1)**:

MX-3, MXS-3	= G1/2"
MX-6, MXS-6	= M33x1,5
AREX-20, AREXS-20	= M35x1,5

420: **Max pressure settings** (bar):
420 = for CART MX(S)-3 and CART MX(S)-6
400 = for CART AREX(S)-20

PED = safety version certified by DEKRA according to 2014/68/EU

***** (pressure setting):
Pressure setting:
280 = factory preset regulation to be defined depending to the customer requirements (example 280 = 280 bar)
min step: 1bar
min pressure setting: 25/30 bar see section 4

***** (series number): Series number

***** (seals material): **Seals material**, see section 5:
- = NBR low temperature
PE = FKM

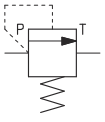
***** (test fluid): **Test fluid**, only for X execution: **(2)**
H = mineral oil
W = pure water

(1) **X** = Full stainless steel
XS = Stainless steel only for external parts

See section 5 for material specification

(2) CART MX and CART AREX in full stainless steel execution are factory tested with mineral oil or pure water in order to avoid the contamination of the end user system. At the end of each valve model code must be specified the type of fluid to be used in the valve's testing: "**H**" for hydraulic oil or "**W**" for pure water.

2 HYDRAULIC SYMBOL



CART-*X/PED

CART-*XS/PED

3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Cavity	See section 10
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C
Compliance	PED Directive 2014/68/EU - EU type-examination certificate **(1)** RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model		CART MX(S)-3 /PED	CART MX(S)-6 /PED	CART AREX(S)-20 /PED
Max pressure setting	[bar]	420	420	400
Pressure range **(1)**	[bar]	25÷420	25÷420	30÷400
Max flow	[l/min]	2,5	60	150

(1) The values correspond to the min and max regulation of the valve's craking pressure

5 MATERIALS SPECIFICATION

Valve code	Valve type	Valve body	Internal parts	Spring	Seals	
					std	/PE
CART-*X	Screw-in	AISI 316L	AISI 316L, 420B, 440C	AISI 302	NBR 70 Sh low temp	FKM (viton)
CART-*XS	Screw-in	AISI 316L	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature **(1)**	NBR low temp. seals (standard) = -40°C ÷ +60°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s min = 0,9 mm²/s for X full stainless steel execution with pure water		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR low temp., FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

(1) The operating temperature of the fluid must be compatible with the maximum viscosity range allowed for the valve

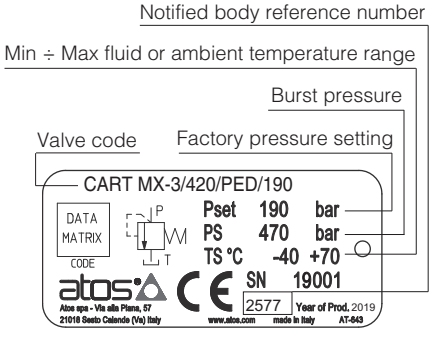
7 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 8

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
CART MX-3 CART MXS-3	0.5
CART MX-6 CART MXS-6	2
CART AREX-20 CART AREXS-20	2

⚠ Any tampering of the lead sealing invalidates the certification

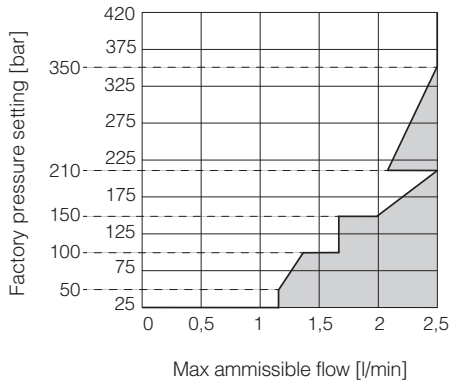
8 NAMEPLATE MARKING



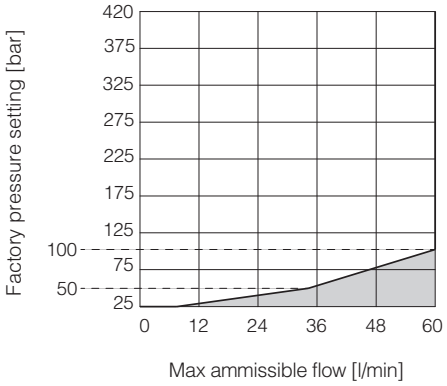
Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

9 PERMITTED WORKING RANGE (based on mineral oil ISO VG 46 at 50°C)

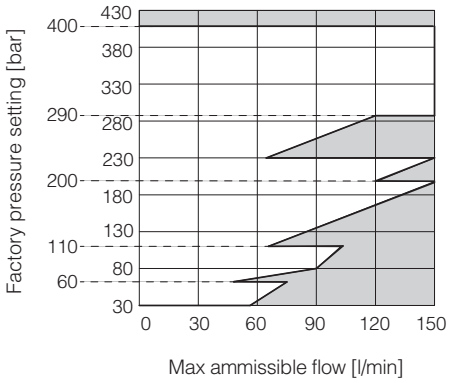
CART MX(S)-3 **/PED



CART MX(S)-6 **/PED



CART AREX(S)-20 **/PED



Notes:

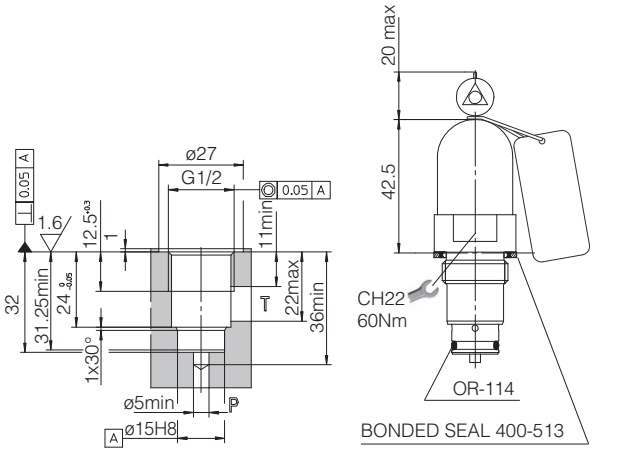
1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting.**
Pressure / flow values located in gray areas cannot be performed.

⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

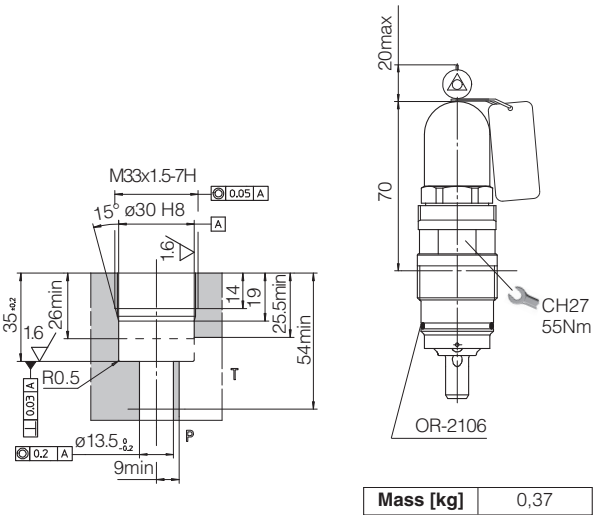
10 CAVITY AND INSTALLATION DIMENSIONS [mm]

CART MX(S)-3



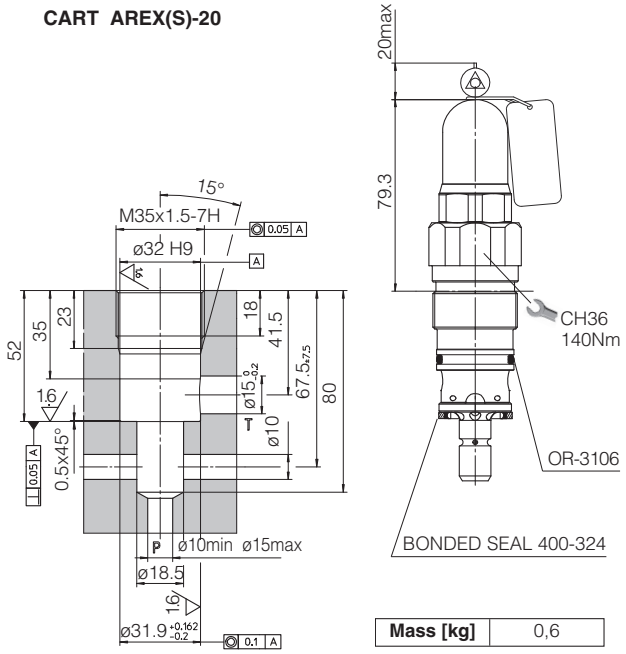
Mass [kg]	0,12

CART MX(S)-6



Mass [kg]	0,37

CART AREX(S)-20



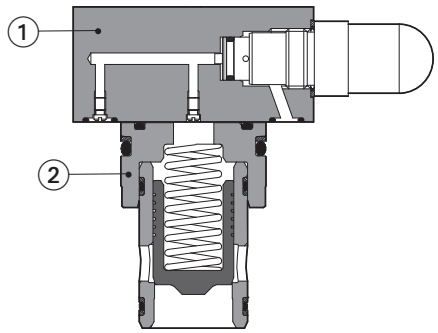
Mass [kg]	0,6

11 RELATED DOCUMENTATION

W010	Basics for electrohydraulics in corrosive environments
W020	Summary of Atos stainless steel components
CWY900	Operating and maintenance information for stainless steel PED pressure relief valves

Stainless steel pressure relief valves

ISO functional cover and 2-way slip-in cartridge



LIMMX-2 + SC LIX-25

① Functional cover with integrated pressure relief pilot valve
② Slip-in cartridge

LIMMX, LIMMXS, SC LIX

Pressure relief valves, in cartridge design conforming to ISO7368 standard for installation in compact manifolds.
They are made by a functional cover **LIMMX(S)** and a 2-way slip-in cartridge **SC LIX**:

Functional covers are available in two different stainless steel executions for corrosive environments and fluids:

- **•X** full stainless steel for external and internal parts, to withstand extreme and corrosive environmental conditions, and to ensure full compatibility also with water base and special fluids.
- **•XS** stainless steel only for external parts to withstand extreme and corrosive environmental conditions.
  LIMMXS cover can be used also with standard SC LI-25*, see tech. table H030

LIMMX + SC LIX
LIMMXS + SC LI:

Size: **25** - ISO 7368
Max flow: **370 l/min** at Δp 5 bar
Max pressure: **350 bar**

1 MODEL CODE OF FUNCTIONAL COVER and SLIP-IN CARTRIDGE VALVES

1.1 Model code of fuctional cover

LIMM	X	-	2	/	350	**	/	*	/	*

Cover according to ISO 7368

Stainless steel execution: **(1)**
X = Full stainless steel
XS = Stainless steel only external parts **(2)**

Size: **2** = 25

Pressure range
50 = 6 ÷ 50 bar
100 = 8 ÷ 100 bar
210 = 10 ÷ 210 bar
350 = 15 ÷ 350 bar

Series number

Seals material, see section 5:
- = NBR low temp. -40°C
PE = FKM
BBT = FVMQ fluorosilicon -60°C **(4)**

Test fluid, only for X execution: **(3)**
H = mineral oil
W = pure water

1.2 Model code of slip-in cartridge

SC LI	X	-	25	31	/	2	**	/	*	/	*

Cartridge according to ISO 7368

Stainless steel execution:
X= Full stainless steel

Size 25

Poppet type:
31= Area ratio 1÷1

Spring cracking pressure
1 = 0,3 bar
2 = 1,2 bar
3 = 3 bar
6 = 6 bar

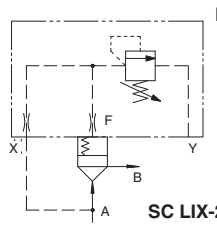
Series number

Seals material, see section 5:
- = NBR low temp. -40°C
PE = FKM
BBT = FVMQ fluorosilicon -60°C

Test fluid: **(3)**
H = mineral oil
W = pure water

(1) See section 5 for material specifications **(2)** LIMMXS cover can be used with standard SCLI-25* cartridge
(3) LIMMX and SC LIX in full stainless steel execution are factory tested with mineral oil or pure water in order to avoid the contamination of the end user system. At the end of each valve model code must be specified the type of fluid to be used in the valve's testing: "**H**" for hydraulic oil or "**W**" for pure water.
(4) Only for full stainless steel "**X**" execution

2 HYDRAULIC SYMBOL



LIMMX(S)-2/*

SC LIX-2531*
(SC LI-2531*)

3 GENERAL CHARACTERISTICS

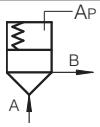
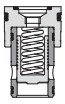
Assembly position / location	Any position
Mounting surface and cavity dimensions	ISO 7368, see section 9
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	**Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BBT** option = -60°C ÷ +70°C
Storage temperature range	**Standard** = -40°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BBT** option = -60°C ÷ +80°C
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULICS CHARACTERISTICS

4.1 Hydraulic characteristics of LIMMX(S) functional cover

Functionl cover		**LIMMX, LIMMXS**
Operting pressure	[bar]	Port X = 350; Port Y = 50

5.2 Hydraulic characteristics of SC LIX slip-in cartrige

Slip-in cartridge		**SC LIX**
Operting pressure	[bar]	350
Nominal Flow at Δp 5 bar	[l/min]	370
Type of poppet		**31**
Functional sketch (Hydraulic symbol)		
Typical section		
Area ratio A: AP		1:1

5 MATERIALS SPECIFICATION

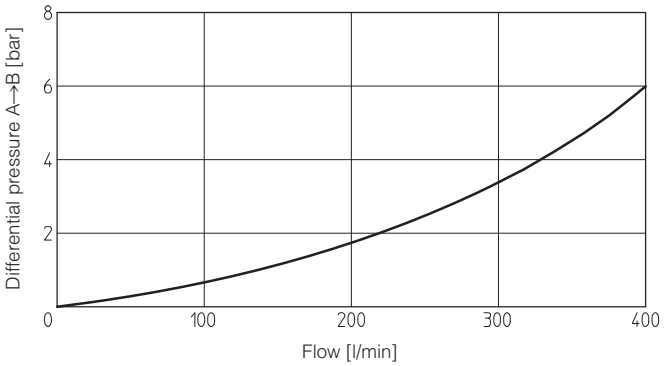
Valve code	Valve type	Valve body	Internal parts	Spring	Seals		
					std	/PE	/BBT
LIMMX	Functional cover	AISI 316L	AISI 316L, 420B, 630	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)
LIMMXS	Functional cover	AISI 316L	Carbon steel	AISI 302	NBR 70 Sh low temp	FKM (viton)	-
SC LIX	Cartridge	AISI 316L	AISI 316L, 420B, 630	AISI 302	NBR 70 Sh low temp	FKM (viton)	FMVQ (fluorosilicon)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature **(1)**	NBR low temp. seals (standard) = -40°C ÷ +60°C FKM seals (/PE option) = -20°C ÷ +80°C FVMQ seals (/BBT option) = -60°C ÷ +60°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s min = 0,9 mm²/s for X full stainless steel execution with pure water		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR low temp., FKM, FVMQ	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM, FVMQ	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

(1) The operating temperature of the fluid must be compatible with the maximum viscosity range allowed for the valve

7 FLOW/Δp DIAGRAM (based on mineral oil ISO VG 46 at 50°C)

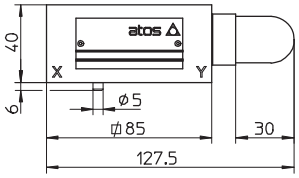


8 FASTENING BOLTS AND SEALS

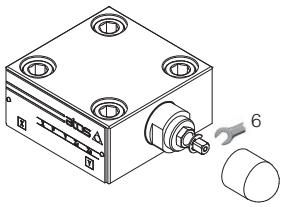
Type	Size	Fastening bolts	Seals
LIMMX LIMMXS	25 (ISO 7368)	n°4 M12x45-A4-70 Tightening torque = 125Nm	n°2 OR-108
SC LIX	25 (ISO 7368)	-	n°1 OR-3100 n°1 OR-4150, n°2 4150.BURC-39.20 n°1 OR-2118, n°2 2118.BURC-31.20

9 INSTALLATION DIMENSIONS

LIMMX(S)-2/*

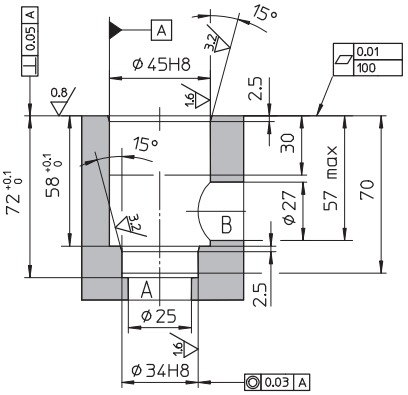


Pressure adjustment screw

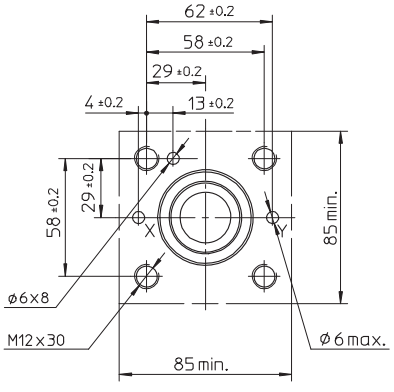


Mass [kg]	
LIMMX(S)	2,2
SC LIX	0,5

Cavity dimensions for SC LIX-25



Cover interface dimensions for LIMMX(S)-2



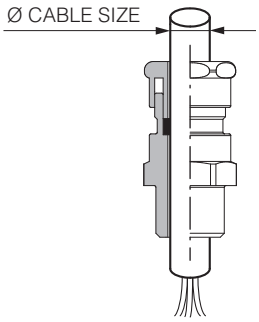
10 RELATED DOCUMENTATION

W010	Basics for electrohydraulics in corrosive environments
W020	Summary of Atos stainless steel components
EW900	Operating and maintenance information for stainless steel on-off valves

Cable glands and plugs for ex-proof valves

Multicertified ATEX, IECEx, EAC

1 MULTICERTIFIED CABLE GLAND FOR NON-ARMOURED CABLES - Group II (surface plants)

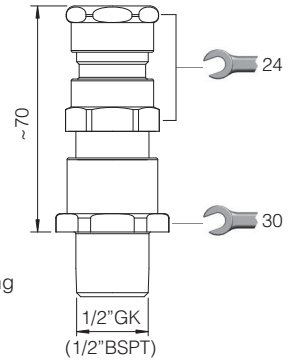
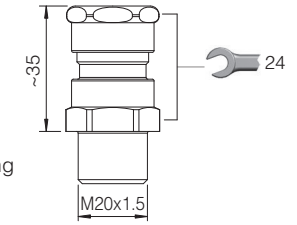
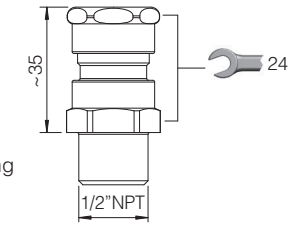
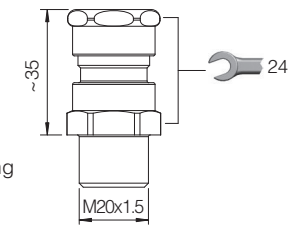


Cable glands for use with non-armoured plastic insulated cables
Flameproof **Exd IIC Gb**, Increased Safety **Exe IIC Gb** and Dust **Extb IIIC Db II 2 GD**, suitable for use in Zone 1, Zone 2, Zone 21, Zone 22.
Construction and Test Standards: IEC/EN 60079-0, IEC/EN60079-1, IEC/EN 60079-7 and IEC/EN 60079-31.
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529 and NEMA 4X
Deluge Protection to DTS01
Operating Temperature Range: -60 °C to +100 °C

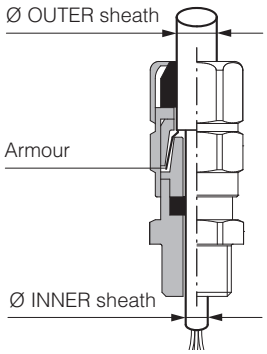
Material: Nickel Plated Brass or AISI 316
Cable glands are marked ATEX, IECEx and EAC

The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
PAMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 06 ATEX0056X - IECEx BAS 06.0013X Item type: 501-421 **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves with "NPT" threaded connection (solenoid and LVDT transducer)
PAXMC/M  Tightening torque: **20 Nm**		**Material:** Stainless steel AISI 316 **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** 6,5 to 11,9 mm	On-off ex-proof stainless steel valves type "X" and "XS"

2 MULTICERTIFIED CABLE GLAND FOR ARMOURED CABLES - Group II (surface plants)

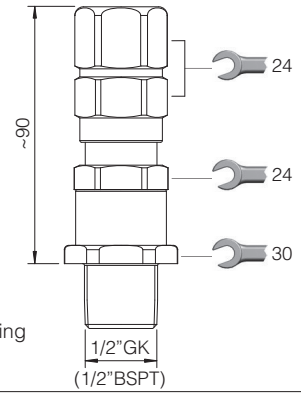
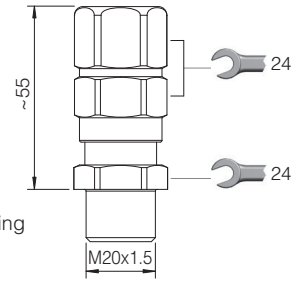
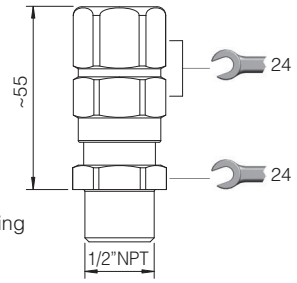
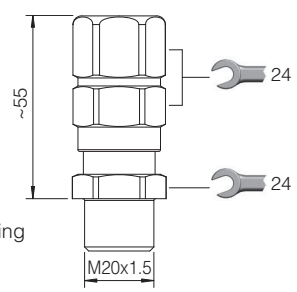


Cable glands for use with single wire armour 'W', wire braid 'X', steel tape armour 'Z', plastic insulated cables.
Flameproof **Exd IIC Gb**, Increased Safety **Exe IIC Gb**, Dust **Extb IIIC Db** and **ExnR IIC Gc II 2 / 3GD**, suitable for use in Zone 1, Zone 2, Zone 21, Zone 22.
Construction and Test Standards: IEC/EN 60079-0, IEC/EN 60079-1, IEC/EN 60079-7, IEC/EN 60079-15 and IEC/EN 60079-31.
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529 and NEMA 4X
Deluge Protection to DTS01.
Operating Temperature Range: -60 °C to +80 °C

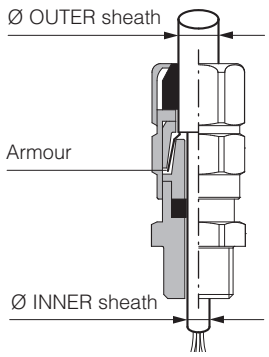
Seal on the cable inner sheath
Outer deluge seal to prevent moisture ingress to the cable armour / braid
Cable retention, low smoke
Material: Nickel Plated Brass or AISI 316
Cable glands are marked ATEX, IECEx and EAC

The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
PAAMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 06 ATEX0056X - IECEx BAS 06.0013X Item type: 501-453RAC CE Ex **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 IECEx **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 EAC **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAAMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAAMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "NPT" threaded connection (solenoid and LVDT transducer)
PAAXMC/M  Tightening torque: **20 Nm**		**Material:** Stainless steel AISI 316 **Threaded connection:** M20x1,5 UNI-4535 (6H/6g) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off ex-proof stainless steel valves type "X" and "XS"

3 MULTICERTIFIED CABLE GLAND FOR ARMOURED CABLES - Group I (Mining)

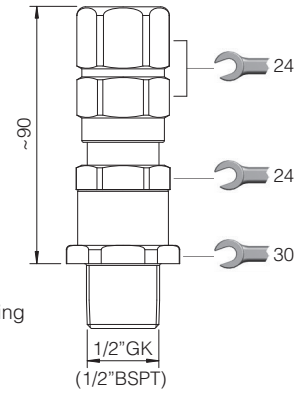
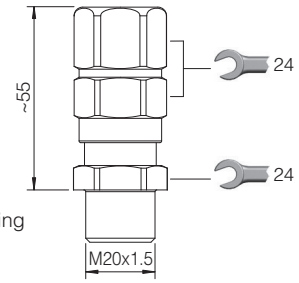
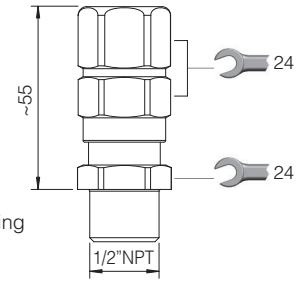


Cable glands for use with single wire armour 'W', wire braid 'X', steel tape armour 'Z', plastic insulated cables.
Flameproof **Exd I M2** and Increased Safety **Exe I M2**, suitable for use in Mines
Construction and Test Standards: IEC/EN 60079-0, IEC/EN 60079-1 and IEC/EN 60079-7
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529
Operating Temperature Range: -60 °C to +80 °C

Seal on the cables inner sheath
Cable retention, low smoke
Material: Nickel Plated Brass
Cable glands are marked ATEX, IECEx and EAC

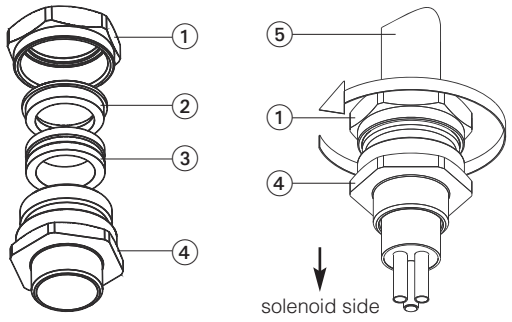
The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
PAAMMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 08 ATEX0331X - IECEx BAS 08.0112X Item type: 453RAC **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAAMMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAAMMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with "NPT" threaded connection (solenoid and LVDT transducer)

4 CABLE GLAND ASSEMBLY

Cable glands PAMC/* and PAXMC/M for non-armoured cables

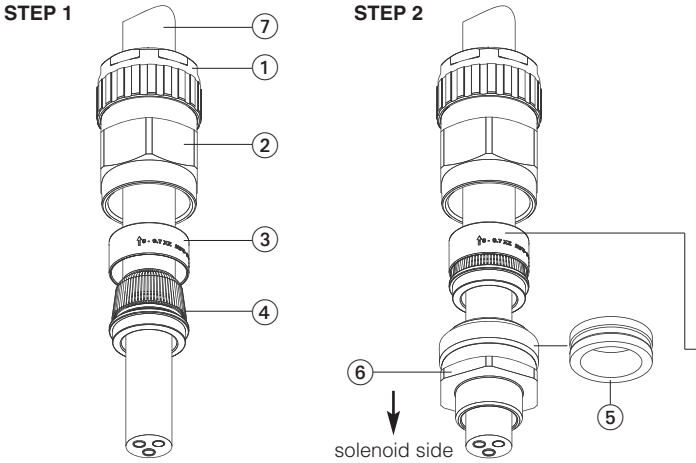


Assembling procedure

Unscrew the Back-nut ① from Entry ④
Push the electric cable ⑤ though the cable gland
Connect the cable wires to the solenoid terminal board
Screw-in the Entry ④ into the solenoid cable entrance lock it at relevant tightening torque specified in section 1
Lock the Back-nut ① using a wrench until a resistance is felt between internal seal ③ and the cable
Turn the Back-nut ① through a further half turn to ensure the complete inner sealing

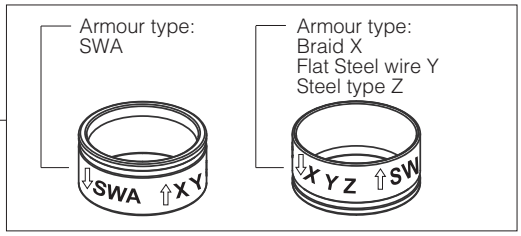
① Back-nut
② Compression Spigot
③ Seal
④ Entry
⑤ Electric cable (non-armoured)

Cable glands PAAMC/*, PAAXMC/M and PAAMMC/* for armoured cables



① Back-nut
② Middle-nut
③ Reversible Armour Clamping Ring (RAC)
④ Armour Spigot
⑤ Inner Seal
⑥ Entry (with captive deluge seal), if required
⑦ Electric cable (armour type SWA, Braid X, Flat Steel wire Y, Steel type Z)

Reversible Armour Clamping ring (RAC) orientation



Note: the arrow corresponding to the correct armour type (SWA or X, Y, Z) must be orinted towards the ex-proof solenoid

Assembling procedure

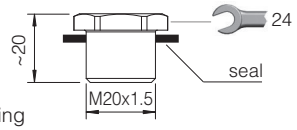
STEP 1

Unscrew Back-nut ① from Middle-nut ② and Entry ⑥ , push the cable through the Armour Spigot ④
Spread the armour over the Armour spigot ④ until the end of the armour is up against the shoulder of the armour cone
Position the Armour clamping ring ③ paying attention to its correct orientation depending to the armour type (see above)
Remove the Inner seal ⑤ from the Entry ⑥ , place the Entry ⑥ over the Armour Spigot ④
Move the sub-assembly ① + ② to meet the Entry ⑥ , connect the cable wires to the solenoid terminal board
Screw-in the Entry ⑥ into the solenoid cable entrance and lock it at relevant tightening torque specified in section 2 and 3
Hand tighten the Middle-nut ② to the Entry ⑥ and turn a further half turn with a wrench
Unscrew the Middle-nut ② and visually inspect that the armour has been successfully clamped between the armour spigot ④ and the armour clamping ring ③. If the armour is not correctly clamped, repeat the assembly

STEP 2

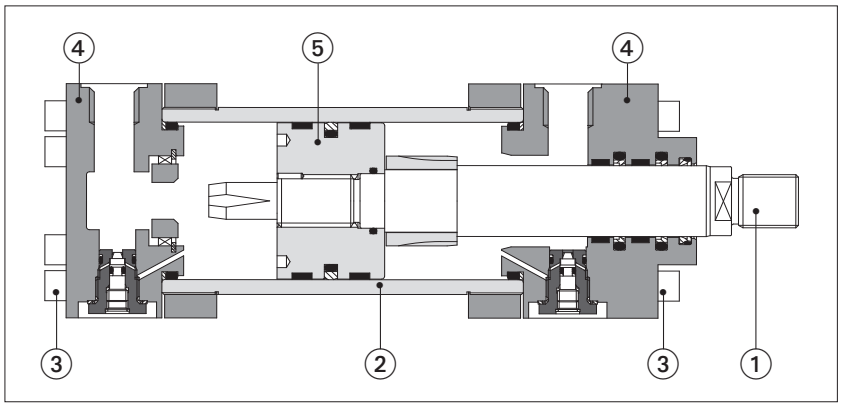
Re-assemble Middle-nut ② onto the components ③ + ④ + ⑤ + ⑥ paying attention to the correct orientation of the reversible armour Clamping ring ③ , tighten up the Middle-nut ② by hand first and then using a wrench a further 1 to 2 turns until fully tight
Hand tighten the Back-nut ① then tighten a further full turn using a wrench
Ensure that the Middle-nut ② does not rotate when tightening the Back-nut ①
Ensure that the deluge seal is compressed into correct position

5 THREADED PLUG

THREADED PLUG CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
ZMX-T  Tightening torque: **20 Nm**	**ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535	Proportional ex-proof valves with on-board driver

Stainless steel hydraulic cylinders type CNX

ISO 6020-1, round heads with counterflanges, Pnom 10 MPa (100 bar), Pmax 15 MPa (150 bar)



CNX cylinders are derived from standard CN (tab. B180) with stainless steel construction to withstand extreme and corrosive environmental conditions and to ensure compatibility with water based fluids or pure water.
They are ideally suited for a variety of applications and industries including: pharmaceutical, marine, military, waste management, offshore and chemical processing.

- Bore sizes from **50** to **100** mm
- Strokes up to **3000** mm
- Rods with rolled threads
- **9** standard mounting styles
- **3** seals options
- Rod guide rings for low wear
- Adjustable or fixed cushioning
- Optional built-in position transducer, **see tab. B310**

Stainless steel attachments are available on request, for dimensions **see tab. B500**
For cylinder dimensions and options **see tab. B180**

1 MATERIALS AND SPECIFICATIONS

Cylinder component	Material	Features
ROD ① and PISTON ⑤	AISI 431	High strenght and good corrosion resistance
HOUSING ② and HEADS ④	AISI 316L	Optimum corrosion resistance
SCREWS ③	AISI 316 A4	Optimum corrosion resistance and high strength

2 MODEL CODE

CNX	F	-	63	/	45	*	0500	-	S	3	0	8	-	A	-	B1E3X1Z3	**

Cylinder series
CNX to ISO 6020 - 1

Rod position transducer
see section 4
- = omit if not requested
F = magnetosonic
M = magnetosonic programmable
N = magnetostrictive
P = potentiometric
V = inductive
Transducer available on request, contact our technical office

Bore size, see section 6
from **50** to **100** mm

Rod diameter, see sections 6
from **36** to **70** mm

Stroke (1)
up to **3000** mm

Mounting style (1)

	REF. ISO
A = front round flange	MF3
B = rear round flange	MF4
D = fixed eye	MP3
E = feet	MS2
L = intermediate trunnion	MT4 **(3)**
N = front square flange	MF1
P = rear square flange	MF2
S = fixed eye + spherical bearing	MP5
X = basic execution	-

Cushioning (1)
0 = none

Fast adjustable	Fast fixed
1 = rear only	**7** = rear only
2 = front only	**8** = front only
3 = front and rear	**9** = front and rear

Spacer (1)
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Sealing system, see section 5
3 = (FKM + PTFE) very low friction, high temperatures and water based fluids
5 = (NBR + PTFE) very low friction, high speeds and water based fluids
8 = (NBR + PTFE and POLYURETHANE) high static and dynamic sealing

Options (1) (2):
Air bleeds
A = front air bleed
W = rear air bleed

Heads' configuration (1) (2)
Oil ports positions
B1 = front head
X1 = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E3 = front head*
Z3 = rear head*
* = enter E2 and Z2 for mounting style E

****** Series number

(1) For details see **tab. B180**
(2) To be entered in alphabetical order
(3) XV dimension must be indicated in the model code, see **tab. B180**

3 STAINLESS STEEL PROPERTIES

CNX cylinders are manufacured with selected stainless steel to withstand extended exposure to aggressive environments, the table at side shows the compatibility of AISI 316L and AISI 431 with the main aggressive substances.
The rod is chromeplated: chrome thickness 0,020 mm; hardness 850-1150 HV.
The low strength of AISI 316L limits the max pressure to 150 bar; for heavy duty applications AISI 630 is recommended, contact our technical office.

Material	Cylinder component	Mechanical properties **Rm min** [MPa]	**Rs min** [MPa]	Corrosion resistance (2)
AISI 316L	housing and heads	450	195	> 1200 h
AISI 316 A4 70	screws	700	450	> 1200 h
AISI 431	piston and rod	800	600	> 600 h
AISI 420	Spherical bearing of style S	700	500	< 100 h
AISI 630 (17-4 ph) **(1)**	housing and rod	860	724	> 1000 h

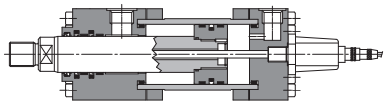
Note: (1) Available on request for heavy duty applications
(2) Corrosion resistance in neutral salt spray to ISO 9227 NSS

Corrosion index for AISI 316L and AISI 431

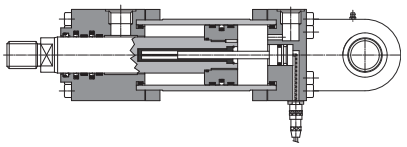
Substance	Corrosion index AISI 316L	AISI 431
Marine atmospheres	very good	good
Salt water	good	sufficient
33% Acetic acid	excellent	limited
2% Muriatic acid	good	limited
70% Phosphoric acid	limited	limited
65% Nitric acid	good	good
2% Sulfuric acid	excellent	limited
20% Sulfuric acid	limited	limited

4 CNX WITH BUILT-IN POSITION TRANSDUCER

CNXM - Magnetosonic programmable



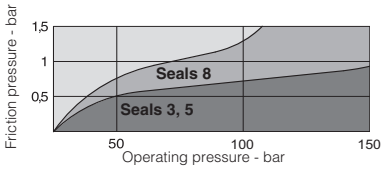
CNXV - Inductive



CNX cylinders are also available with magnetostrictive, potentiometric and inductive rod position transducers.
Stainless steel or aluminum materials used for transducers components make CNX servocylinders ideal for extreme working conditions as aggressive external environments or corrosive fluids.
For transducer performance and other details see **tab. B310**

5 SEALING SYSTEM FEATURES

The sealing system must be choosen according to the working conditions of the system: speed, fluid type and temperature.
For HFA fluids or pure water it is recommended the use of proper additives to increase the sealing working life. Contact our technical office to check the compatibility with other fluids not mentioned below and specify type and composition.



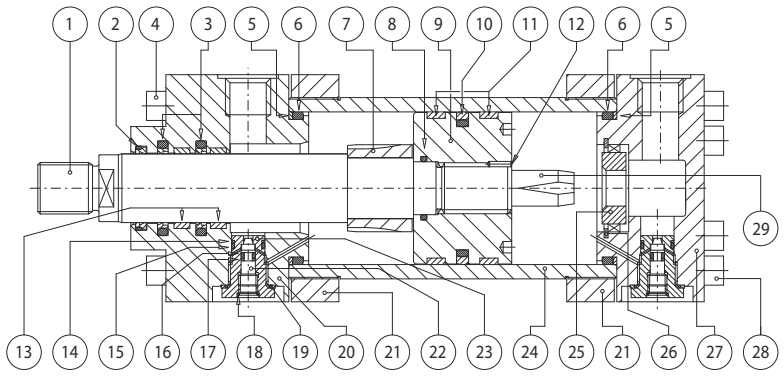
Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals Piston	Rod
3	FKM + PTFE	**very low friction and high temperatures**	4	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV fire resistance fluids HFA, HFB, HFD-U, HFD-R and water	ISO 7425/1	ISO 7425/2
5	NBR + PTFE	**very low friction and high speeds**	4	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606; fire resistance fluids HFA, HFC (water max 45%), HFD-U and water	ISO 7425/1	ISO 7425/2
8	NBR + PTFE + POLYURETHANE	**high static and dynamic sealing**	1	-20°C to 85°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV	ISO 7425/1	ISO 7425/2

6 BORE / ROD SIZES

Ø Bore	**50**	**63**	**80**	**100**
Ø Rod	**36**	**45**	**56**	**70**

The table at side shows the available bore/rod sizes, see **tab. B180** for installation dimensions and options.

7 CYLINDER SECTION

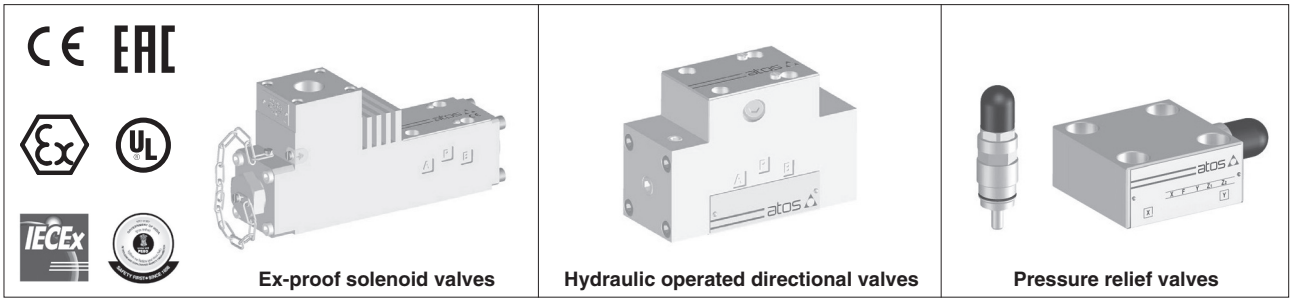


POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL	POS.	DESCRIPTION	MATERIAL
1	Rod	AISI 431 Chromeplated	11	Piston guide rings	PTFE	21	Counterflange	AISI 316L
2	Wiper	NBR / FKM and PTFE	12	Screw stop pin	AISI 304 / AISI 316L	22	Cushioning adjustment screw	AISI 316L
3	Rod seal	NBR / FKM and PTFE	13	Rod guide rings	PTFE	23	Cushioning adjustment plug	AISI 316L
4	Screw	AISI 316 A4	14	Anti-extrusion ring	PTFE	24	Cylinder housing	AISI 316L
5	Anti-extrusion ring	PTFE	15	O-ring	FKM	25	Rear cushioning sleeve	Bronze
6	O-ring	NBR / FKM	16	O-ring	FKM	26	Toroidal ring	AISI 304 / AISI 316L
7	Front cushioning piston	AISI 431	17	Anti-extrusion ring	PTFE	27	Rear head	AISI 316L
8	O-ring	NBR / FKM	18	Seeger	AISI 304 / AISI 316L	28	Screw	AISI 316 A4
9	Piston	AISI 431	19	Seal	FKM	29	Rear cushioning piston	AISI 431
10	Piston seal	NBR / FKM and PTFE	20	Front head	AISI 316L			

Operating and maintenance information for stainless steel on-off valves

ex-proof solenoid valves, hydraulic operated directional valves, pressure relief valves

This operating and maintenance information applies to Atos stainless steel on-off valves and is intended to provide useful guidelines to avoid risks when the valves are installed in the hydraulic system, particularly for components operating in hazardous areas with explosive or flammable environment.
The prescriptions included in this document must be strictly observed to avoid damages and injury. The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



Ex-proof solenoid valves | **Hydraulic operated directional valves** | **Pressure relief valves**

1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence risks to be carefully avoided.

In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
CAUTION	Minor or moderate injury could occur	
NOTICE	Property damage could occur	
	Notes relevant to stainless steel ex-proof solenoid directional valves with Multicertification	
c UL us LISTED	Notes relevant to stainless steel ex-proof solenoid directional valves with cULus Noth American certification	
	Information to be observed	

2 GENERAL NOTES

This document is relevant to the installation, use and maintenance of Stainless steel on-off directional and pressure control valves.

On-off solenoid directional valves are equipped with ex-proof solenoids type OAX(S)-* for application in explosive hazardous environments.

2.1 Warranty

All the ex-proof on-off valves have 1 year warranty; the expiration of warranty results from the following operations:

- unauthorized mechanical or electronic interventions
- the ex-proof on-off valves are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

Service work performed on the valve by the end users or not qualified personnel invalidates the certification

3 CERTIFICATIONS

3.1 Ex.proof certification and protection mode

The ex-proof on-off solenoids subject of this operating and maintenance information are multicertified ATEX, IECEx, EAC, PESO or cULus
They are in compliance with following protection mode:

Multicertification Group II – ATEX, IECEx, EAC, PESO

II 2 G Ex d IIC T6, T4, T3 Gb

II 2 D Ex tb IIIC T85°C, T135°C, T200°C Db

cULus Noth American certification

Class I, Div. I, Groups C & D T. class T4/T3
Class I, Zone I, Groups II A & II B T. class T4/T3

3.2 SIL certification in accordance with IEC 61508

Valves DHAX, DHAXS, DLAHX, DLAHXS, DLPX and DLPXS are TUV certified in compliance with IEC EN 61508:2010 as being suitable for use in safety-related application up to SIL 3.
This manual covers all installation, maintenance and operation requirements for these applications.

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

ATEX

EN 60079-0 Explosive atmospheres - Equipment: General requirements
EN 60079-1 Explosive atmospheres - Equipment protection by flameproof enclosures “d”
EN 60079-31 Explosive atmospheres - Equipment dust ignition protection by enclosures “t”

IECEx

IEC 60079-0 Explosive atmospheres - Part 0: General requirements
IEC 60079-1 Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures “d”
IEC 60079-31 Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosures “t”

cULus

UL 1203 Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for use in Hazardous (classified) locations
UL 429 Standard for Electrically Operated valves
CSA C22.2 No.139-13 Electrically Operated Valves

5 GENERAL CHARACTERISTICS

Ambient temperature range	**Standard** = -40°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BBT** option = -60°C ÷ +70°C
Storage temperature range	**Standard** = -40°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BBT** option = -60°C ÷ +80°C
Compliance	Explosion proof protection (for valves with ex-proof solenoid) -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” SIL to IEC 61508: 2010, see section 3.2 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

See technical tables relevant to the specific components, listed in section 12

7 ELECTRIC CHARACTERISTICS - for ex-proof solenoid directional valves

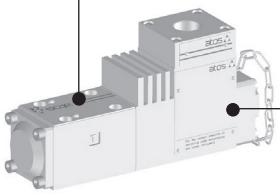
Harmonized standard	**Multicertification**	**cULus**
Power consumption at 20°C	8W or 25W	12W or 33W

See technical tables relevant to the specific components, listed in section 12

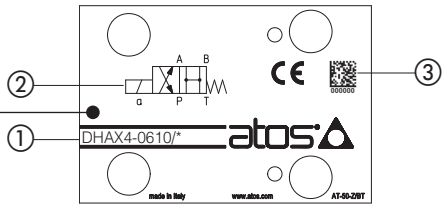
8 PRODUCT IDENTIFICATION NAMEPLATES

ATEX, IECEx, EAC and PESO multicertification

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22

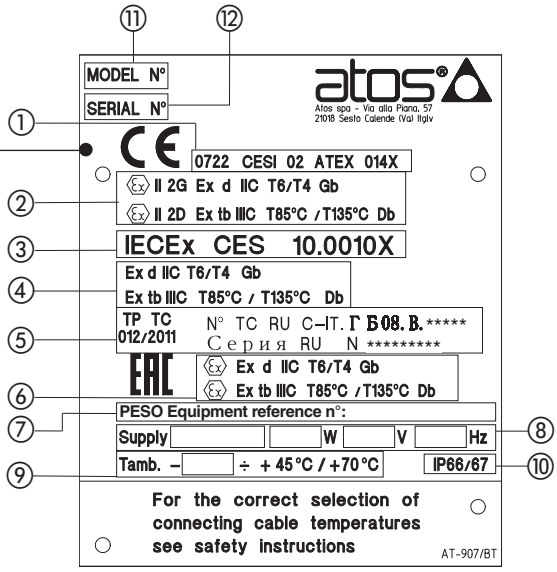


Valve nameplate



① Valve code
② Hydraulic symbol
③ Valve serial number

Ex-proof solenoid nameplate



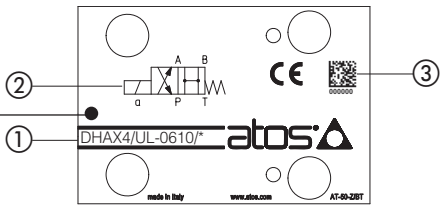
① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ EAC notified body and certificate number
⑥ Marking according to EAC
⑦ PESO certificate number
⑧ Power supply characteristics
⑨ Ambient temperature
⑩ Ingress protection:
-IP66 = no dust ingress, protection against heaving seas or powerful jets of water
-IP67 = no dust ingress, protection to water immersion
⑪ Solenoid model code
⑫ Solenoid serial number

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/UE directive and to the relevant technical norms
II 2 G	Equipment for surface plants with gas or vapors environment, category 2, suitable for zone 1 and 2
Ex d	Explosion-proof equipment
II C	Group II C equipment suitable for substances (gas) for group II C
T6, T4, T3	Equipment temperature class (maximum surface temperature)
Gb	Equipment protection level, high level protection for explosive Gas atmospheres
II 2 D	Equipment for surface plants with dust environment, category 2, suitable for zone 21 and zone 22
Ex tb	Equipment protection by enclosure"tb"
IIIC	Suitable for conductive dust (applicable also IIIB and/or IIIA)
IP66/67	Protection degree
T85°C, T135°C, T200°C,	Maximum surface temperature (Dust)
Db	Equipment protection level, high level protection for explosive Dust atmospheres
CESI 02 ATEX 014 X	Name of the laboratory responsible for the CE certification: 02 year of the certification release; 014 X certification number
0722	Number of the Notified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 10.0010X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 10 year of the certification release; 0010X number of certification
T amb.	Ambient temperature range

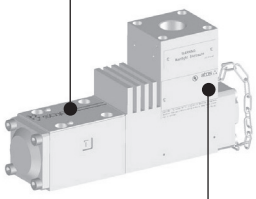
8.2 Ex-proof solenoid directional valves

cULus certification
Class I, Division 1
Class I, Zone 1

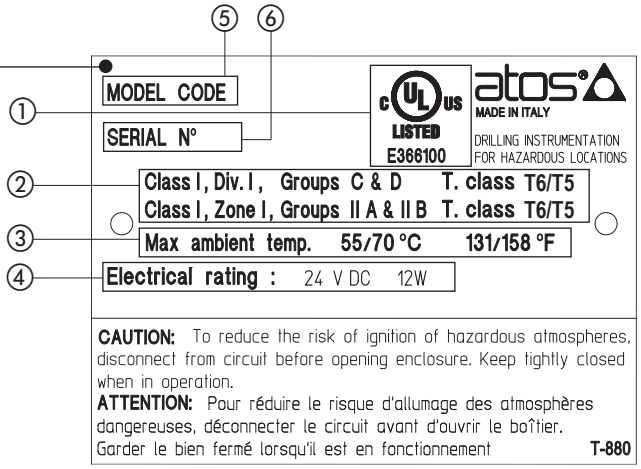
Valve nameplate



① Valve code
② Hydraulic symbol
③ Valve serial number



Ex-proof solenoid nameplate



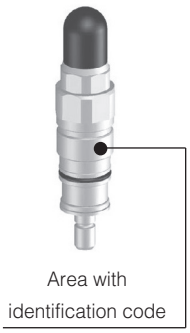
① cULus marking and certificate number
② Marking according to NEC 500 and NEC 505 standards
③ Ambient temperature
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number

LISTED E366100	cULus mark and certificate number
Class I	Equipment for flammable gas and vapours
Division I	Explosive substances continuously or intermittently present in the atmosphere
Groups C & D	Gas group C (Methane, Buthane, Petrol, etc) and D (Etylene, Formaldeyde, Cloruprophane, etc)
Zone I	Location where explosive substances are continuously present
Groups IIA & IIB	Equipment of group IIA and IIB suitable for gas of group IIA and IIB
Class T6/T5	Solenoid temperature class (maximum surface temperature)
Max ambient temp.	Max ambient temperature range in °C and °F

8.3 Hydraulic operated valves

① Valve code
② Hydraulic symbol
③ Valve serial number

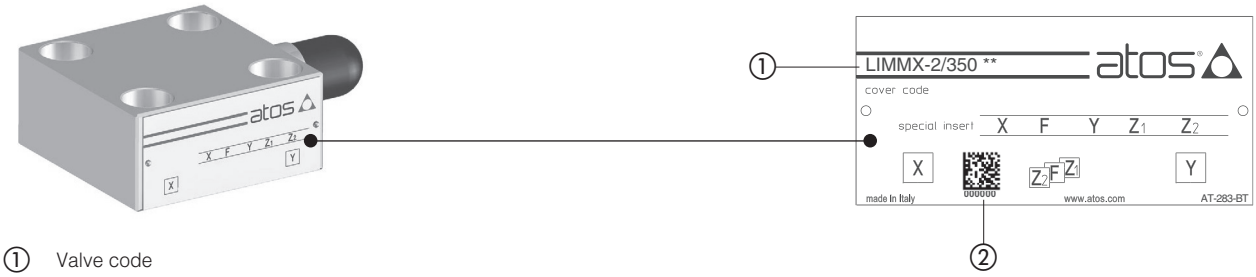
8.4 Pressure relief valve



Identification code	Max pressure (bar)	
	CART MX(S)-3	CART MX(S)-6
1	100	100
2	210	210
3	350	350
4	50	420
9	420	

Identification code	Max pressure (bar)
	CART AREX(S)-20
50	50
100	100
210	210
315	315
400	400

① Valve code
② Hydraulic symbol
③ Valve serial number



① Valve code
② Valve serial number

9 SAFETY NOTES

9.1 Intended use

Atos stainless steel valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.

9.2 Improper use

Improper use of the components includes:

- Wrong installation / installation in areas not approved for the specific component (for ex-proof valves)
- Incorrect storage
- Incorrect transport
- Lack of cleanliness during storage and installation
- Incorrect installation
- Use of inappropriate or non-admissible fluids
- Operation outside the specified performance limits
- Operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use. The user assumes all riks involved with improper use.

9.3 Installation

The installation or use of inappropriate components in explosive hazardous environments could cause personal injuries and damage to property.

For the application in explosion hazardous environments, the compliance of the solenoid with the zone classification and with the flammable substances present in the system must be verified.
The main safety requirements against the explosion risks in the classified areas are established by the European Directives 2014/34/UE (for the components) and 99/92/CE (for the plants and safety of the workers against the risk of explosion).

The classification criteria of the area against the explosion risks are established by the norm EN60079-10.
The technical requirements of the electrical systems are established by the norm EN60079-14 (group II).

Note: the max fluid temperature controlled by the valve must not exceed + 60°C

WARNING
Ensure that no explosive atmosphere may occur during the valve installation.
Only use the valve in the intended explosion protection area.
The ignition temperature of the hydraulic fluid used must be 50°C higher than the maximum surface temperature of the valve.

WARNING: non-compliance with functional safety
In case of mechanical or electric failures, risk of death or persons injury could occur.
Functional safety prescriptions according to EN ISO 13849 must be observed in the hydraulic circuit.

WARNING: hot surface
The valve considerably heats up during operation. Allow the valve to cool down sufficiently before touching it.
During operation, touch the valve solenoid only by using protective gloves. Please also observe ISO 13732-1 and EN 982

CAUTION
Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid.
Only use the valve within the specified ambient and fluid temperature range.

WARNING: fixing bolts
For the valve mounting, use only class A4-70 stainless steel bolts, with dimensions and length reported in the valves technical tables.
Observe the specified tightening torque.
Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.

CAUTION: pressurized systems
When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), valves may even be pressurized after the hydraulic power supply has been switched off.
During assembly and disassembly works, serious injury may be caused by a powerful leaking of hydraulic fluid jet.
Ensure that the whole hydraulic system is depressurized, and the electrical control is de-energized.

WARNING: missing equipotential bonding
Electrostatic phenomena, an incorrect earthing or missing equipotential bonding may lead to dangerous situations in case of explosive atmosphere.
Provide for correct earthing or proper equipotential bonding.

CAUTION: penetrating water and humidity
In case of use in humid or wet environments, water or humidity may penetrate at electrical connections.
This may lead to malfunctions or electric short which may result in personal injury and damage to property:
- only use the valve within the intended IP protection class
- ensure that the cable glands are correctly installed and sealed

NOTICE:
High-pressure water jets could damage the valve seals. Do not use a high-pressure washer for the valve cleaning.

NOTICE: impact
Impact or shock may damage the valves. Never use the valves as step.

NOTICE: dirt and foreign particles
Penetrating dirt and foreign particles lead to wear and malfunctions of the valves.
During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system
Do not use linting fabric for the valve cleaning.

Environmental protection
Hydraulic fluids are harmful to the environment.
Leaking hydraulic fluid may leads to environmental pollution.
In case of fluid leakage immediately act to contain the problem.
Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.
Atos components do not contain substances hazardous for the environment.
The materials contained in Atos components are mainly: stainless steel, carbon steel, rubber.
Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

10 HYDRAULIC AND MECHANICAL INSTALLATION

10.1 Power packs tank and tubes cleaning

The power unit tank has to be accurately cleaned, removing all the contaminants and any extraneous object.
When completely assembled an accurate washing of the piping (flushing) is requested to eliminate the contaminants.

10.2 Hydraulic connections

Flexible hoses are normally used on pressure line between powerpack and the valve and on user lines to connect the actuators. If their potential breakage may cause damages to the machine or system or can cause injure to the operator, a proper retenction (as the chain locking at both the pipe-ends) or alternately a protecting carter must be provided.

10.3 Hydraulic drains and return lines

Drain lines must be connected to the tank without counter pressure. The drain pipe must end above the oil level.
Return line has to be sized in order to avoid pressure peaks caused by instantaneous flow variations.

10.4 Fluid conditioning

A high-performance system must be thermally conditioned to ensure a limited fluid temperature excursion (generically between 40 and 50°C) so that the fluid viscosity remains constant during operation.
The machine working cycle should start after the prescribed temperature has been reached.

10.5 Air bleeds

Air in the hydraulic circuits affects the hydraulic stiffness and it causes malfunctioning and vibrations.
Following precautions have to be considered:
- at the system start-up all the bleeds must be released to allow the air removal
- untight the connections of the piping
- the system must be bled at first start-up or after maintenance
- a check valve (e.g. 0,5 bar) should be installed on the return line to tank to avoid emptying of the pipes following a long stop of the system

10.6 System flushing

The whole system must be flushed for a sufficient time in order to obtain the required minimum cleanliness level.
Make sure that also external pilot lines, if present in the system, are flushed.
A decisive factor for the flushing time is the contamination level of the hydraulic fluid which can only be determined by means of a particle counter.
During the flushing procedure, perform a frequent monitor of the filters clogging indicator, replacing the filter elements when required.

10.7 Hydraulic fluids and operating viscosity range

The hydraulic fluids must be compatible with the selected seals.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR low temp., FKM, FVMQ	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM, FVMQ	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

Fluid viscosity: 15 ÷ 100 mm^2/s - max allowed range 2,8 ÷ 500 mm^2/s
min = 0,9 mm^2/s for X full stainless steel execution with pure water

CAUTION: easily inflammable hydraulic fluid
In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

10.8 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevents anomalous wearing or sticking

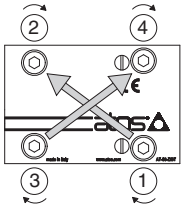
Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet. In the worst case, this may result in unexpected system movements and thus constitute a risk of injury.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the valve over the entire operating range.

Max fluid contamination level: ISO 4406 class 20/18/15 NAS 1638 class 9

Note: see also filter section at www.atos.comm or KTF catalog

10.9 Valve fastening - for all directional valvels and LIMMX(S) functional cover

Remove the protection pad located on the valve mounting surface.
Check the correct positioning of the seals on the valve ports.
Verify that the valve mounting surface is clean and free from damages and burrs.
Lock the fastening bolts in cross sequence (like in aside example) at the tightening torque specified in the valve technical table.



10.10 Tightening torque - for screw-in pressure relief cartridges

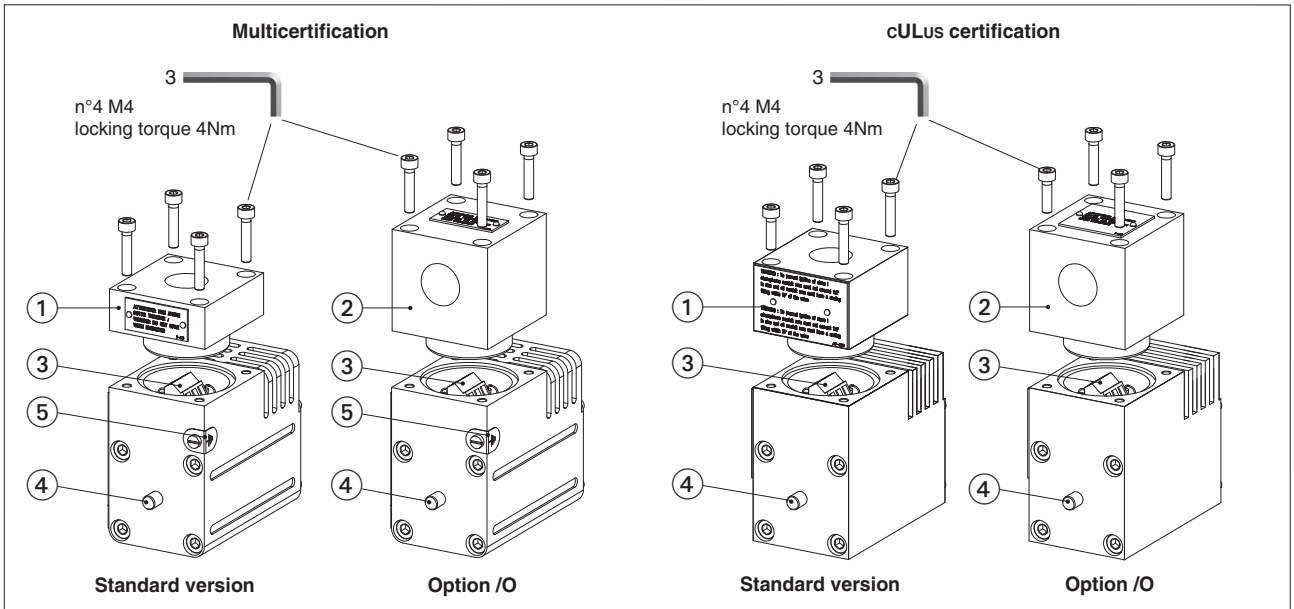
Valve code	CART MX-3	CART MXS-3	CART MX-6	CART MXS-6	CART AREX-20	CART AREXS-20
	22		27		36	
Tightening torque (Nm)	60		55		140	

11 ELECTRICAL CONNECTIONS - for ex-proof solenoid directional valves

The connection to the external circuit is made with a screw clamps 2 poles + ground, installed inside the solenoid. Only for multicertified valves the eventual requirement of the additional ground connection on the solenoid housing must be made on the relative screw (M3x6 UNI-6107).

- The threaded cable entrance is provided with following connections:
- Cylindrical thread M20x1,5 UNI 4535 for Multicertified valves
- Conical thread 1/2" NPT ANSI B2.1 for cULus certified valves

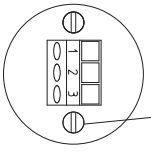
The cable glands used for the cable entrance must be certified for the specific hazardous environment – see tech. table **KX800** for Atos ex-proof cable glands (only for multicertified valves).
Note: a Loctite sealant type 545, should be used on the cable gland entry threads
The electrical cables must be suitable for the working temperatures as shown in the section 11.1



① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)



Pay attention to coil polarity

1 = Coil **+** PCB 3 poles terminal board sugge-
2 = GND sted cable section up to 1,5 mm²
3 = Coil **-** (max AWG16)

alternative GND screw terminal connected to solenoid housing

11.1 Cable specification and temperature

Cable specification - Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²	**Grounding:** section of internal ground wire = 2,5 mm² section of external ground wire = 4 mm²

Cable temperature - Multicertification Group I and Group II

Solenoid code	Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
OA(B)X OA(B)XS	45 °C	T6	85 °C	not prescribed
	70 °C	T4	135 °C	90 °C
OA(B)KX OA(B)KXS	45 °C	T4	85 °C	100 °C
	50 °C	T3	200 °C	100 °C
	60 °C	T3	200 °C	120 °C
	70 °C	T3	200 °C	130 °C

Cable specification - cULus certification

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -40°C to +110°C

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

Cable temperature - cULus certification

Solenoid code	Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
OAX/EC OAXS/EC	55 °C	T6	85 °C	100 °C
	70 °C	T5	100 °C	100 °C
OAKX/EC OAKXS/EC	55 °C	T3	200 °C	115 °C
	70 °C	T3	200 °C	140 °C

10 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

10.1 Ordinary maintenance

Ex-proof solenoid must not be disassembled

For all stainless steel valves:

- The valves do not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer over 5 mm
- Do not use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

10.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service center, which will provide for the reparation.
If the reparations are not made by the manufacturer, they must be performed in accordance to the criteria of IEC 60079-19 standard for IECEx and EN 60079-19 for ATEX, and by facilities having the technical know-how about the protection modes and equipped with suitable tools for repairing and controls.

Service work performed on the ex-proof solenoid valve by end user or not qualified personnel invalidates the certification. Ex-proof solenoid must not be disassembled

Before beginning any repairing activity, the following guidelines must be observed:

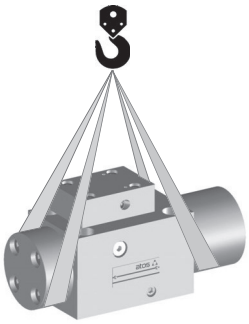
- Unauthorized opening of the valves during the warranty period invalidates the warranty and invalidates the certification
- Be sure to use only original spare parts manufactured or supplied by Atos factory
- Provide all the required tools to make the repair operations safely and to don't damage the components
- Read and follow all the safety notes given in section 9

11 TRANSPORT AND STORAGE

11.1 Transport

Observe the following guidelines for transportation of valves:

- Before any movement check the valve weight reported in the technical table relevant to the specific component
- Use soft lifting belts to move or lift the heavy valves to avoid damages



CAUTION
Danger of damage to property and personal injuries!
The valve may fall down and cause damage and injuries, if transported improperly:
- Use the original packaging for transport
- Use personal protective equipment (such as gloves, working shoes, safety goggles, working clothes, etc.)

11.2 Storage

Stainless steel valves are made with selected materials offering the best protection against oxidization.
Additionally, they are boxed using a VpCi protective packing system, offering an increased protection during sea transport or long storage in humid environments, even if the stainless valves are already free from oxidation.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables.
Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:
- If there is no specific information in the components technical tables, comply with a storage temperature of –20 °C to +50 °C
- Stainless steel valves factory tested with pure water (code /W) must not be stored with ambient temperature lower than 5 °C
- Do not store the valves outdoors
- Protect the valves against water and humidity in case of storage in open air
- Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

12 RELATED DOCUMENTATION

Directional valves

EW010 DHAX, DHAXS – ex-proof solenoid, direct, spool type
EW020 DLAHX, DLAHXS, DLAHMX, DLAHMXS – ex-proof solenoid, direct, poppet type
EW050 DLAHPX, DLAHPXS DLAPX, DLAPXS - ex-proof solenoid, piloted, poppet type
EW100 DLHPX, DLHPXS, DLPX, DLPXS – hydraulic operated

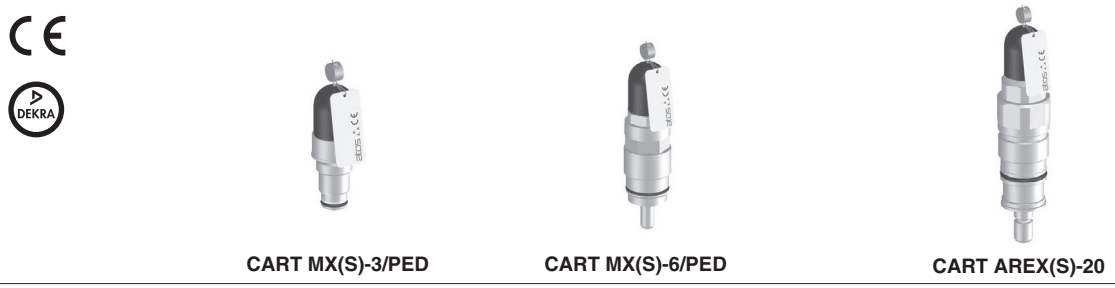
Pressure relief valves

CW010 CART MX, CART MXS, CART AREX. CART AREXS – direct, screw-in cartridges
DW010 HMPX, HMPXS – direct, modular
HW010 LIMMX, LIMMXS + SC LIX – piloted, ISO cartridges

Operating and maintenance information for stainless steel PED valves

safety pressure relief valves, conforming to PED Directive 2014/68/EU

This operating and maintenance information applies to Atos stainless steel safety pressure relief valves conforming to Pressure Equipment Directive (PED) 2014/68/EU. It is intended to provide useful guidelines on the safe and proper assembly, commissioning, operation, use, maintenance and transport of PED valves. The prescriptions included in this document must be strictly observed to avoid damages and injury.



CART MX(S)-3/PED **CART MX(S)-6/PED** **CART AREX(S)-20**

1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.
In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
CAUTION	Minor or moderate injury could occur	
NOTICE	Property damage could occur	
	Information to be observed	

2 GENERAL NOTES

This document is relevant to the installation, use and maintenance of on-off directional, flow and pressure control valves.
It is intended for machine manufacturers, assemblers and system end-users.

WARNING
Personal injury and property damage may be caused by incorrect use of the products!
The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos valves, the following requirements must be met to ensure the appropriate use of the products:
- personnel who uses Atos valves must first read and understand the operating and maintenance information, particularly the Safety Notes in section 6
- the products must remain in their original state, no modifications are permitted
- damaged or faulty valves must not be installed or put into operation
- make sure that the products have been installed as described in section 7

2.1 Warranty

The expiration of warranty results from the following operations:
- incorrect assembly and commissioning
- improper use, see 6.2
- improper handling and storage, see 10
- modification of the original condition

3 CERTIFICATION

Safety pressure relief valves are certified by DEKRA, according to Pressure Equipment Directive 2014/68/EU (PED).

They meet the requirements specified in: Module B - EU Type Examination - Production Type (Annex III) of Directive 2014/68/EU - PED category IV

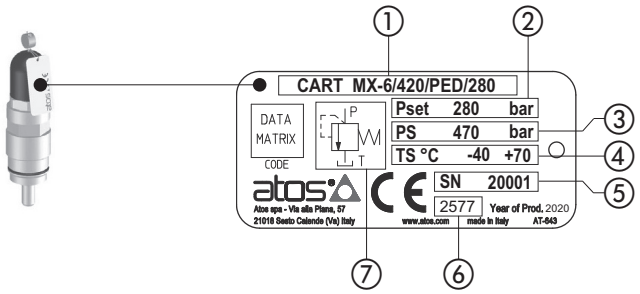
4 COMPONENTS DESCRIPTION

This document applies to direct operated safety pressure relief valves type CART MX(S)-* and CART AREX(S).
These valves are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the circuit from overpressure.
They are also used as safety valves to protect hydraulic accumulators.

The valves are factory set at the pressure level required by the costumer.
The pressure adjustment screw of the valves is protected with a lead sealed plastic cap to avoid manumission of the factory setting.

⚠ Any tampering of the lead sealing invalidates the certification.

5 PRODUCT IDENTIFICATION EXAMPLES - nameplates



① Valve code
② Factory pressure setting
③ Burst pressure
④ Min ÷ Max fluid or ambient temperature range
⑤ Valve serial number **(1)**
⑥ Notified body reference number
⑦ Hydraulic symbol

(1) Example for serial number**:**

20	-	001
Year: **20** = 202		Progressive number

Note: nameplates may not be painted but must be kept in a readable condition

6 SAFETY NOTES

6.1 Intended use

Atos valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.

6.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:
- Wrong installation
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of specified performance limits
- Use outside the specified temperature range
- The safety valves must not be used if the maximum system flow exceeds the value indicated as “max admissible” reported in the relevant technical table
- Manumission of the factory pressure setting
- Incorrect transport

6.3 Installation

Installation must beperformed following the raccomandations contained in the valves technical tables

⚠ Any tampering of the lead sealing invalidates the certification.

⚠ **CAUTION**
Use of the valve outside the approved temperature range may lead to functional failures.
Only use the valve within the specified ambient and fluid temperature range.

⚠ **CAUTION: pressurized systems**
When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), valves may even be pressurized after the hydraulic power supply has been switched off.
During assembly and disassembly works, serious injury may be caused by a powerful leaking of hydraulic fluid jet.
Ensure that the whole hydraulic system is depressurized, and the electrical control is de-energized.

NOTICE: dirt and foreign particles
Penetrating dirt and foreign particles lead to wear and malfunctions of the valves.
During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system
Do not use linting fabric for the valve cleaning.

⚠ **Environmental protection**
Hydraulic fluids are harmful to the environment.
Leaking hydraulic fluid may leads to environmental pollution.
In case of fluid leakage immediately act to contain the problem.
Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.
The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber
Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

7 HYDRAULIC AND MECHANICAL INSTALLATION

Safety pressure relief valves must be used as supplied by Atos, without unduly opening, division and/or substitution of internal parts.

Oil direction: P→T
Inlet oil port: P
Outlet oil port: T

Pressure on the discharge line T must be close to zero.

Verify that the seals are in good conditions before install the valves in the system.

The valves, must not be removed from their manifold after commissioning, in order to avoid the loosening of internal parts.

The end user must provide proper systems to avoid the cartridge disassembling.

See also section 7.1 for tightening torque.

7.1 Tightening torque

Valve code	CART MX-3	CART MXS-3	CART MX-6	CART MXS-6	CART AREX-20	CART AREXS-20
	22		27		36	
Tightening torque (Nm)	60		55		140	

7.2 Hydraulic fluids and operating viscosity range

The hydraulic fluids must be compatible with the selected seals.
Make sure that the working fluid is compatible with gas and dust present in the environment.
The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR low temp., FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM, FVMQ	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR low temp.	HFA-E, HFA-S, HFB, HFC	

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
min = 0,9 mm²/s for X full stainless steel execution with pure water

7.3 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.

Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet.
In the worst case, this may result in unexpected system movements and thus constitute a risk of injury.
Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the valve over the entire operating range.

Max fluid contamination level:

ISO 4406 class 20/18/15 NAS 1638 class 9

Note: see also filter section at www.atos.com or KTF catalog

8 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

8.1 Ordinary maintenance

Safety pressure relief valves do not require specific maintenance.
A visual inspection is definitely useful to check the integrity of lead sealing and the absence of external oil leakages.
Periodically the external surface of the valve should be cleaned from dirt to allow a clear readability of the identification plate.

8.2 Repairing

Safety pressure relief valves are supplied as single assembled unit: spare parts are not allowed.
In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service center which will provide for the reparation.

9 CERTIFIED DISCHARGE COEFFICIENT Kdr - only for valves CART MX(S)-3 and CART MX(S)-6

CART MX-3/420/PED and CART MXS-3/420/PED - minimum calibration flow: Q =0.5 l/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	1,2 - 1,2	0,18	55
51 - 100	1,2 - 1,35	0,18	110
101 - 150	1,6 - 1,6	0,12	165
151 - 210	2 - 2,5	0,18	231
211 - 350	2,1 - 2,5	0,41	385
351 - 420	2,5 - 2,5	0,39	462

CART MX-6/420/PED and CART MXS-6/420/PED - minimum calibration flow: Q =2 l/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	8 - 34	0,71	55
51 - 100	34 - 60	0,89	110
101 - 150	60 - 60	0,57	231
151 - 210	60 - 60	0,58	308
211 - 350	60 - 60	0,39	385
351 - 420	60 - 60	0,58	462

Notes:

(1) Pset: factory pressure setting at the indicated minimum flow (Q)
(2) Qmax: max flow rate reached at Pset + 10%
(3) Kdr: Certified discharge coefficient. It represents the ratio between the actual flow that is discharged by the valve and the theoretical flow calculated on the basis of the passage section and the Δp.
(4) Pmax: pressure reached at Qmax (with limit of Pset + 10%)

10 STORAGE

10.1 Storage

Stainless steel valves are made with selected materials offering the best protection against oxidization.
Additionally, valves are boxed using a VpCi protective packing system, offering an increased protection during sea transport or long storage in humid environments even if the stainless valves are already free from oxidation.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables.
Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

- If there is no specific information in the components technical tables, comply with a storage temperature of –20 °C to +50 °C
- Stainless steel valves factory tested with pure water (code /W) must not be stored with ambient temperature lower than 5 °C
- Do not store the valves outdoors
- Protect the valves against water and humidity in case of storage in open air
- Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

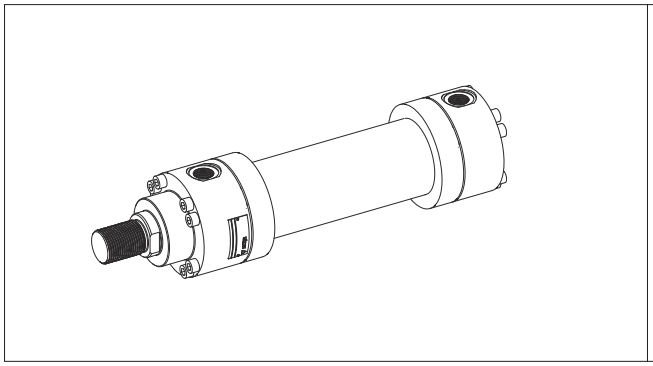
11 RELATED DOCUMENTATION

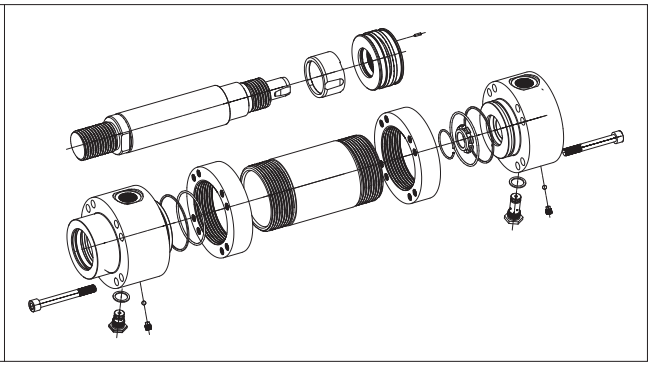
Pressure relief valves

CWY010 CART MX*/PED, CART MXS*/PED, CART AREX*/PED. CART AREXS*/PED – direct, screw-in safety cartridges with PED certification

Operating and maintenance information for stainless steel cylinders

These operating and maintenance information are valid only for Atos hydraulic cylinders and are intended to provide useful guidelines to avoid risks when hydraulic cylinders are installed in a machine or a system. Information and notes on the transport and storage of hydraulic cylinders are also provided.
These norms must be strictly observed to avoid damages and ensure trouble-free operation. The respect of these operating and maintenance information ensures an increased working life and thus reduced repairing cost of the hydraulic cylinders and system.





1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.
In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

CAUTION	Minor or moderate injury could occur	risk classes to ANSI Z535.6 / ISO 3864
	Information to be observed	

2 GENERAL NOTES

The cylinder operating and maintenance information are part of the operating instructions for the complete machine but they cannot replace them

Atos is not liable for damages resulting from an incorrect observance of these instructions.
All the hydraulic cylinders have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorised mechanical or electronic interventions
- The hydraulic cylinders are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

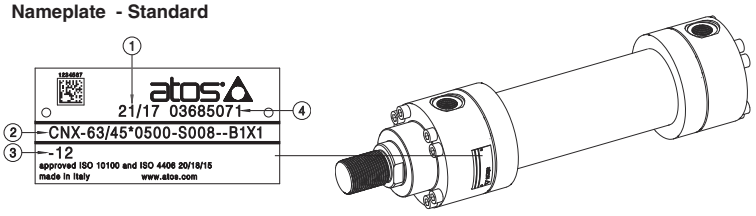
3 WORKING CONDITIONS

CAUTION
The operation of hydraulic cylinders is not permitted at different operating and environmental conditions than those specified below

Description	CNX
Ambient temperature	-20 ÷ +120°C
Fluid temperature	-20 ÷ +120°C
Max surface temperature	-
Max working pressure	10 MPa (100 bar)
Max pressure	15 MPa (150 bar)
Max frequency	5 Hz
Max speed	4 m/s
Recommended viscosity	15 ÷ 100 mm^2/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

4 NAMEPLATES

Nameplate - Standard



Nameplate - Standard (1)

Pos.	Description
①	Delivery date
②	Cylinder code
③	Series number
④	Customer code (only if requested)

Notes: (1) The position of the nameplate on the rear or front heads can change due to the cylinder overall dimensions

5 SAFETY NOTES

5.1 General
- The presence of cushioning can lead to a peak of pressure that can reduce the cylinder working life, ensure that the dissipated energy is less than the max value reported in **tab. B015**
- Make sure that the maximum working conditions, shown in section 3, are not exceeded
- Ensure to use hydraulic fluids compatible with the selected sealing system, see **tab. BW500**
- The rod must be handled with care to prevent damages on the surface coating which can deteriorate the sealing system and lead to the corrosion of the basic material
- The mounting screws must be free from shearing stress
- Transverse forces on the rods must always be avoided
- When the cylinder has to drive a rotating structure or where little alignment errors are expected, mounting style with spherical bearing should be used
- Contact surfaces, support elements in tolerance, elastic materials and labels must be covered before painting the cylinder

5.2 Position measuring system
- Position transducers must never be removed, if not otherwise specified in **tab. B310**, while the cylinder is under pressure
- Observe the information provided in **tab. B310** for the electronic connections
- The connectors must never be plugged or unplugged when the power supply is switched-on

5.3 Installation
- Consult **tab. P002** for installation, commissioning and maintenance of electrohydraulic system
- The piping have to be dimensioned according to the max pressure and max flow rate required
- All pipes and surfaces must be cleaned from dirt before mounting
- Remove all plug screws and covers before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the cylinders
- Bleed-off the system or the hydraulic cylinder using the proper device, see the technical data sheet for details
- Ensure that the cylinder mounting allow easy of acces for the purpose of maintenance and the adjustment of cushioning

6 MAINTENANCE

⚠ Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

6.1 Preliminary check and ordinary maintenance

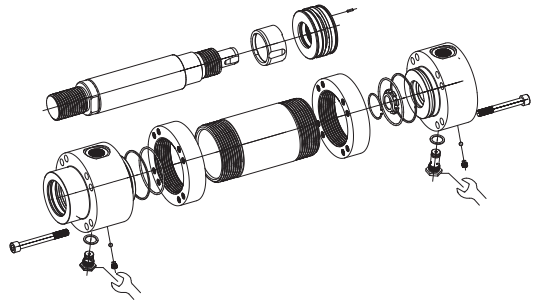
Atos hydraulic cylinders don't require any maintenance after commissioning. Anyway it is recommended to take into account the following remarks:
- Results of maintenance and inspection must be planned and documented
- Check oil escaping from oil ports or leakages at the cylinder heads
- Check for damages of the chromeplated surface of the rod: damages may indicate oil contamination or the presence of excessive transverse load
- Determine lubricating intervals for spherical clevises, trunnion and all parts not self-lubricated
- The rod should always be retracted during long stop of the machine or system
- Remove any salt, machining residuals or other dirt cumulated on the rod surface
- Follow the maintenance instructions of the fluid manufacturer

6.2 Repairing

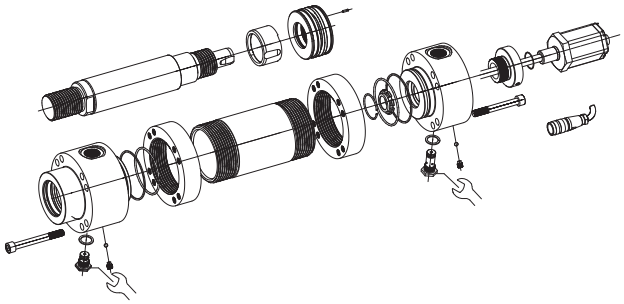
Before beginning any repairing observe the following guidelines:
- Unauthorized opening of the cylinder during the warranty period results in the warranty expiration
- Be sure to use only original spare parts manufactured or supplied by Atos
- Provide all the required tools to make the repair operations safely and not damage the components
- Read and follow all the safety notes given in section 5
- Ensure that the cylinder is well locked before beginning any operation
- Disassembly or assembly the cylinder with the right order as indicated in section **6.3**
- When mounting rod or piston guides and seals observe the correct position as indicated in section **6.4**. Any bad positioning can result in oil leakages
- It is strongly recommended the use of expanding sleeves to insert the seals in the proper groove
- Tighten all the screws or nuts as follow: lubricates the threads, insert the screw or the nut by hand for some turns, tighten the screw crosswise with the tightening torque specified in the technical table (a pneumatic screw driver may be used)
- Rod bearing and piston must be locked respectively to the front head and to the rod by means of special pin to avoid unscrewing
- The replacement of wear parts such as seals, rod bearing and guide rings depends on the operating conditions, temperature and quality of the fluid

6.3 Cylinders exploded views

CNX - For spare parts contact our technical office



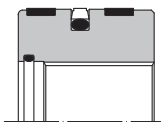
CNX* - For spare parts contact our technical office



Note: this symbol means that a particular equipment is required for mounting, contact our technical office

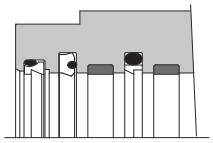
6.4 Sealing system mounting

PISTON

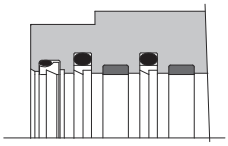


G3-G5-G8

ROD BEARING



G8



G3-G5

7 TRANSPORT AND STORAGE

7.1 Transport

Observe the following guidelines for transport of hydraulic cylinders:
- Cylinders have to be transported using a forklift truck or a lifting gear always ensuring a stable position of the cylinder
- Cylinders have to be transported in horizontal position in their original packaging
- Use soft lifting belts to move or lift the cylinders in order to avoid damages
- Before any movement check the cylinders weight (due to tolerances, the weight may be 10% greater than the values specified in the technical table)

CAUTION
Additional parts such as pipes, subplates and transducers must never be used for lifting

7.2 Storage

Stainless steel cylinders are made with selected materials offering the best protection against oxidation. Additionally all cylinders are tested with mineral oil OSO 46; the oil film, presents in the cylinder chambers after testing, ensures the internal corrosion protection.
Anyway be care to observe the following remarks:
- When a storage in the open air is foreseen ensure that cylinders are well protected against water
- The cylinders must be inspected at least once a year and rotated through 90° every six months to preserve the seals

In case of storage period longer than 12 months, contact our technical office

8 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads involve a premature wear of the bronze bushing, seals and wear rings	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **D**-**S**-**L**
	Fluid contaminants produce scratch and score marks on the seals	Check the fluid contamination class is < 20/18/15
	Chemical attack cause the deterioration of seals compound	Check seals compatibility with operating fluid
	High temperatures (fluid/ambient) the seals dark and flaked	a) Decrease the fluid temperature b) Install **G3** sealings for high temperatures
	Low temperature (ambient) make the seals brittle	Move the cylinder in a higher temperature zone
	High rod speed reduce the lubricant capacity of the seals	For rod speed > 5 m/s Install **G3**-**G5** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect)	Bleed off completely the air inside the hydraulic circuit
Wiper or seal extrusion	Overpressure	a) Limit the pressure of the system b) Install **G3**-**G5** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	See possible causes and solutions for oil leakage troubles
Lose of cushioning effect	Rod speed too low at end stroke	Check the cushioning adjustment is not fully open, regulate it if necessary
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants produce scratch and score marks on the cushioning piston	Check the fluid contamination class is < 20/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking	a) Replace "fixed" cushioning **7**-**9** with "adjustable" cushioning **1**-**3** b) For adjustable cushioning, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances	Check the fluid contamination class is < 20/18/15
Rod failure	Overload/overpressure involves ductile rod failure	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation involves fatigue rod failure	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G3**-**G5**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 20/18/15
	High oil flow speed > 6 m/s	Increase the piping diameters to reduce the oil flow speed

9 SERVOCYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

Note: for cylinders troubleshooting refer to section 8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