15 MODEL CODE OF PROPORTIONAL DIRECTIONAL VALVES

DHZA /UL - T - 0 7 1 - L 5 / NPT / * /* / ** /*

DHZA = size 06
DKZA = size 10
DPZA = size 10
= size 16
= size 25

UL = C UL US certification

A = without integral position transducer
T = with integral position transducer (not for DPZA)

Valve size (ISO 4401)

DHZA	DKZA	DPZA
0= size 06	**1**= size 10	**1**= size 10
		2= size 16
		4= size 25
		6= size 32

Configuration, DHZA and DKZA see section 16, DPZA see section 17
5 = external plus central position, spring centered
7 = 3 position, spring centered

Spool overlapping in central position, DHZA and DKZA see section 16, DPZA see section 17
1 = P, A, B, T positive overlapping
3 = P positive overlapping; A, B, T, negative

Spool type
L = linear; **S** = progressive; **D** = as **S**, but with P-A = Q, P-B = Q/2

Spool size: DHZA and DKZA see section 16, DPZA see section 17

Solenoid threated connection:
NPT = 1/2" NPT ANSI/ASME B46.1 (tapered)

Options:
B = solenoid at side of port A (only for single solenoid valves)
C = position transducer with current feedback 4÷20 mA (only for -T)
D = internal drain (only for DPZA)
E = external pilot (only for DPZA)
G = pressure reducing valve for piloting (only for DPZA)
MV = vertical hand lever (2)
O = horizontal cable entrance (only for -A)
WP = prolongued manual override protected by metallic cap (only for -A)
Y = external drain (only for DHZA and DKZA)

Omit for standard coil 12 VDC:
24 = with 24 VDC coils (only A version)

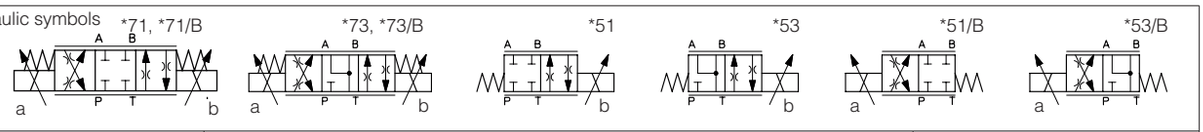
Series number

Seals material (1):
omit for NBR (mineral oil & water glycol)
PE = FPM

(1) Option **/BT** = low temperature -40°C also available on request
(2) Option **/MV** Available only for DHZA configuration 51, 53, 71, spool type S3, S5, D3, D5, L3, L5

16 HYDRAULIC CHARACTERISTICS of DHZA and DKZA (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols

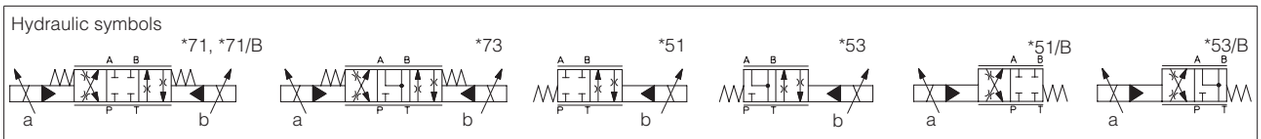


Valve model		DHZA-A DHZA-T					DKZA-A	DKZA-T
Spool overlapping		**1, 3**	**1, 3**	**1, 3**	**1, 3**	**1, 3**	**1, 3**	**1, 3**
Spool type and size		**L14**	**L1**	**S2**	**S3, L3, D3**	**S5, L5, D5**	**S3, L3, D3**	**S5, L5, D5**
Pressure limits	[bar]	ports P, A, B = 350; T = 160 (250 with external drain /Y)						
Δp max P-T	[bar]	70			50		40	
Max flow	[l/min]							
at Δp = 10 bar (P-T)		1	4,5	8	17	28	45	60
at Δp = 30 bar (P-T)		2	8	14	30	50	80	105
max permissible flow		3	12	21	45	60	90	120
Response time (1)	[ms]	< 30 (A) < 15 (T)					< 40 (A)	< 20 (T)
Hysteresis	[%]	≤ 5% (A) ≤ 0,2% (T)					≤ 5% (A)	≤ 0,2% (T)
Repeatability		± 1% (A) ± 0,1% (T)					± 1% (A)	± 0,1% (T)

(1) Response times at step signal (0%→100%) are measured from 10% to 90% of step value and are strictly referred to the valve regulation

17 HYDRAULIC CHARACTERISTICS OF DPZA (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols



Valve model		DPZA-1			DPZA-2					DPZA-4			DPZA-6		
Spool type and size (1)		**L5**	**S5**	**D5**	**S3**	**D3**	**L5**	**S5**	**D5**	**L5**	**S5**	**D5**	**L5**	**S5**	**D5**
Pressure limits	[bar]	Ports P, A, B, X = 350; T = 250; Y = 0													
Max flow	[l/min]														
at Δp = 10 bar		100	100	100 : 60	160	160:98	250	225	225 : 160	420	400	400 : 245	600	600	600:370
at Δp = 30 bar		160	160	160 : 100	270	270:160	430	390	390 : 280	720	690	690 : 420	1000	1000	1000:620
max permissible flow		180	180	180 : 110	400	400:245	550	550	550 : 390	900	900	900 : 550	1600	1600	1600:990
Response time (2)	[ms]	< 80			< 100					< 120					
Hysteresis	[%]	≤ 5%			≤ 5%					≤ 5%					
Repeatability		± 1%			± 1%					± 1%					

(1) Additional spools and configurations for -T execution, see table F172.
(2) Response times at step signal (0%→100%) are measured from 10% to 90% of step value and are strictly referred to the valve regulation

ELECTRONIC DRIVERS TO BE USED WITH EX-PROOF PROPORTIONAL VALVES
- Atos driver for proportional valves type **-A** (without transducer): **E-ME-AC**, see tab. G035
- Atos driver for proportional valves type **-T** (with transducer): **E-ME-T**, see tab. G140

18 MODEL CODE OF SERVOPROPORTIONAL VALVES

DLHZA /UL - T - 0 4 0 - L 7 3 / NPT / * ** /*

DLHZA = size 06
DLKZA = size 10

UL = C UL US certification

T = with integral position transducer

Valve size (ISO 4401)
0 = size 06 (DLHZA)
1 = size 10 (DLKZA)

Configuration, see section 19
4 = spring offset with fail safe
6 = spring offset

Spool overlapping in central position, see section 19
0 = P, A, B, T zero overlapping

Spool type
L = linear; **T** = not linear;

(1) Option **/BT** = low temperature -40°C also available on request

Spool size: see section 19

Fail safe configuration:
1 = A, B, P, T with positive overlapping **3** = P, positive overlapping; A, B, T negative

Solenoid threated connection:
NPT = 1/2" NPT ANSI/ASME B46.1 (tapered)

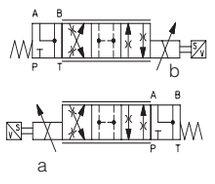
Options:
B = solenoid at side of port A
C = position transducer with current feedback 4÷20 mA
Y = external drain

Series number

Seals material (1):
omit for NBR (mineral oil & water glycol)
PE = FPM

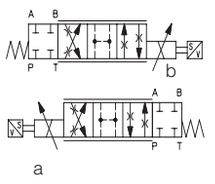
19 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols



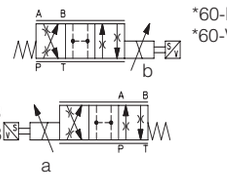
*40-L*3
*40-D*3
*40-DT*3
*40-T*3
*40-V*3

*40-L*3/B
*40-D*3/B
*40-DT*3/B
*40-T*3/B
*40-V*3/B



*40-L*1
*40-D*1
*40-DT*1
*40-T*1
*40-V*1

*40-L*1/B
*40-D*1/B
*40-DT*1/B
*40-T*1/B
*40-V*1/B



*60-L*1
*60-V*1

*60-L*1/B
*60-V*1/B

Valve model		DLHZA-T*											DLKZA-T*					
Pressure limits	[bar]	ports P, A, B = 350; T = 160 (250 with external drain /Y)											ports P, A, B = 315; T = 160 (250 with external drain /Y)					
Δp max P-T		70											60					
Spool		L0	L1	V1	L3	V3	L5	T5	L7	T7	V7	D7	DT7	L3	L7	T7	V7	D7	DT7
Max flow	[l/min]																		
at Δp = 30 bar		2,5	4,5	5	9	13	18		26			26÷13		40	65			65÷33	
max permissible flow		4	7	8	14	20	28		40			40÷20		55	80			80÷40	
Leakage [cm³/min] at P = 100 bar (1)		<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<1500	<400	<400	<1200	<400
Response time	[ms]	≤ 10												≤ 15					
Hysteresis	[%]	≤ 0,1%												≤ 0,1%					
Thermal drift		zero point displacement < 1% at ΔT = 40°C																	

(1) Referred to spool in center position and 50°C oil temperature.

20 MODEL CODE OF PRESSURE COMPENSATED PROPORTIONAL FLOW CONTROL VALVES

QVHZA / UL - T - 06 / 12 / NPT / * /* ** /*

QVHZA = size 06
QVKZA = size 10

UL = C UL US certification

A = without position transducer
T = with integral position transducer

Valve size (ISO 4401)
QVHZA: **06** QVKZA: **10**

Max regulated flow:

QVHZA		QVKZA
3 = 3,5 l/min;	**36** = 36 l/min;	**65** = 65 l/min
12 = 12 l/min	**45** = 45 l/min;	**90** = 90 l/min
18 = 18 l/min;		

(1) Option **/BT** = low temperature -40°C also available on request

Solenoid threated connection:
NPT = 1/2" NPT ANSI/ASME B46.1 (tapered)

Options:
C = current feedback signal 4÷20 mA (only for -T versions)
D = quick venting
O = horizontal cable entrace (only for -A versions)
WP = prolongued manual override protected by metallic cap (only for valves without transducer)

Omit for standard coil 12 VDC:
24 = with 24 VDC coils (only A version)

Series number

Seals material (1):
omit for NBR (mineral oil & water glycol)
PE = FPM

21 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols

Note: In three-way versions port P is open. In two-way versions port P must be plugged. Port T must always be plugged.

QVHZA-A
QVKZA-A

QVHZA-T
QVKZA-T

Valve model		QVHZA-A					QVHZA-T					QVKZA-A		QVKZA-T	
Valve size		06					06					10		10	
Max pressure ports P, A, B	[l/min]	210													
Max regulated flow	[l/min]	3,5	12	18	36	45	3,5	12	18	35	45	65	90	65	90
Min regulated flow (1)	[cm³/min]	15	20	30	50	60	15	20	30	50	60	85	100	85	100
Regulating Δp	[bar]	4 - 6		10 - 12		15	4 - 6		10 - 12		15	6 - 8	10 - 12	6 - 8	10 - 12
Max flow on port A	[l/min]	40		35	50	55	50				60	70	100	70	100

Above performance data refer to valves coupled with Atos electronic drivers.
(1) Values are referred to 3-way configuration. In the 2-way configuration, the values of min regulated flow are higher

22 MODEL CODE OF PROPORTIONAL PRESSURE RELIEF AND COMPENSATOR VALVES

RZMA / UL – A – 010 / 250 / NPT / * /* ** /*

Pressure relief:
RZMA = subplate size 06
HZMA = modular size 06
AGMZA= subplate size 10, 20, 32
LIMZA = cartridge (1)
Pressure compensator:
LICZA = cartridge (1)

UL = C UL US certification

A = without integral pressure transducer

Valve size:
see section 23 for size code

Max regulated pressure:
see section 23

Seals material (2):
omit for NBR (mineral oil & water glycol)
PE = FPM

Series number

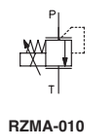
Omit for standard coil 12 V_{DC}:
24 = with 24 VDC coils (only A version)

Options:
E = external pilot (only for AGMZA)
O = horizontal cable entrace
P = with integral mechanical pressure limiter (only for LI*ZA)
Y = external drain (only for AGMZA)

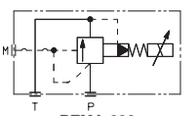
Solenoid threated connection:
NPT = 1/2" NPT ANSI/ASME B46.1 (tapered)

(1) For the code of the ISO cartridge to use with LIMZA and LICZA, see tab. F300 section 2.
(2) Option **/BT** = low temperature -40°C also available on request

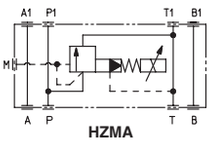
23 HYDRAULIC CHARACTERISTICS



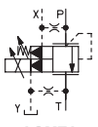
RZMA-010



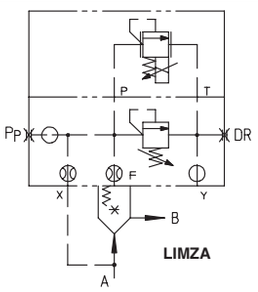
RZMA-030



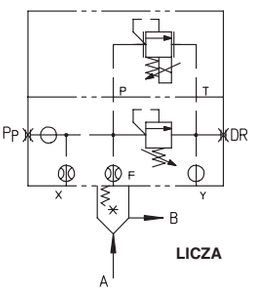
HZMA



AGMZA



LIMZA



LICZA

Valve model		RZMA		HZMA	AGMZA			LIMZA							LICZA				
Size code		010	030	030	10	20	32	1	2	3	4	5	6	8	1	2	3	4	5
Valve size		06			10	20	32	16	25	32	40	50	63	80	16	25	32	40	50
Max regulated pressure	[bar]	80; 180; 250																	
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	200	400	750	1000	2000	3000	4500	200	400	750	1000	2000

24 MODEL CODE OF PROPORTIONAL PRESSURE REDUCING VALVES

RZGA / UL – A – 010 / 250 / NPT / * /* ** /*

Pressure reducing:
RZGA = subplate size 06
HZGA = modular size 06
KZGA = modular size 10
AGRCZA = subplate size 10, 20
LIRZA = cartridge

UL = C UL US certification

A = without integral transducer

Valve size:
see section 25 for size code

Max regulated pressure:
see section 25

Seals material (1):
omit for NBR (mineral oil & water glycol)
PE = FPM

Series number

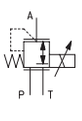
Omit for standard coil 12 V_{DC}:
24 = with 24 VDC coils (only A version)

Options:
O = horizontal cable entrace (1)
P = with integral mechanical pressure limiter (only for AGRCZA and LIRZA)
R = with check valve (only for AGRCZA)

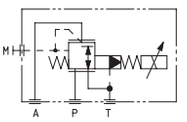
Solenoid threated connection:
NPT = 1/2" NPT ANSI/ASME B46.1 (tapered)

Note: for the code of the ISO cartridge to use with LIRZA, see tab. F300 section 2.
(1) Option **/BT** = low temperature -40°C also available on request

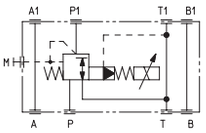
25 HYDRAULIC CHARACTERISTICS



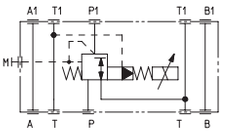
RZGA-A-010



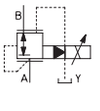
RZGA-A-033



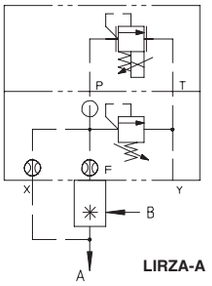
HZGA-A-031



KZGA-A-031



AGRCZA-A

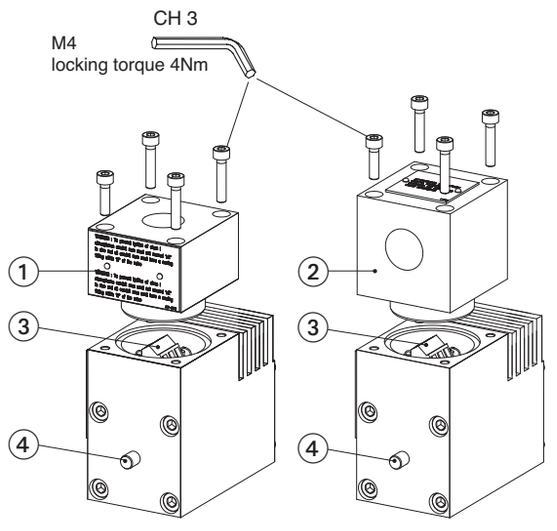


LIRZA-A

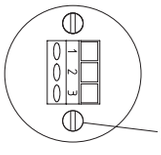
Valve model		RZGA		HZGA	KZGA	AGRCZA		LIRZA			
Size code		010	033	031	031	10	20	1	2	3	4
Valve size		06			10	10	20	16	25	32	40
Max regulated pressure	[bar]	32; 100; 210	80; 180;					250			
Min regulated pressure	[bar]	0,8	1	1	1	1	1	7	7	7	7
Max pressure at port P	[bar]	315									
Max pressure at port T	[bar]	210									
Max flow	[l/min]	12	40	40	100	160	300	160	300	550	800

26 EX PROOF SOLENOIDS WIRING

ON-OFF and proportional valves -A



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

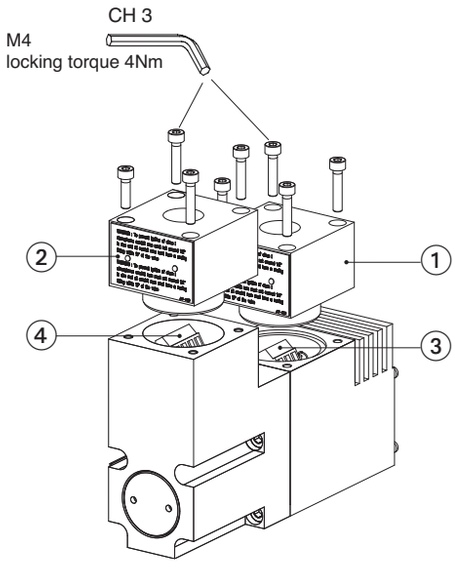


1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

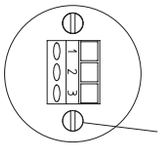
(2) = alternative GND screw terminal connected to solenoid housing

Proportional valves -T



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



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

(2) = 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 suitable for wires cross sections up to 2,5 mm² (max AWG14)

Cable Specification:
Power supply and transducer cables have to comply with following characteristics

- 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)

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.

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

26.1 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.

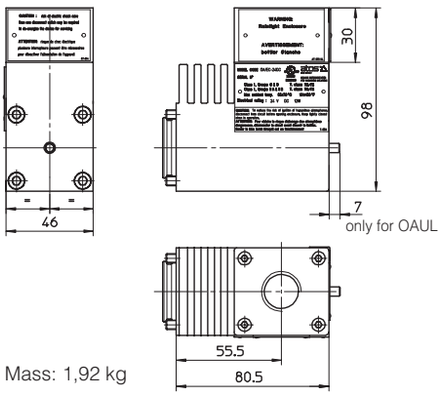
ON-OFF

Max ambient temperature [°C]	Temperature class	Surface temperature [°C]	Cable temperature
55 °C	T6	<85 °C	100 °C
70 °C	T5	<100 °C	100 °C

PROPORTIONAL

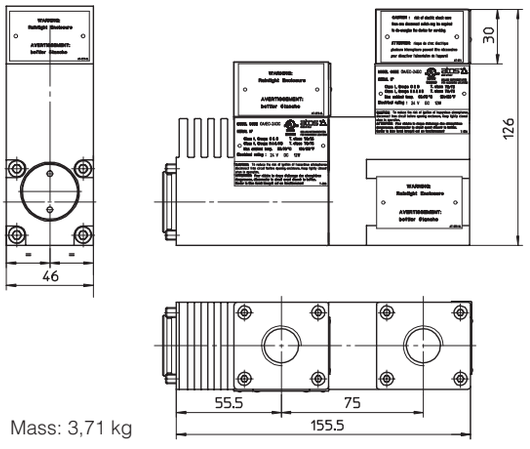
Max ambient temperature [°C]	Temperature class	Surface temperature [°C]	Cable temperature
55 °C	T4	<135 °C	100 °C
70 °C	T3	<200 °C	100 °C

OAUL
OZAUL-A



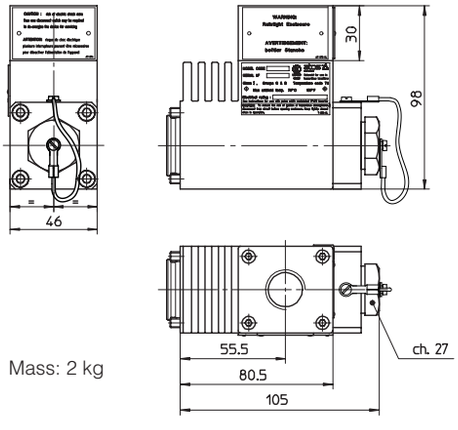
Mass: 1,92 kg

OZAUL-T



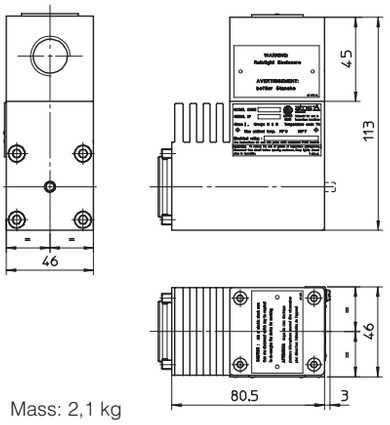
Mass: 3,71 kg

Option /WP



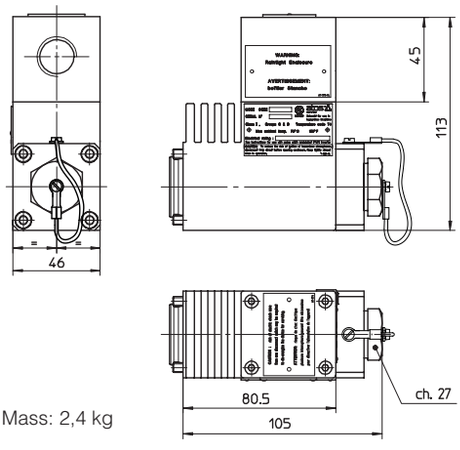
Mass: 2 kg

Option /O



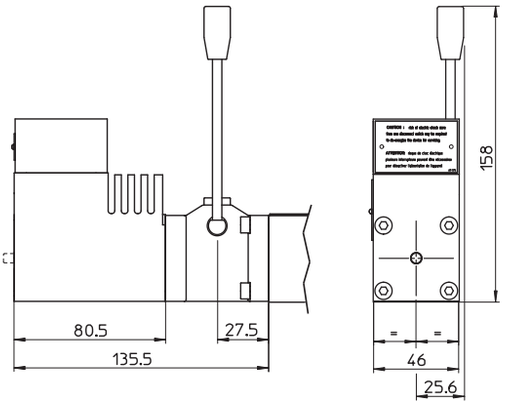
Mass: 2,1 kg

Option /OWP



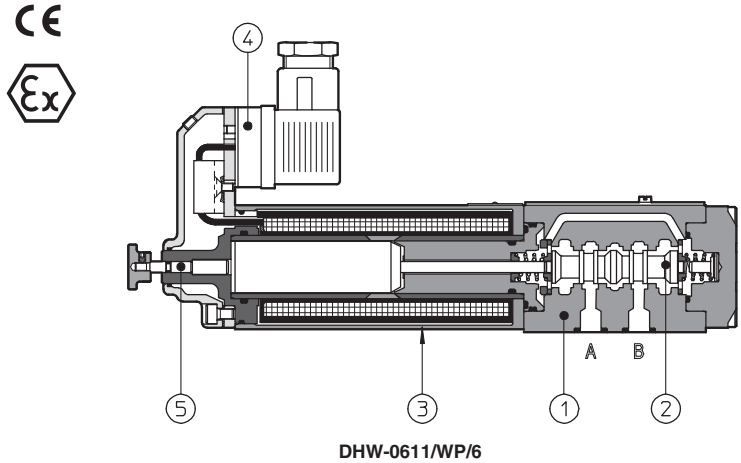
Mass: 2,4 kg

Option /MV



Intrinsically safe solenoid valves

on/off controls - ATEX certification



DHW-0611/WP/6

① valve body
② valve spool
③ intrinsically safe solenoid
④ electrical connector
⑤ manual override

On/off valves equipped with intrinsecally safe solenoids certified according to ATEX 94/9/CE, protection mode:
- Ex II 1 G, Ex ia IIC T6, IIB T6 or IIA T5 (surface plants with gas or vapours environment, category 1, zone 0, 1 and 2).
- Ex I M2 Ex ia I (solenoids group I for surface, tunnels or mining plants).

"Intrinsically safe" protection is based on the principle of limiting the energy of electric circuits in environments with presence of hazardous atmospheres. For this reason the valves must be supplied through specific "safety barriers" which limitate the max current to the solenoid. Atos provides galvanically insulated barriers for single and double solenoid valves, see section 18 to 21. 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.

1 INTRINSICALLY SAFE SOLENOIDS: MAIN DATA

Solenoid code	Group II	**OW-18/6**	**OW-18/H**
	Group I (mining)	**OWM-18/6**	**OWM-18/H**
Nominal resistance at 20°C		150 Ω	
Coil insulation		Class H	
Protection degree		IP65	IP67
Duty factor		100%	
Electrical connector		DIN 43650 2 pin+GND	MIL-C-26482 3 pin

2 INTRINSICALLY SAFE SOLENOIDS: ELECTRICAL AND TEMPERATURE DATA

Method of protection		**Ex ia / Ex ib** according to EN60079-0: 2006, EN60079-11:2007					
Gas group		**I** and **IIC**			**I** and **IIB**	**I** and **IIA**	**I**
Temperature class		**T6**			**T6**	**T5**	**-**
Electrical characteristic	V max	27 V	19,5 V	19,11 V	28 V	28 V	12,2 V
	I max	130 mA	360 mA	360 mA	250 mA	396 mA	2200 mA
	P max	0,9 W	1,64 W	1,72 W	1,8 W	2,8 W	6,82 W
Minimum supply current		≥ 65mA, for I.S. barriers see section 18 to 21					
Surface temperature (ambient temp. +60°C)		≤ 85°C				≤ 100°C	150 °C
Ambient temperature		-40 ÷ +60°C (1)					-20 ÷ +60°C

(1) The Group II solenoids are Atex certified for minimum temperature -40°C. Select /BT in the valve code for the application with minimum temperature -40°C

3 CERTIFICATIONS

In the following is resumed the valves marking according to the Atex Group I and Group II certification

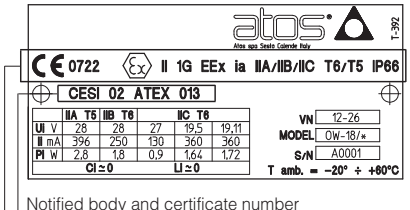
3.1 GROUP II, Atex

Ex = Equipment for explosive atmospheres
II = Group II for surface plants
I = Very high protection (equipment category)
G = For gas and vapours
ia = Intrinsically safe execution
IIC = Gas group - application in surface plants
T6 / **T5** = Temperature class of the solenoid surface referred to +60°C ambient temperature
Zone 0 (1 and 2) = Explosive atmosphere continuosly present

3.2 GROUP I (mining), Atex

Ex = Equipment for explosive atmospheres
I = Group I for mines and surface plants
M2 = High protection (equipment category)
d = Flame proof housing
I = Gas group (Methane)

3.3 EXAMPLE OF NAMEPLATE MARKING



Notified body and certificate number
Marking according to Atex Directive

4 MAIN CHARACTERISTICS OF INTRINSICALLY SAFE VALVES

Assembly position	the installation of DHW valves with the axis in vertical position is not recommended. If this type of installation is absolutely necessary, please consult our technical office
Subplate surface finishing	Roughness index $\sqrt{}^{0.4}$ flatness ratio 0,01/100 (ISO 1101)
Ambient temperature	from -20°C to +60°C (standard, /WG and /PE seals) -40°C to +60°C for /BT option
Fluid	Hydraulic oil as per DIN 51524 .... 535; for other fluids see section 5
Recommended viscosity	15 ÷ 100 mm²/s at 40°C (ISO VG 15 ÷ 100) max viscosity 400 mm²/s
Fluid contamination class	ISO 18/15, achieved with in line filters at 10 μm value to $\beta_{10} \geq 75$ (recommended)
Fluid temperature	-20°C +60°C (standard, /WG and /PE seals) -40°C to +60°C for /BT option

4.1 Corrosion protection characteristics

Valve screws: all screws made in stainless steel class A2

5 MODEL CODE OF SPOOL TYPE ON-OFF DIRECTIONAL SOLENOID VALVES

DH W /* – 0 71 3H / A / 6 ** /*

DH = spool type - direct
DPH = spool type - piloted

W = intrinsecally safe solenoid, Atex certified

omit for Group II
M = Group I (mining)

Valve size (ISO 4401):
for DHW : **0** = size 06;
for DPHW : **1** = size 10 **2** = size 16; **3** = size 25

Valve configuration, DHW see section 6 and DPHW see section 7

Spool type, DHW see section 6 and DPHW see section 7
3H = spool type 3H for marine applications (1) Only for DHW-071

Options:
/A = solenoid at side of port B
/WP = prolunged manual override

Connector type - see section 17
/6 = DIN 43650 (standard)
/H = MIL-C-26482

Series number

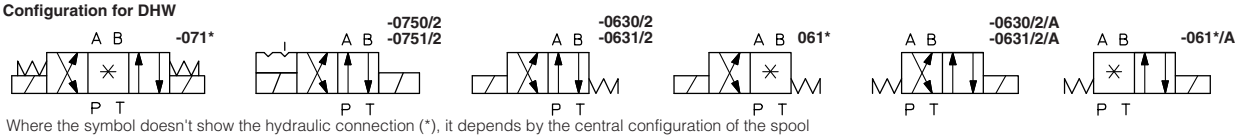
Synthetic fluids (2):
WG = water-glycol
PE = phosphate ester

(1) Spool type 3H provides larger passages A-B to T in central position than spool type 3, see section 11.3

(2) Option **/BT** = low temperature -40°C also available on request (not for group I Atex -mining-)

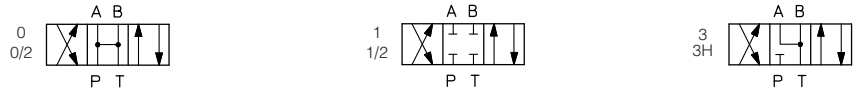
6 HYDRAULIC CONFIGURATIONS OF DHW VALVES

Configuration for DHW

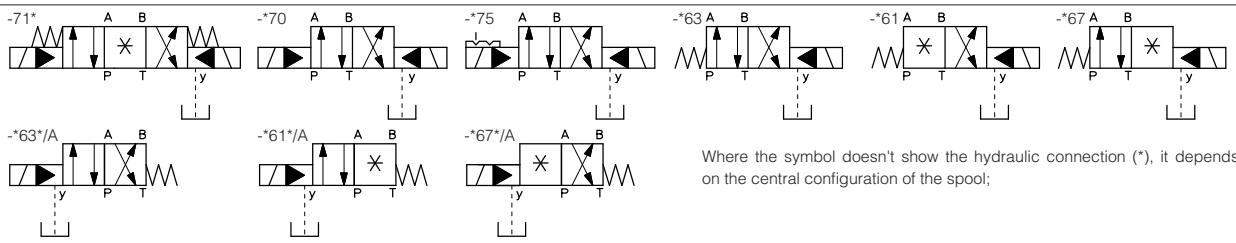


Where the symbol doesn't show the hydraulic connection (*), it depends by the central configuration of the spool

Spools for DHW



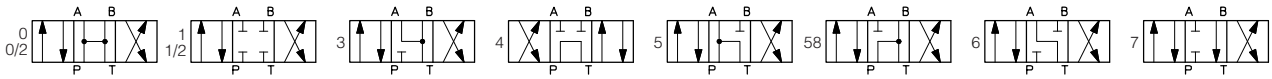
7 CONFIGURATION OF DPHW VALVES



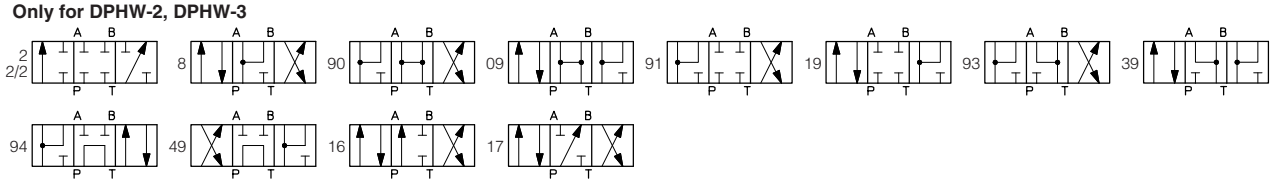
Where the symbol doesn't show the hydraulic connection (*), it depends on the central configuration of the spool;

Spools for DPHW valves

For all size



Only for DPHW-2, DPHW-3



8 MODEL CODE OF POPPET TYPE LEAK FREE ON-OFF DIRECTIONAL SOLENOID VALVES

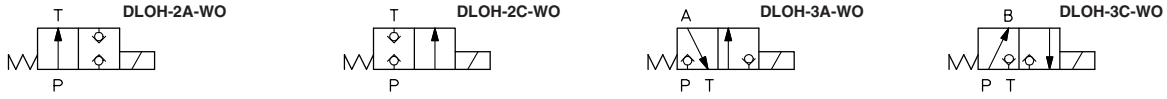
DLOH **/*** **–** **2** **A** **/** **R** **–** **WO** **/** **6** ****** **/***

- DLOH: directional control valve, poppet type size 06
- /*: omit for Group II; **M** = Group I (mining)
- 2: **2** = 2 way; **3** = 3 way
- A: **A** = open in rest position; **C** = closed in rest position
- R: Options: **/R** = with check valve on port P; **/WP** = prolunged manual override
- WO: **/WO** = intrinsically safe solenoid, Atex certified
- 6: Connector type - see section 17; **/6** = DIN 43650 (standard); **/H** = MIL-C-26482
- **: Series number
- /*: Synthetic fluids (1): **WG** = water-glycol; **PE** = phosphate ester

(1) Option **/BT** = low temperature -40°C also available on request (not for group I Atex -mining)

9 HYDRAULIC CONFIGURATIONS OF DLOH VALVES

DLOH*-WO



10 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C

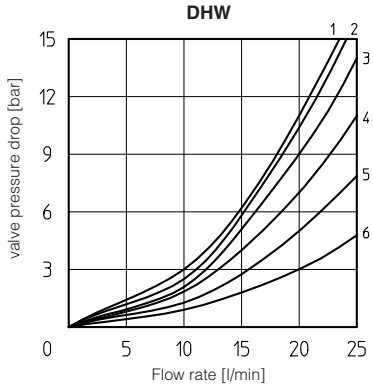
DHW

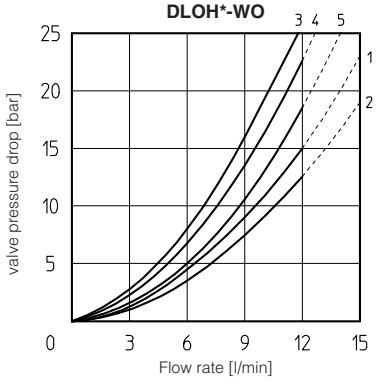
Flow direction \ spool type	0	0/2	1/2	1	3	3H
P→A / P→B	4	5	5	3	3	3
A→T / B→T	6	2	1	2	4	5

DLOH*-WO

Flow direction \ configuration	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



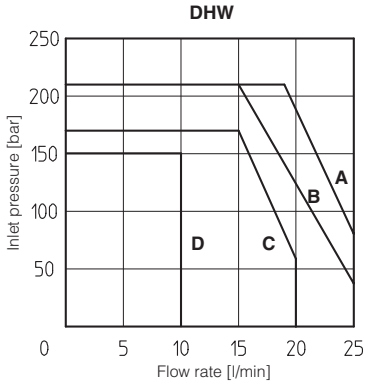


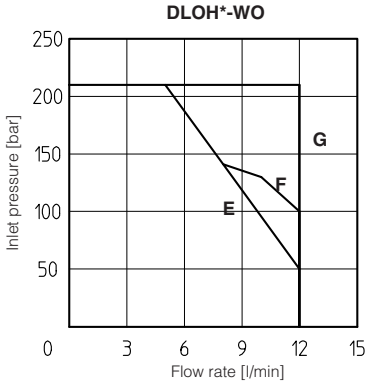
11 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

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

DLOH type	2A	2C	3A	3C
Diagram	G	G	F	E





11.1 Operating pressure:
Ports P, A, B = 350 bar Port T = 160 bar

11.2 Operating limits (only for **DHW-0713H**)
Max flow = 10 l/1' - Max pressure = 150 bar

11.3 Flow capability in central position A-B → T (only for **DHW-0713H**)
Max flow = 25 l/1' with Δp 10,5 bar

12 INTERNAL LEAKAGES

12.1 DHW internal leakages
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

12.2 DLOH-*-WO internal leakages based on mineral oil ISO VG 46 at 50°C
less than 5 drops/min (0,36 cm³/min) at max pressure.

13 MODEL CODE OF PRESSURE CONTROLS

AGAM /* – 20 / 2 0 / 210 - WO / WP / 6 ** /*

AGAM = pressure relief valve, subplate mounting, see tab. C066
ARAM = pressure relief valve, threaded connections, see tab. C045

Omit for Group II
M = Group I (mining)

Valve size
for AGAM: **10** = size 10 (ISO 6264); **20** = size 20 (ISO 6264); **32** = size 32 (ISO 6264);
for ARAM: **20** = G 3/4"; **32** = G 1 1/4"

Number of the different setting pressure values:
1 = one setting pressure
2 = two setting pressure
3 = three setting pressure

Valve configuration
0 = venting with de-energized solenoid
1 = venting with energized solenoid
2 = without venting

Pressure range of first/second/third setting:
50 = 4 - 50 bar **210** = 7 - 210 bar
100 = 6 - 100 bar **350** = 8 - 350 bar

WO = Intrinsically safe solenoid, Atex certified

Option:
/WP = prolunged manual override

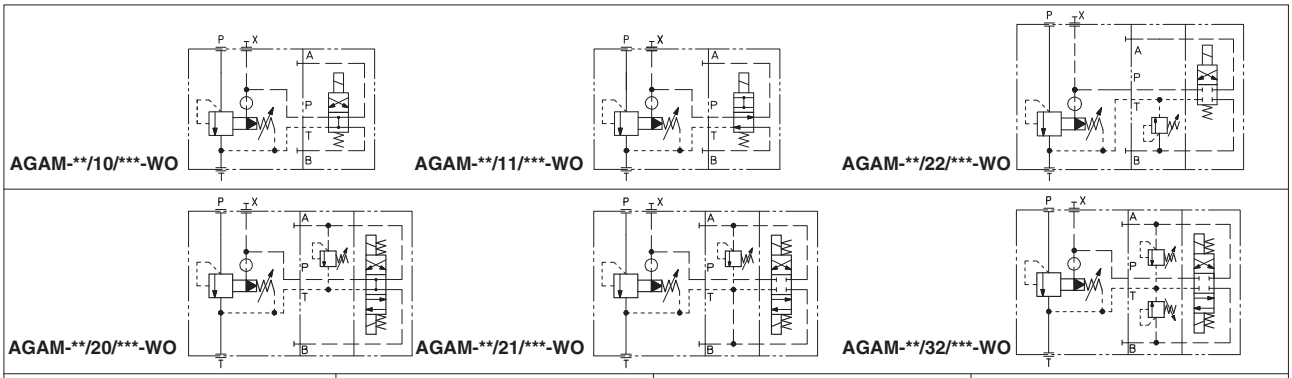
Connector type - see section 17
/6 = DIN 43650 (standard)
/H = MIL-C-26482

Series number

Synthetic fluids (1):
WG = water-glycol
PE = phosphate ester

(1) Option **/BT** = low temperature -40°C also available on request (not for group I Atex -mining-)

14 HYDRAULIC CHARACTERISTICS



Valve model		AGAM-10-WO	AGAM-20-WO	AGAM-32-WO
Max pressure	[bar]	350		
Setting			**50; 100; 210; 350**	
Pressure range	[bar]		4÷50; 6÷100; 7÷210; 8÷350	
Max flow	[l/min]	200	400	600

15 MODEL CODE OF COVERS FOR CARTRIDGE VALVES

LIDEW /* 1 – 1 / * - WO / 6 ** /*

Cover type:
LIDBH = with solenoid valve and shuttle valve for pilot selection
LIDEW = with solenoid valve for pilot selection

Omit for Group II
M = Group I (mining)

Valve configuration, see section 16

Valve size (ISO 7368)
for LIDBH*: **1** = 16, **2** = 16, **3** = 16, **4** = 16, **5** = 50
for LIDEW* **1** = 16, **2** = 16, **3** = 16, **4** = 16, **5** = 50, **6** = 63, **8** = 80

Options:
/B = cartridge piloted via port "B" of solenoid pilot valve
/E = external attachments X (G 1/4") and underneath port X supplied plugged (only for sizes 40 to 80)

WO = Intrinsically safe solenoid, Atex certified

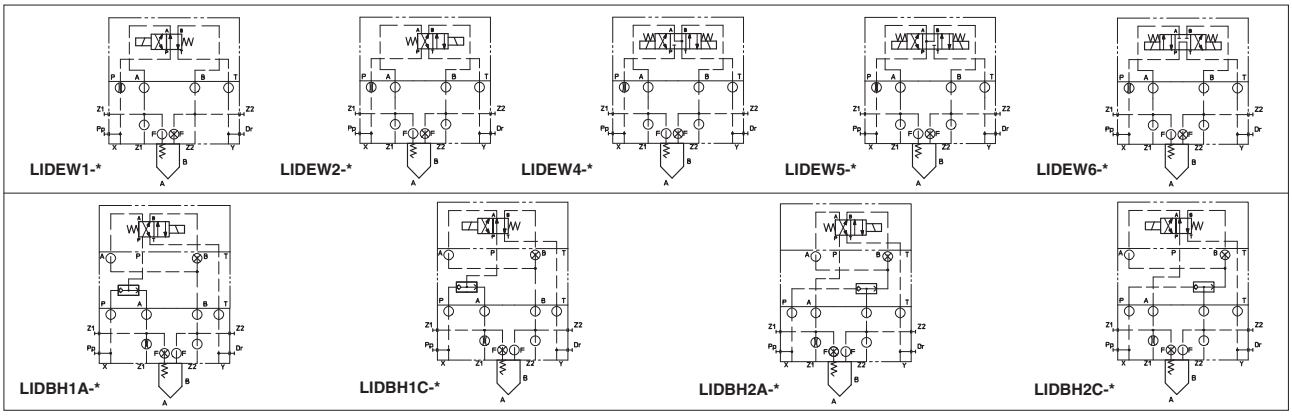
Connector type - see section 17
/6 = DIN 43650 (standard)
/H = MIL-C-26482

Series number

Synthetic fluids (1):
WG = water-glycol
PE = phosphate ester

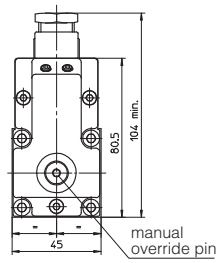
Note: for the code of the ISO cartridge to use with the above covers see tab. H003, section 2 and tab. H030, section 3.
(1) Option **/BT** = low temperature -40°C also available on request (not for group I Atex -mining-)

16 HYDRAULIC SYMBOLS

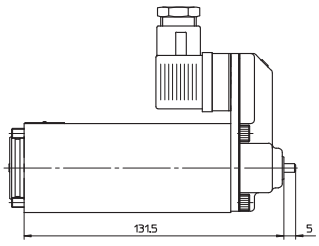


17 SOLENOID DIMENSIONS AND WIRING

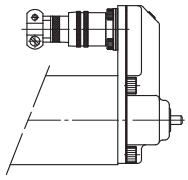
Dimension [mm]



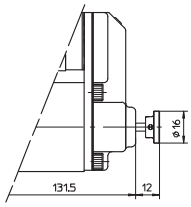
OW-18/6 (standard)



Option /H

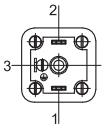


Option /WP

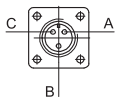


Connector wiring		
/6	/H	Connections
1	A	Coil
2	C	Coil
3	B	GND

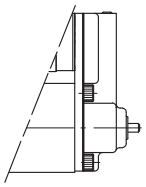
DIN 43650

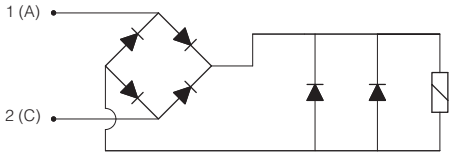


MIL-C-26482



cover shape for mining version





note: the connectors are supplied with the valves

18 INTRINSICALLY SAFE BARRIERS

The electric supply to these solenoids must be done through electronic devices situated out of potentially flammable environment (i.e. in safe zone), which limit the electric current to the intrinsically safe solenoid. These electronic devices are normally called “intrinsically safe barriers” 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 2 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, developed according to the European Norms EN60079-0/06, EN60079-11/07 and certified ATEX 94/9/CE, 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.

19 MODEL CODE OF I.S. BARRIER

19.1 I.S. barrier for double solenoid valves

Y-BXNE 412 00 *

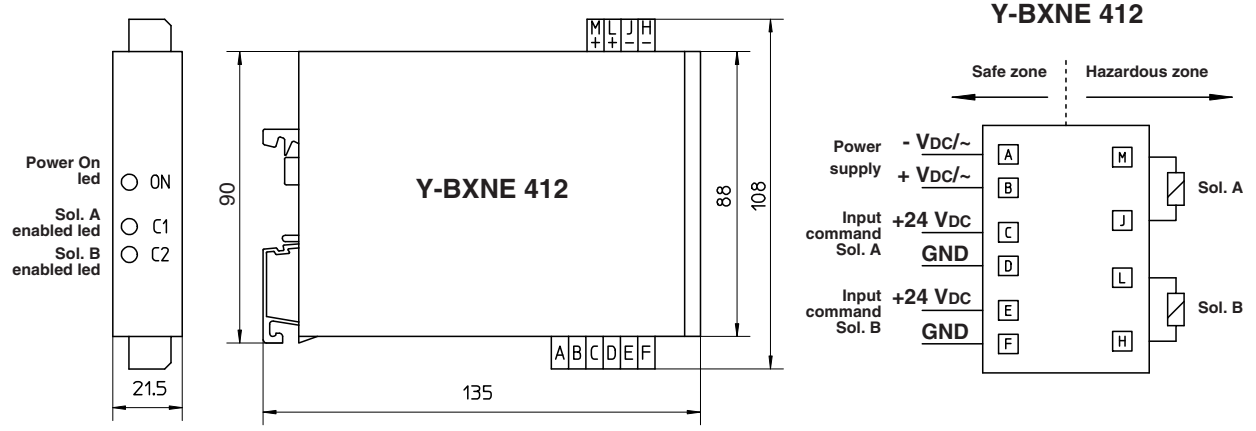
Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

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, see section 18.

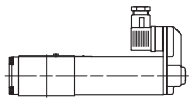
20 TECHNICAL CHARACTERISTICS OF I.S. BARRIER

	Y-BXNE 412
N° output channels	2
Power supply voltage	110÷230 VAC ±10% (50/60 HZ) 21,6 ÷ 53 VDC
Power consumption	< 3W
Output voltage Uo	19,5 V
Output current Io	341 mA
Output power Po	1,64 W
Galvanic insulation supply/output	2500 VAC / 50 Hz
Storage temperature	-25 °C ÷ +70 °C
Working temperature	-10 °C ÷ +60 °C
Housing material	ABS case
Mounting	on rail EN 50022
Electrical connections	screw terminals
Method of protection	Ex ia IIC
ATEX classification	Ex II 1 G/D

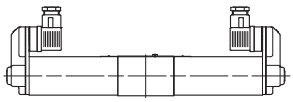
21 INSTALLATION DIMENSIONS OF I.S. BARRIER [mm]



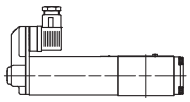
22 EXTERNAL PROFILE OF INTRINSICALLY SAFE VALVES [mm]



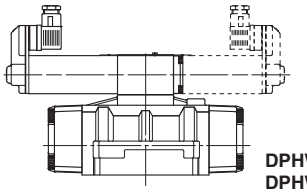
DHW-06



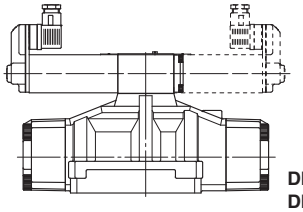
DHW-07



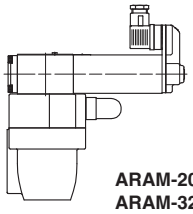
DLOH-**/WO



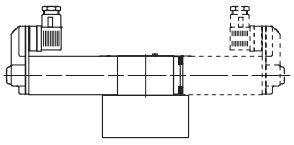
DPHW-16
DPHW-17



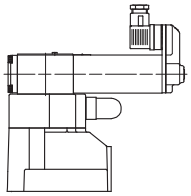
DPHW-26
DPHW-27



ARAM-20/1*-WO
ARAM-32/1*-WO



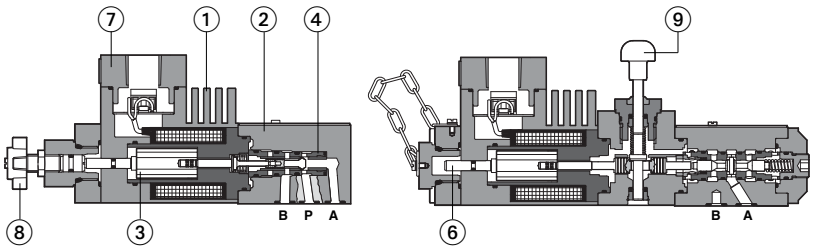
LIDEW1-*-WO
LIDEW2-*-WO
LIDEW4-*-WO



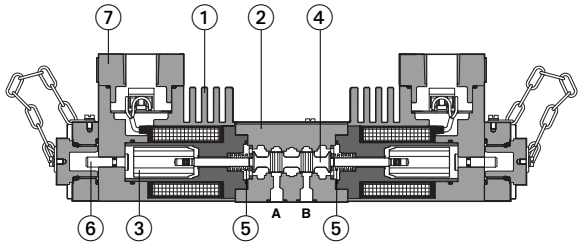
AGAM-10/1*-WO
AGAM-20/1*-WO
AGAM-32/1*-WO

Stainless steel valves for standard fluids

explosion-proof solenoid valves and pressure relief valves



① Ex-proof solenoid
② Valve body
③ Solenoid plunger
④ Spool / poppet
⑤ Spring
⑥ Manual override pin
⑦ Cable entrance
⑧ Handwheel manual override
⑨ Manual reset



DHAXS4-0711/M

New line of directional solenoid valves and pressure relief valves with stainless steel external parts for corrosive environments.

Stainless steel solenoids ①, ex-proof Atex, for hazardous areas - see section 3.

Features:

- These valves are made by selected inoxidizable materials for external parts to withstand extreme and corrosive environmental conditions. Internal components are in carbon steel.
- Directional valves are available in two basic versions: poppet type, 3-way leak free (suitable for accumulator systems) or spool type, 4-way on-off valves.
- Explosion proof solenoids ① with ATEX 94/9/CE certification, protection mode Ex II 2G, Ex d IIC T6/T4/T3
- Standard manual override pin ⑥ protected by a sealed stainless steel cap.
- Cable connection ⑦ M20x1,5.
- Stainless steel cable glands available
- ISO standard subplate mounting.

Options:

- Handwheel manual override ⑧ (option /V)
- Manual reset ⑨ (option /R) for safety applications
- Horizontal cable entrance.

Common Applications:
Offshore, Marine.

1 STAINLESS STEEL VALVES: MAIN DATA

Code (1)	Description	ISO size	Voltages DC	Voltages AC	ATEX T class (1) Standard	ATEX T class (1) Option /7	Input Power W	Max flow l/min	Δp (at max flow) bar	Max pressure bar (2)
DHAXS6 **DHAXS4**	4 way, spool type direct solenoid valves	06 (ISO 4401)	12	12/50/60	T6 T4	T4 T3	8 25	60 70	see diagram at section 8	350
DLOHXS6-AO **DLOHXS4-AO**	3 way, poppet type, direct solenoid valves	06 (ISO 4401)	24 48	24/50/60 110/50	T6 T4	T4 T3	8 25	10 12		350
DLOKXS6-AO **DLOKXS4-AO**	3 way, poppet type, direct solenoid valves	06 (ISO 4401)	110 198	120/60 220/50	T6 T4	T4 T3	8 25	25 30		250 315
DLOPXS6-AO	3 way, poppet type, piloted solenoid valve	no	220	220/60	T6	T4	8	220		315
DLPXS	3 way, poppet type, hydraulic operated valve	no	–	–	–	–	–	220		315
SP-CART-MXS-3 **SP-CART-MXS-6** **SP-CART AREXS-20**	relief valve direct screw-in	no no no	– – –	– – –	– – –	– – –	– – –	2,5 40 (60 PED) 120 (150 PED)	30	350 350 400
HMPXS-*	relief valve direct modular	06 (ISO 4401)	–	–	–	–	–	40	35	350
LIMMXS-2/* (3)	relief valve DIN cartridge	25 (ISO 7368)	–	–	–	–	–	400	6	350

Notes:

1) X6 and X4 versions differ only for the coil power (see Input Power) - The certified temperature class T6, T4, T3 is related to the max ambient temperature, from which results the max solenoid surface temperature allowed in the application (see section 3). The reference ambient temperature is -40÷+40°C (standard, see the sixth column in the above table), for higher ambient temperature (-40÷+70 °C) the temperature class has to be degraded (option /7).
2) Max pressure on T port = 110 bar
3) Optional electrohydraulic venting available on request.
4) Valves are provided by NBR seals, which allow min ambient temperature down to -40 °C (max oil viscosity = 380 cSt). The min ambient temperature fr valves with PE option (FPM seals) is -20°C.

2 MATERIALS SPECIFICATION

Valve type	solenoid housing ①	valve body ②	internal parts ③+④	spring ⑤	seals std	seals /PE
DHAXS	AISI 630	AISI 316L	Carbon steel	AISI 302	NBR (buna)	FPM (viton)
DLOHXS **DLOKXS**	AISI 630	AISI 316L	Carbon steel	AISI 302	NBR (buna)	FPM (viton)
DLOPXS	AISI 630	AISI 630	Carbon steel	AISI 302	NBR (buna)	FPM (viton)
DLPXS	–	AISI 630	Carbon steel	AISI 302	NBR (buna)	FPM (viton)
SP-CART-*XS	–	AISI 316L	Carbon steel	AISI 302	NBR (buna)	FPM (viton)
HMPXS	–	AISI 316L	Carbon steel	AISI 302	NBR (buna)	FPM (viton)
LIMMXS	–	AISI 316L	Carbon steel	AISI 302	NBR (buna)	FPM (viton)

3 EXPLOSION PROOF SOLENOIDS: MAIN DATA

VALVE TYPE			DLOHXS6 DLOKXS6 DLOPXS6		DHAXS4 DLOHXS4 DLOKXS4	
Solenoid code	Group II, ATEX		OAX/WP		OAKX/WP	
Voltage	VDC	±10%	**12DC, 24DC, 48DC, 110DC, 220DC**			
code	VAC 50/60 Hz	±10%	**12AC, 24AC, 110AC, 230AC (1)**			
Power consumption			8W		25W	
Coil insulation			Class H			
Protection degree			IP 67 According to IEC 144 when correctly coupled with the relevant cable gland SP-PAX19*, see section 16			
Duty factor			100%			
Mechanical construction			Explosion proof safety case classified Ex d, according to EN 60079-0: 2006, EN 6079-1: 2007			
Cable entrance and electrical wiring			Internal terminal board for cable connection threaded connection M20x1,5 for cable entrance, vertical (standard) or Horizontal (option /O) See section 16 for cable grand			
Metod of protection			Ex d			
Temperature class (surface temp.)			T6 (≤ 85°C)	T4 (≤ 135°C) option /7	T4 (≤ 135°C)	T3 (≤ 200°C) option /7
Ambient temperature (according Atex cerification)			-40 ÷ +45 °C	-40 ÷ +70 °C	-40 ÷ +40 °C	-40 ÷ +70 °C

Certification
Ex = explosion proof according to EN 60079-0, EN 60079-1
d = flame proof execution
IIC = gas group - application in surface plants
Zone 1 (and 2) = explosive atmosphere desultorily present
T6 (T4, T3) = temperature class of the solenoid surface is dependent to the ambient temperature

Solenoid wiring

1 = Coil
2 = GND
3 = Coil

(1) For alternating current supply a rectifier bridge is integrated in the solenoid

4 SPOOL TYPE DIRECTIONAL SOLENOID VALVES: MODEL CODE

DHA XS 4 - 0 63 1/2 / PA – M / V 24DC ** /*

Spool type - direct

Stainless steel execution for external parts

Temperature class
4 = T4
6 = T6

Size:
0 = 06

Valve configuration, see section 4.1
61, 63, 71, 75
(configurations 63 and 75 are available only with spool type 1/2)

Spool type, see section 4.2

Optional cable gland:
PA = with threaded cable gland, see section 16

Solenoid threated connection:
M = M20x1,5 UNI-4535 (6H/6g)

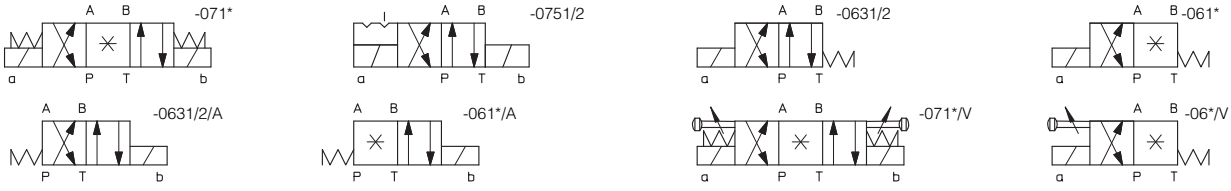
Options:
A = solenoid at side of port B
V = with handweel manual override
7 = for ambient temperature up to 70°C
O = horizontal cable entrance

Voltage code - see section 3

Series number

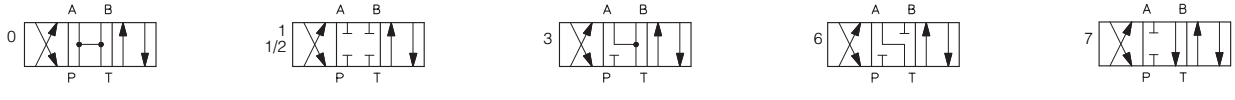
Synthetic fluids:
WG = water-glycol
PE = phosphate ester

4.1 Hydraulic configuration



Where the symbol doesn't show the hydraulic connection (*), it depends on the central configuration of the spool; see section 4.2.

4.2 Spools - for intermediate passages, see tab. E001.



5 POPPET TYPE LEAK FREE DIRECTIONAL SOLENOID VALVES: MODEL CODE

DLOH XS 6 - 3 A / PA - M – AO / V 24DC ** /*

DLOH - DLOK = poppet type - direct
DLOP = poppet type - piloted
DLP = as DLOPX but without pilot valve

Stainless steel execution for external parts

Temperature class
4 = T4 (for DLOHXS and DLOKXS)
6 = T6 (for all models)

3 = three way

Valve configuration, see section 5.1
A = A to T in rest position
C = P to A in rest position

Optional cable gland:
PA = with threaded cable gland, see section 16

Solenoid threated connection:
M = M20x1,5 UNI-4535 (6H/6g)

AO = explosion proof solenoid

Options: (not for DLPX)
R = with solenoid manual reset
V = with handweel manual override
7 = for ambient temperature up to 70°C
O = Horizontal cable entrance
Only for DLOPXS
D = internal drain
E = external pilot pressure

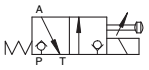
Voltage code - see section 3

Series number

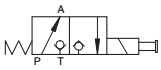
Synthetic fluids:
WG = water-glycol
PE = phosphate ester

5.1 Hydraulic configuration

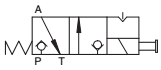
DLOHXS*-3A/M-AO/V



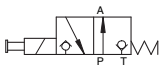
DLOHXS*-3C/M-AO



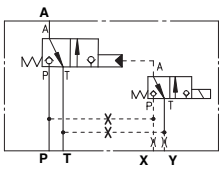
DLOKXS*-3A/M-AO/R



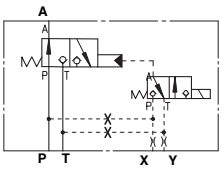
DLOKXS*-3C/M-AO



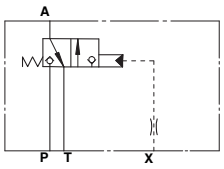
DLOPXS6-3A/M-AO



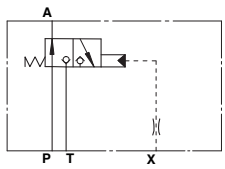
DLOPXS6-3C/M-AO



DLPXS-3A



DLPXS-3C



6 PRESSURE CONTROL VALVES: MODEL CODE

6.1 Screw-in type

SP-CART MXS / 350 / * / * ** / *

Screw-in relief cartridge

Stainless steel execution for external parts and size
MXS-3 =G1/2
MXS-6 =M33x1,5
AREXS-20 =M35x1,5

Pressure range
50 = 50 bar (not for AREXS-20 PED)
100 = 100 bar
210 = 210 bar
315 = 315 bar (only for AREXS-20)
350 = 350 bar (not for AREXS-20)
400 = 400 bar (only for AREXS-20)

Options
PED = reduced leakages and certified according to 97/23/CE

Only for PED
P = factory preset regulation

Series number

Synthetic fluids:
WG = water glycol
PE = phosphate ester

6.2 Modular type

HMP XS - 011 / 350 ** /*

Modular pressure relief valve ISO 4401 size 06

Stainless steel execution for external parts

Configuration, see section 6.5
011, 013, 014

Pressure range for HMP:
50 = 50 bar
100 = 100 bar
210 = 210 bar
350 = 350 bar

Series number

Synthetic fluids:
WG = water glycol
PE = phosphate ester

6.3 Control cover

LIMM XS - 2 / 350 ** /*

Cover according to ISO 7368

Stainless steel execution for external parts

Size
2 = 25

Pressure range
50 = 6 ÷ 50 bar **100** = 8 ÷ 100 bar
210 = 10 ÷ 210 bar **350** = 15 ÷ 350 bar

Series number

Synthetic fluids:
WG = water glycol
PE = phosphate ester

6.4 Standard cartridge valve to be coupled with LIMMX cover

SC LI - 25 31 2 ** /*

Cartridge according to ISO 7368

Size 25

Area ratio 1÷1

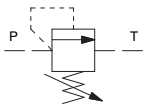
Spring cracking pressure
1 = 0,3 bar **2** = 1,2 bar
3 = 3 bar **6**= 6 bar

Series number

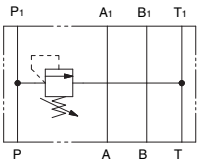
Synthetic fluids:
WG = water glycol
PE = phosphate ester

6.5 hydraulic configuration

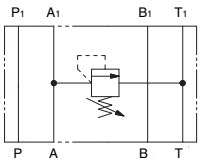
SP-CART-*XS



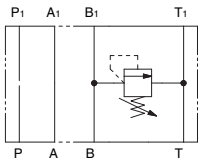
HMPXS-011/*



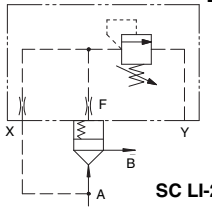
HMPXS-013/*



HMPXS-014/*



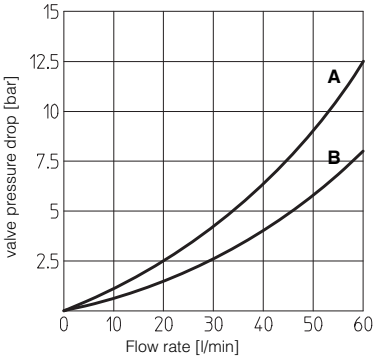
LIMMXS-2/*



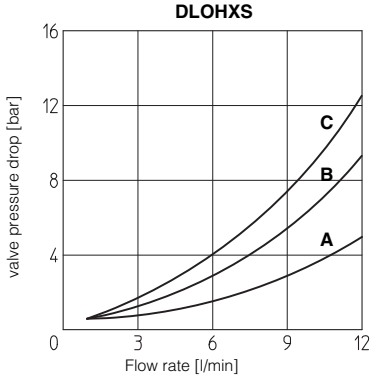
SC LI-2531*

7 Q/Δp DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

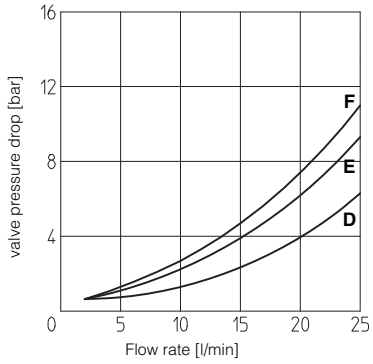
DHAXS



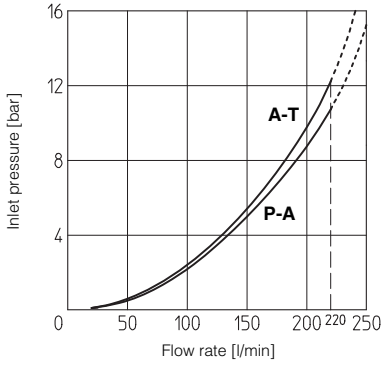
DLOHXS



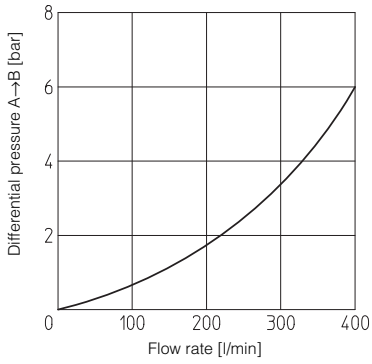
DLOKXS



DLOPXS



SCLI-2531*



DHAXS

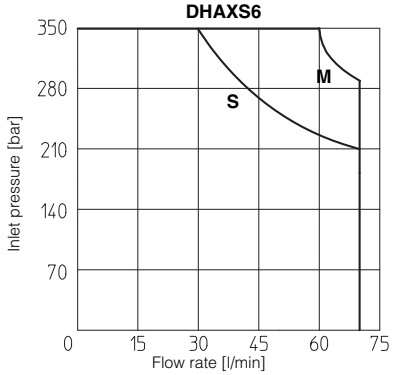
Spool type \ Flow direction	P→A	P→B	A→T	B→T	P→T
0	B	B	B	B	A
1, 1/2	A	A	A	A	
3	A	A	B	B	
6	A	A	B	A	
7	A	A	A	B	

Valve type \ Flow direction	P → A (P → B)	A → T (B → T)
DLOHXS-3A	C	B
DLOHXS-3C	B	A
DLOKXS-3A	F	E
DLOKXS-3C	E	D

8 OPERATING LIMITS OF ON/OFF DIRECTIONAL CONTROLS (based on mineral oil ISO VG 46 at 50°C)

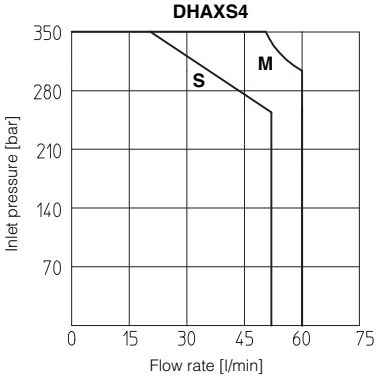
The diagram have been obtained with warm solenoids and power supply at lowest value (V_{nom}-10%). For DHAXS valves the curves refer to application with symmetrical flow through the valve (i.e. P → A and B → T). In case of asymmetric flow the operating limits must be reduced.

DHAXS6



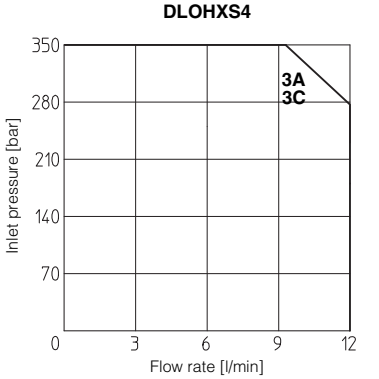
M = Spools 0, 1 **S** = Spools 1/2, 3, 6, 7

DHAXS4

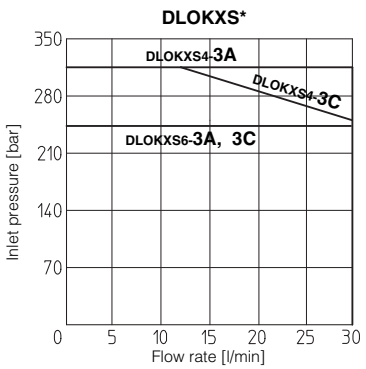


M = Spools 0, 1 **S** = Spools 1/2, 3, 6, 7

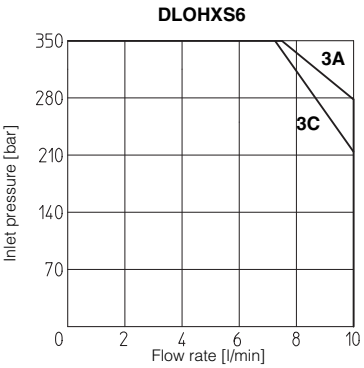
DLOHXS4



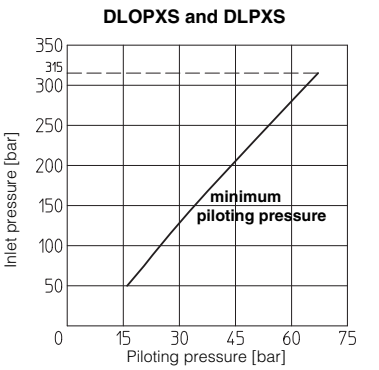
DLOKXS*



DLOHXS6



DLOPXS and DLPXS



8.1 Internal leakages

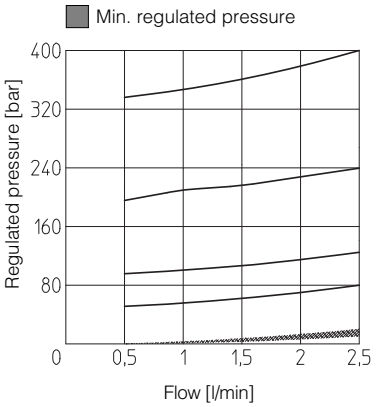
internal leakage of DLOHXS, DLOKXS, DLOPXS and DLPXS: less than 5 drops/min (0,36 cm³/min) at max pressure.

8.2 Piloting pressure (DLOPXS and DLPXS)

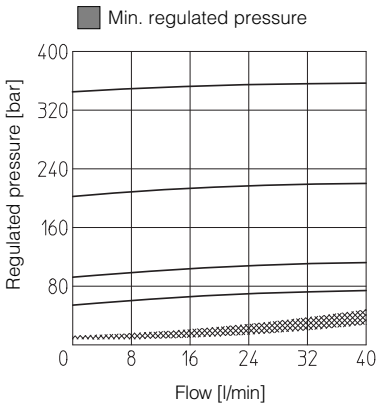
- max piloting pressure = 315 bar
- min piloting pressure = see diagram

9 **REGULATED PRESSURE VERSUS FLOW DIAGRAM** of screw-in cartridge valves (based on mineral oil ISO VG 46 at 50°C)

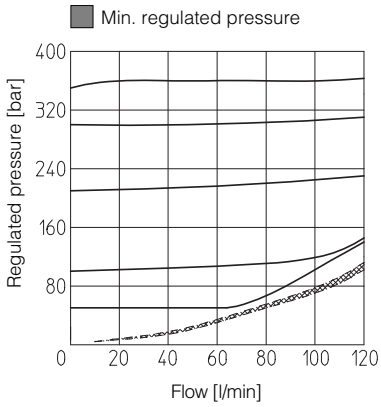
SP-CART MXS-3



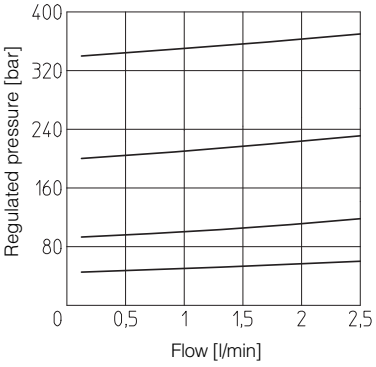
SP-CART MXS-6



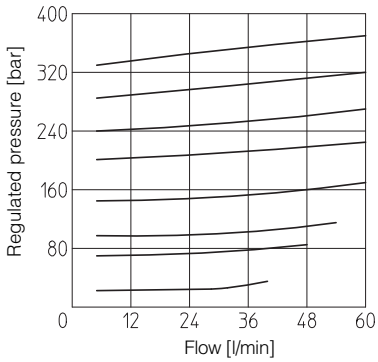
SP-CART AREXS-20



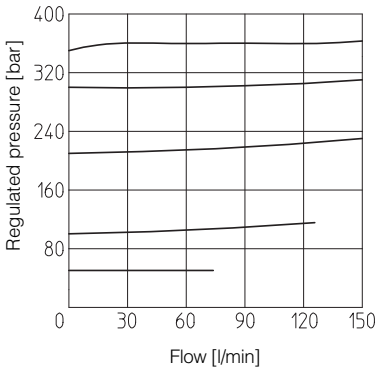
SP-CART MXS-3 **/PED



SP-CART MXS-6 **/PED

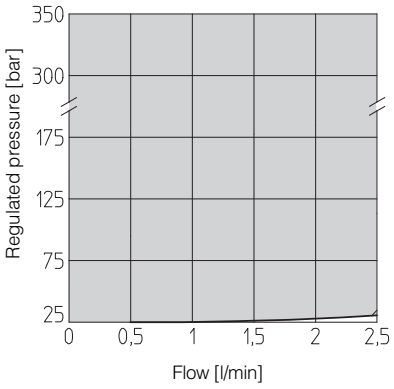


SP-CART AREXS-20 **/PED

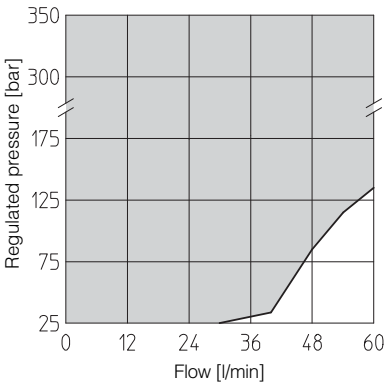


10 **PERMITTED WORKING RANGES** of screw-in cartridge valves with PED option (shared area)

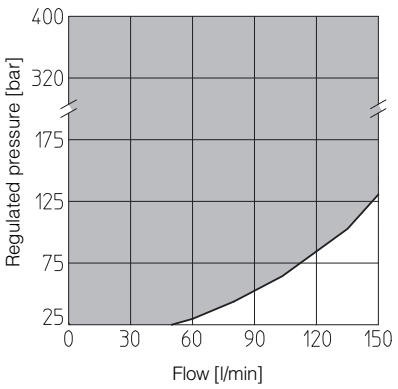
SP-CART MXS-3 **/PED



SP-CART MXS-6 **/PED

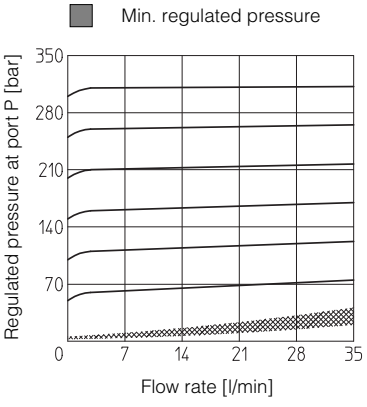


SP-CART AREXS-20 **/PED



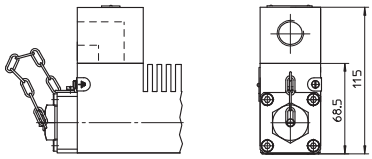
10.1 Regulated pressure for modular valves

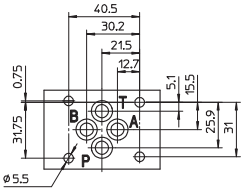
HMPXS-*



11 INSTALLATION DIMENSIONS OF DHAXS [mm]

hortizontal cable entrance oprtion **/O**

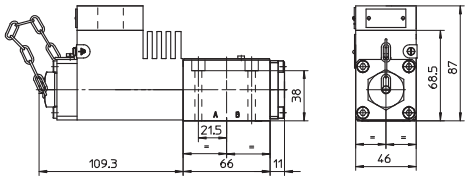




P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

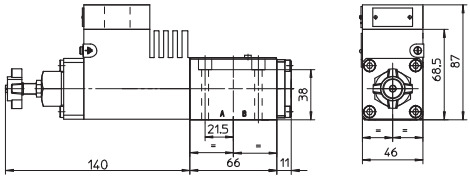
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x50-A4-70
Tightening torque = 5,5 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).

DHAXS4-06*



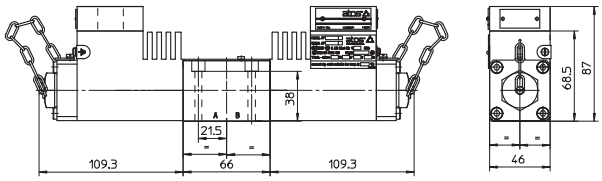
Mass: 2,9 kg

DHAXS4-06*/V



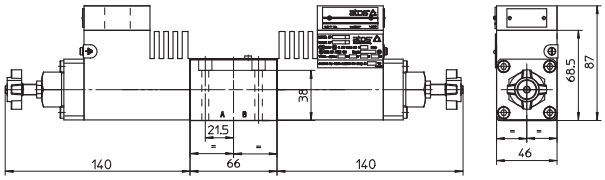
Mass: 3 kg

DHAXS4-07*



Mass: 4,6 kg

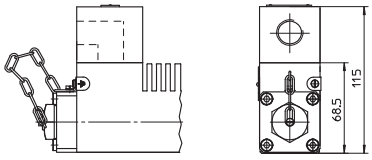
DHAXS4-07*/V

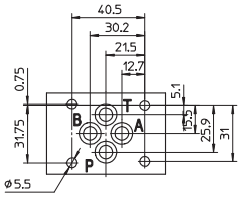


Mass: 4,8 kg

12 INSTALLATION DIMENSIONS OF DLOHXS AND DLOKXS [mm]

hortizontal cable entrance oprtion **/O**

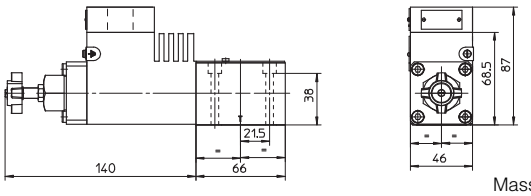




P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

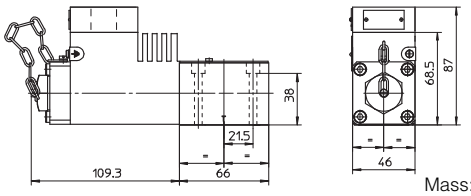
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts:
4 socket head screws M5x50-A4-70
Tightening torque = 5,5 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max).

DLOHXS6-3A/M-AO/V

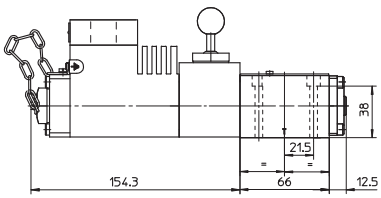


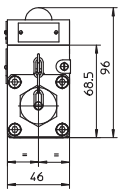
Mass: 3 kg

DLOHXS4-3C/M-AO



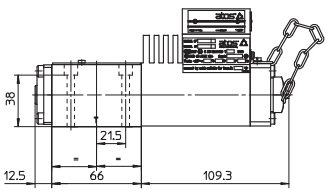
Mass: 2,9 kg

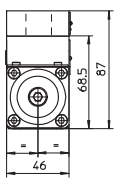




Mass: 3,8 kg

DLOKXS4-3A/M-AO/R



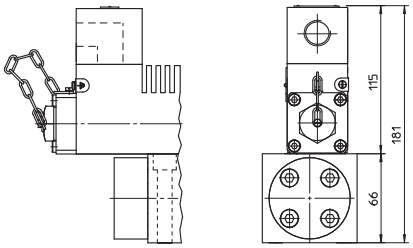


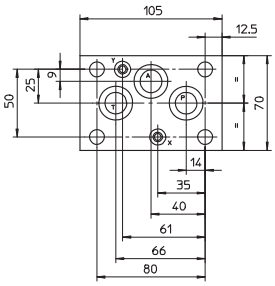
Mass: 2,9 kg

DLOKXS4-3C/M-AO

13 INSTALLATION DIMENSIONS OF DLOPXS AND DLPXS [mm]

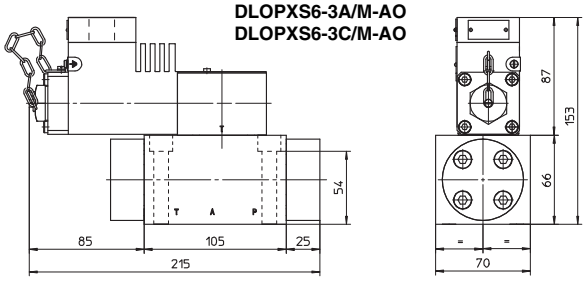
hortizontal cable entrance oprtion **/O**





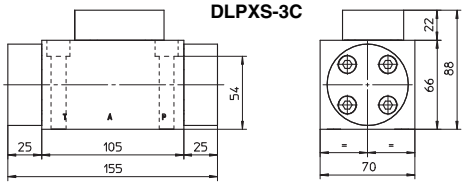
Mounting surface of DLOPXS and DLPXS is not ISO standard
Fastening bolts:
4 socket head screws M10x70-A4-70
Tightening torque = 40 Nm
Seals: 3 OR 3081; 2 OR 108
Ports P,A,T: Ø = 16 mm (max)
Ports X, Y: Ø = 7 mm (max)

DLOPXS6-3A/M-AO
DLOPXS6-3C/M-AO



Mass: 7 kg

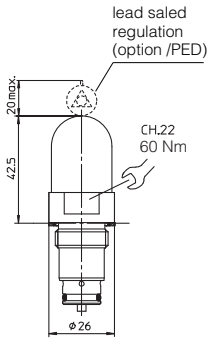
DLPXS-3A
DLPXS-3C



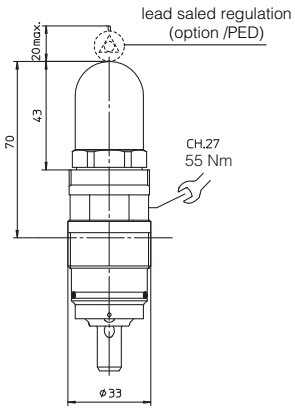
Mass: 4,5 kg

14 INSTALLATION DIMENSIONS OF SCREW IN PRESSURE RELIEF VALVES [mm]

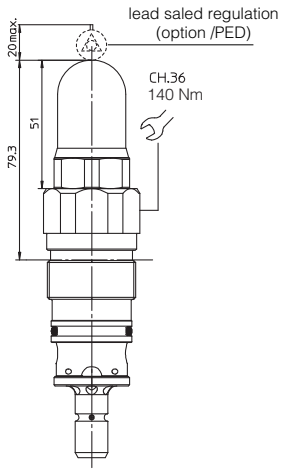
SP-CART MXS-3/*



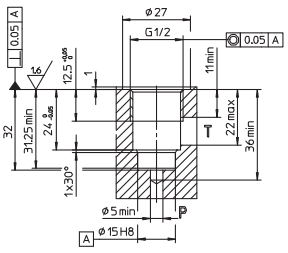
SP-CART MXS-6/*



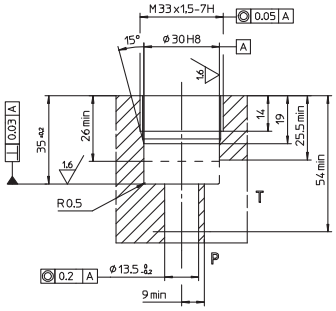
SP-CART AREXS-20



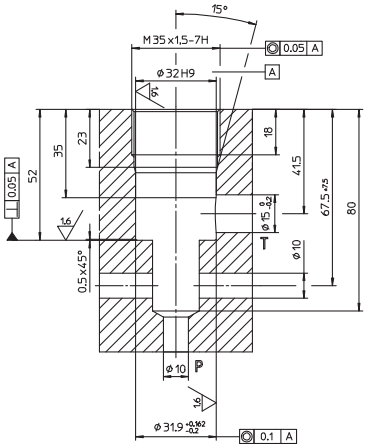
Recess dimensions for SP-CART MXS-3



Recess dimensions for SP-CART MXS-6

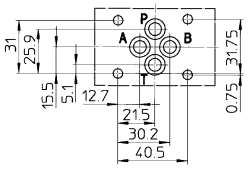


Recess dimensions for SP-CART AREXS-20

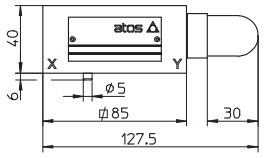


15 INSTALLATION DIMENSIONS OF MODULAR AND CARTRIDGE VALVES

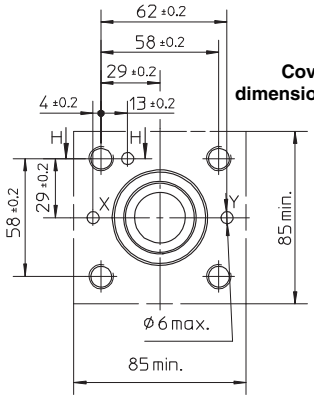
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: M5x**-A4-70
Tightening torque = 5,5 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)



LIMMXS-2/*

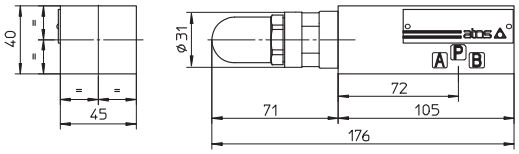


Mass: 2,2 kg



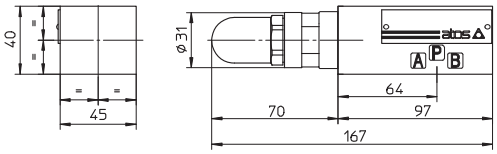
Cover interface dimensions for LIMMXS-2

HMPXS-011/*



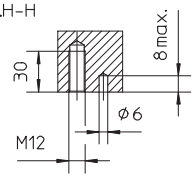
Mass: 1,4 kg

HMPX-013/*

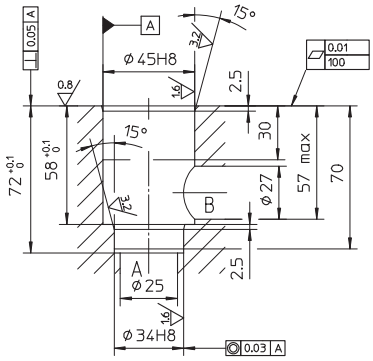


Mass: 1,2 kg

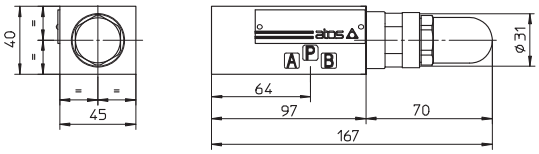
SEZ.H-H



Recess dimensions for SC LI-25



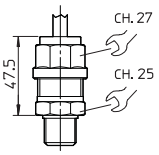
HMPX-014/*



Mass: 1,2 kg

16 CABLE GLAND

STAINLESS STEEL CABLE GLAND SP-PAXS19/* (PG9 - IP67)



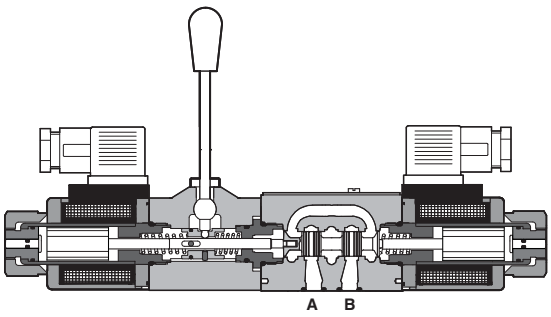
Stainless steel cable glands - available on request - are certified ATEX according to EN60079-0 and EN60079-1.

Following codes have to be specified for spare cable glands:
SP-PAXS19/M = with threated connection M20x1,5 UNI-4535 (6H/6g).
This cable gland must be blocked with loctite or similar or with a lock nut.
The valves must be connected to the power supply using the terminal board inside the solenoid.

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.
Additional equipotential grounding can be also performed by the user on the external facility provided on the solenoid case.
Minimum section of external ground wire = 4 mm².
Minimum section of internal ground wire = the same of supply wire.
In order to reach the terminal board inside the solenoid, the top plate of the solenoid must be removed.
Solenoids are provided with threated connection for cable entrance:
M20x1,5 (UNI-4535)

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 **(1)**

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 **(1)**

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

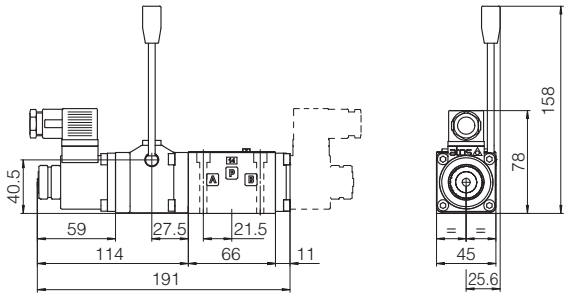
Seals material:
- = NBR
PE = FKM
BT = HNBR

(1) For DHZA model code see table F600 (Multicertification) or E125 (UL)
(2) Valves with position transducer (-T) and/or integrated electronics (only double solenoid valves -TE/-AE) available on request

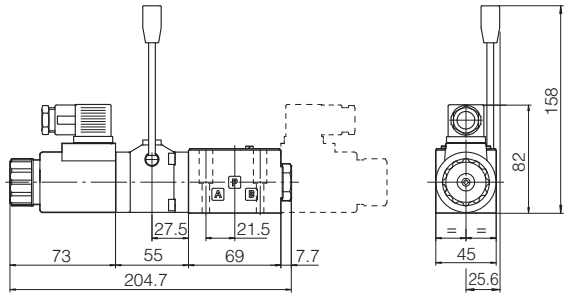
3 LEVER CHARACTERISTICS

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

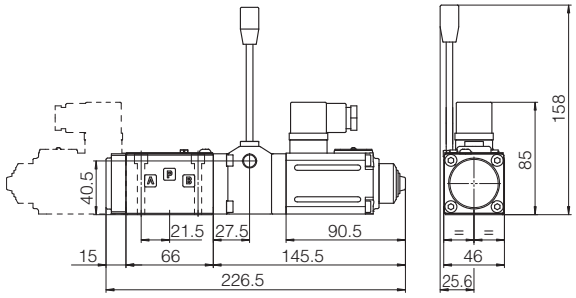
4 INSTALLATION DIMENSIONS [mm]



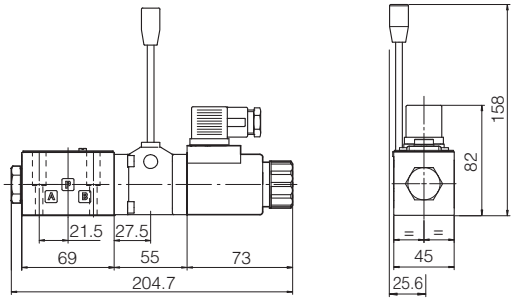
DHI-06*/MV Mass: 2,4 kg (single solenoid)
DHI-07*/MV (dotted line) Mass: 2,7 kg (double solenoid)



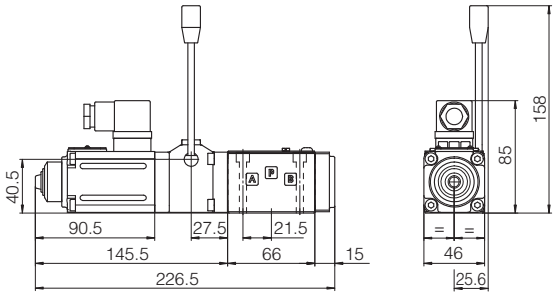
DHE-06*/MV Mass: 2,7 kg (single solenoid)
DHE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



DHZO-A-05*/MV Mass: 2,8 kg (single solenoid)
DHZO-A-07*/MV (dotted line) Mass: 3,5 kg (double solenoid)

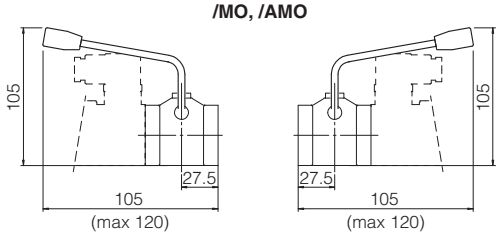


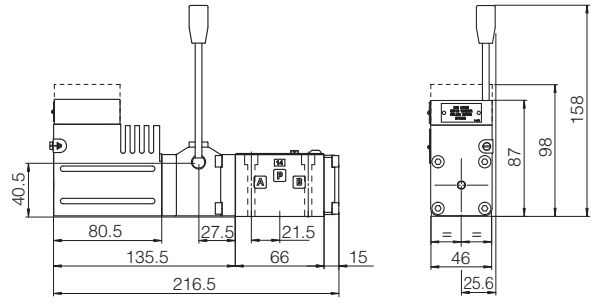
DHZE-05*/MV Mass: 2,7 kg (single solenoid)
DHZE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



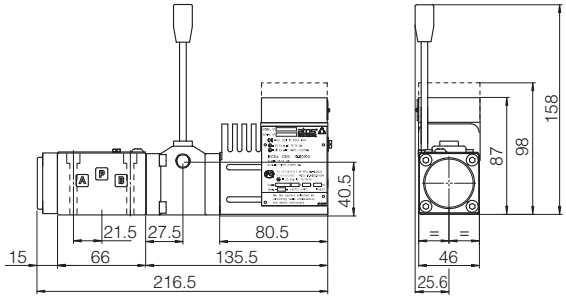
QVHZO-A-06*/MV Mass: 3,2 kg

Horizontal hand lever device
/MO, /AMO





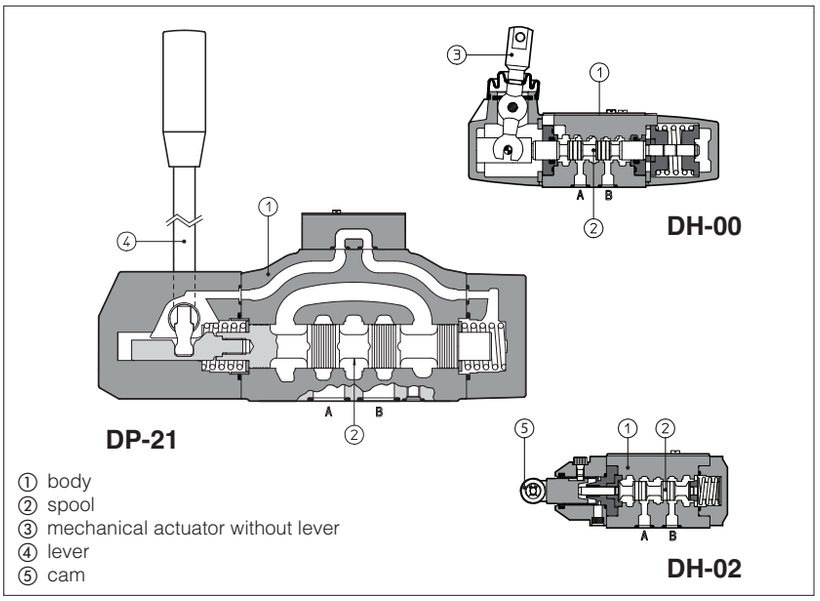
DHA/*-06*/MV Mass: 3,4 kg
DHA/UL-*-06*/MV (dotted line)



DHZA/*-06*/MV
DHZA/UL-*-06*/MV (dotted line)

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

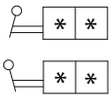
Spool type, see section 3

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

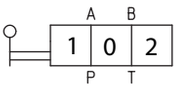
VALVE TYPE	SIZE	VALVE CONFIGURATION								
		0	1	2	3	4	5	6	7	8
DH-00	06	●	●	●	●	●	●	●	●	●
DH-01		●	●	●	●	●	●	●	●	●
DH-02					●				●	●
DK-10	10	●	●	●	●	●	●	●	●	●
DK-11		●	●	●	●	●	●	●	●	●
DK-12					●				●	●
DP-20	16		●		●	●	●			
DP-21			●		●	●	●			
DP-40	25		●		●	●	●			
DP-41			●		●	●	●			

3 **CONFIGURATIONS and SPOOLS** - for intermediate passages, see tab. E001

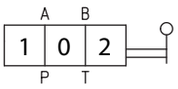
DH-00*, DH-01* and DK-10*, DK-11* - mechanical and hand lever actuator

Configurations

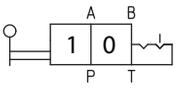
DH-000* DK-100* **DH-010* DK-110***



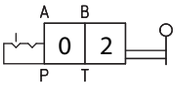
DH-000*/A DK-100*/A **DH-010*/A DK-110*/A**



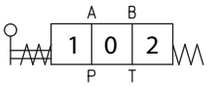
DH-006*/E DK-106*/E **DH-016*/E DK-116*/E**



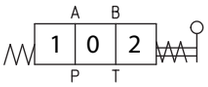
DH-006*/EA DK-106*/EA **DH-016*/EA DK-116*/EA**



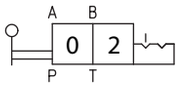
DH-001* DK-101* **DH-011* DK-111***



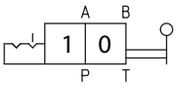
DH-001*/A DK-101*/A **DH-011*/A DK-111*/A**



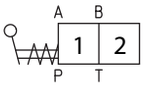
DH-006*/I DK-106*/I **DH-016*/I DK-116*/I**



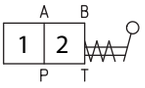
DH-006*/IA DK-106*/IA **DH-016*/IA DK-116*/IA**



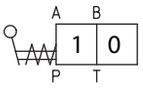
DH-002* DK-102* **DH-012* DK-112***



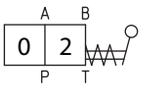
DH-002*/A DK-102*/A **DH-012*/A DK-112*/A**



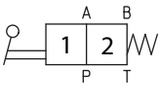
DH-007*/E DK-107*/E **DH-017*/E DK-117*/E**



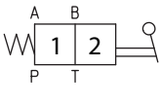
DH-007*/EA DK-107*/EA **DH-017*/EA DK-117*/EA**



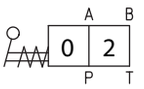
DH-003* DK-103* **DH-013* DK-113***



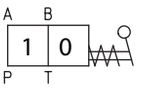
DH-003*/A DK-103*/A **DH-013*/A DK-113*/A**



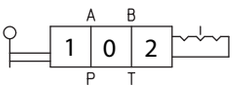
DH-007*/I DK-107*/I **DH-017*/I DK-117*/I**



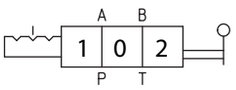
DH-007*/IA DK-107*/IA **DH-017*/IA DK-117*/IA**



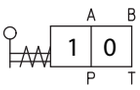
DH-004* DK-104* **DH-014* DK-114***



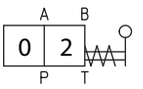
DH-004*/A DK-104*/A **DH-014*/A DK-114*/A**



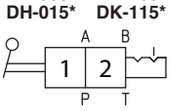
DH-008*/E DK-108*/E **DH-018*/E DK-118*/E**



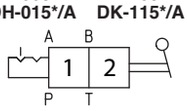
DH-008*/EA DK-108*/EA **DH-018*/EA DK-118*/EA**



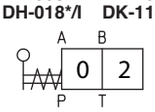
DH-005* DK-105* **DH-015* DK-115***



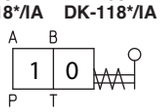
DH-005*/A DK-105*/A **DH-015*/A DK-115*/A**



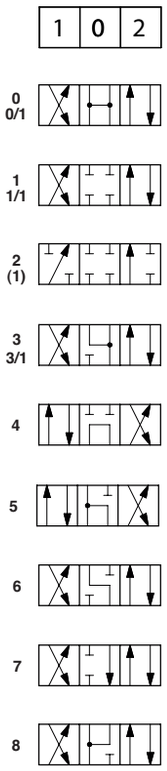
DH-008*/I DK-108*/I **DH-018*/I DK-118*/I**



DH-008*/IA DK-108*/IA **DH-018*/IA DK-118*/IA**



Spools

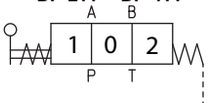


(1) Spool type 2 available only for DH

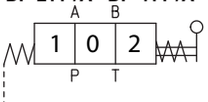
DP-20*, DP-21*, DP-40*, DP-41* - hand lever actuator

Configurations

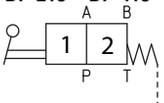
DP-201* DP-401* **DP-211* DP-411***



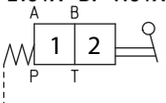
DP-201*/A DP-401*/A **DP-211*/A DP-411*/A**



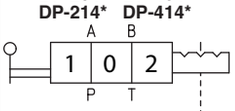
DP-203* DP-403* **DP-213* DP-413***



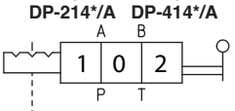
DP-203*/A DP-403*/A **DP-213*/A DP-413*/A**



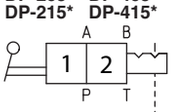
DP-204* DP-404* **DP-214* DP-414***



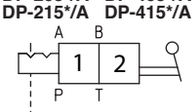
DP-204*/A DP-404*/A **DP-214*/A DP-414*/A**



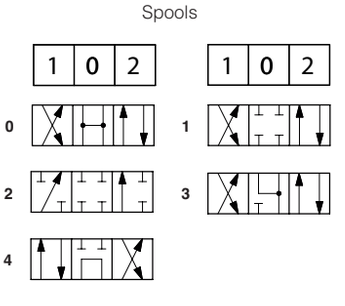
DP-205* DP-405* **DP-215* DP-415***



DP-205*/A DP-405*/A **DP-215*/A DP-415*/A**



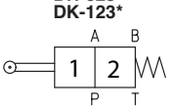
Spools



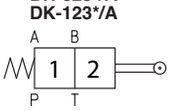
DH-02*, DK-12* - cam actuator

Configurations

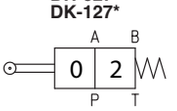
DH-023* DK-123*



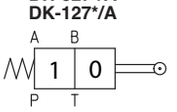
DH-023*/A DK-123*/A



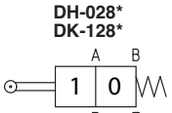
DH-027* DK-127*



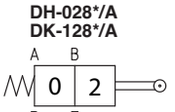
DH-027*/A DK-127*/A



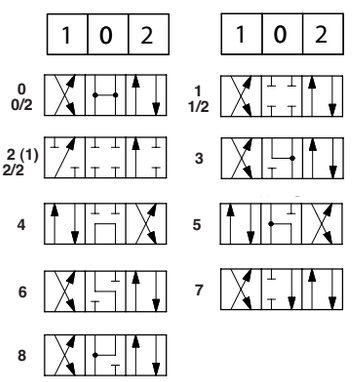
DH-028* DK-128*



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 MAIN CHARACTERISTICS

Assemby position		Any position except for configurtion 7 (without spring) that must be installed with horizontal axis
Subplate surface finishing		Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
Ambient temperature		from -30°C to +70°C (standard seals) -20°C to +70°C (/PE seals)
Flow direction		As shown in the symbols of tables 3
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 **DK-12**	**100 l/min** **140 l/min**
	DP-2 **DP-4**	**300 l/min** **700 l/min**

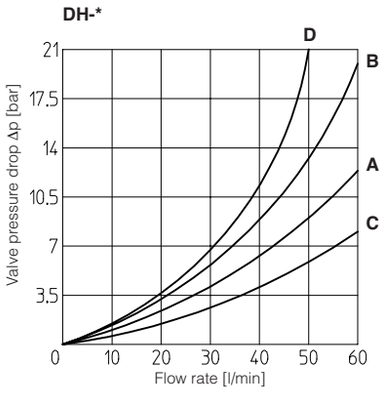
5 SEALS AND HYDRAULIC FLUIDS - For other fluids not included in above table, consult our technical office

Seals, recommended fluid temperature	NBR seals = (standard) -30°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals = (/PE option) -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/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	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

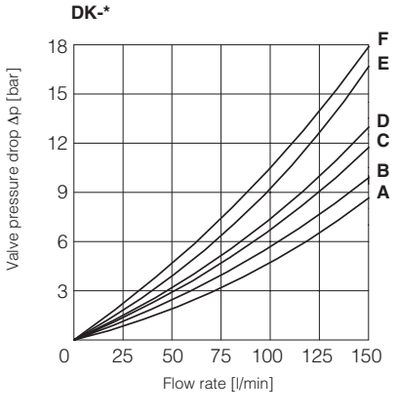
DH-*

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	



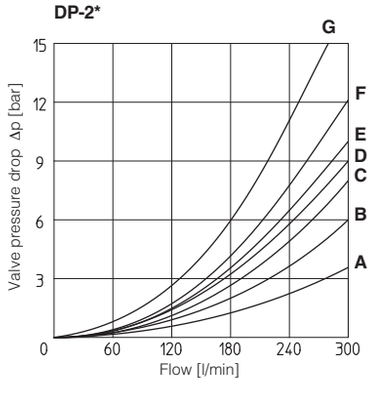
DK-*

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



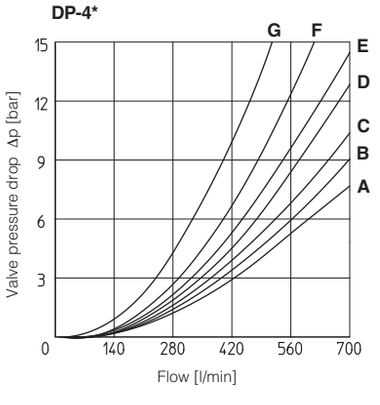
DP-2*

Flow direction / Spool type	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



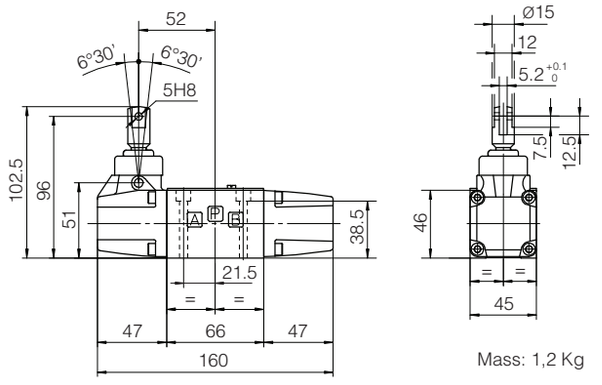
DP-4*

Flow direction / Spool type	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



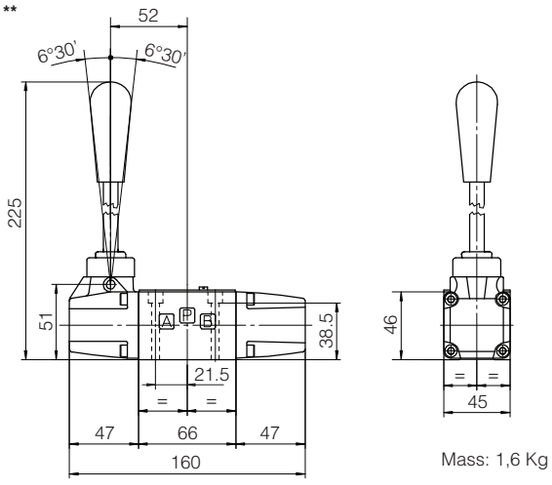
7 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 06 [mm]

DH-00**



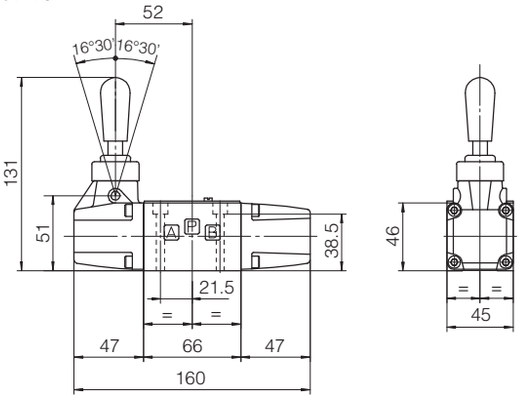
Mass: 1,2 Kg

DH-01**

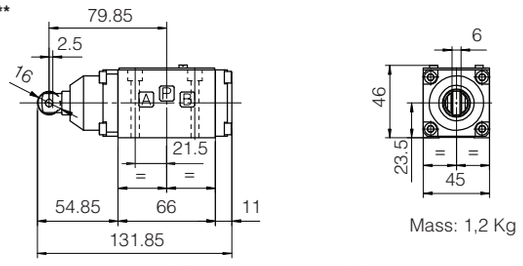


Mass: 1,6 Kg

DH-01/C**



DH-02**



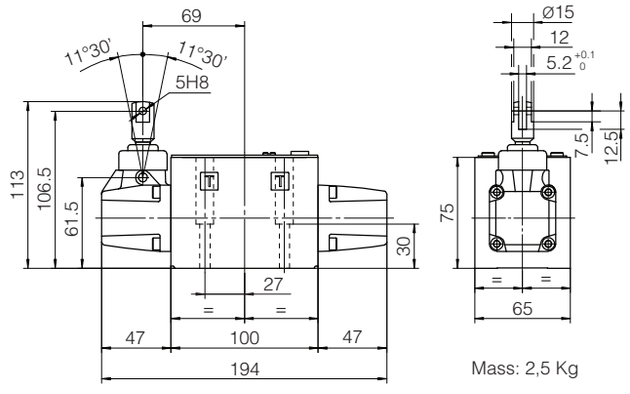
Mass: 1,2 Kg

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

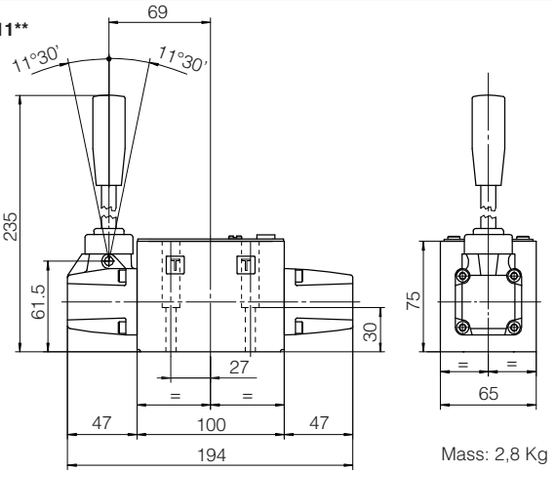
8 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 10 [mm]

DK-10**



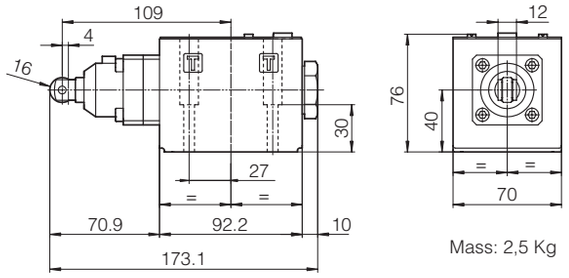
Mass: 2,5 Kg

DK-11**



Mass: 2,8 Kg

DK-12**



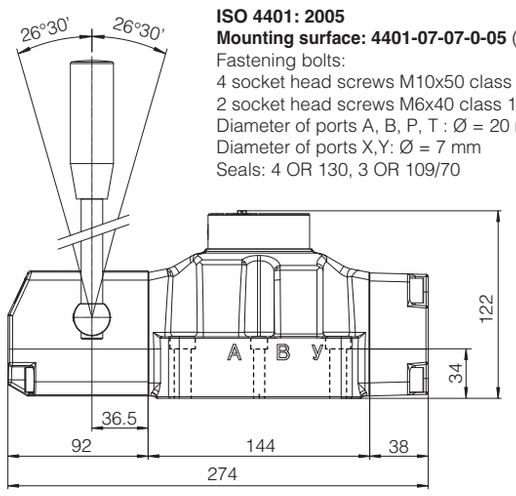
Mass: 2,5 Kg

Working stroke: 4 mm; extra-stroke: 0,5 mm max.

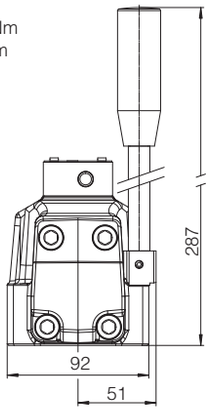
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)
(Without X port, Y port optional)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 11,2 mm (max)
Seals: 5 OR 2050

8 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 16 [mm]

DP-21

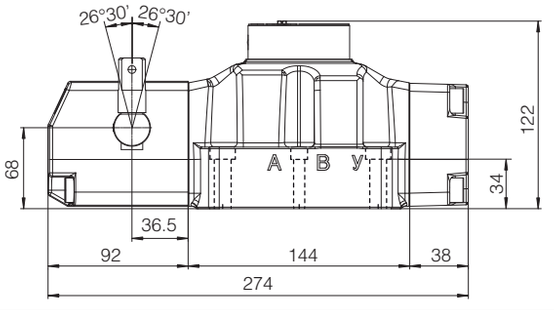


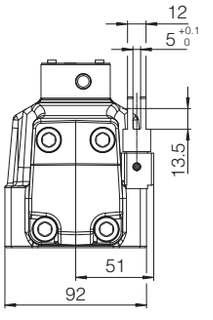
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)
Fastening bolts:
4 socket head screws M10x50 class 12.9, Tightening torque = 70 Nm
2 socket head screws M6x40 class 12.9, Tightening torque = 15 Nm
Diameter of ports A, B, P, T : Ø = 20 mm
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 130, 3 OR 109/70



Mass: 10 Kg

DP-20

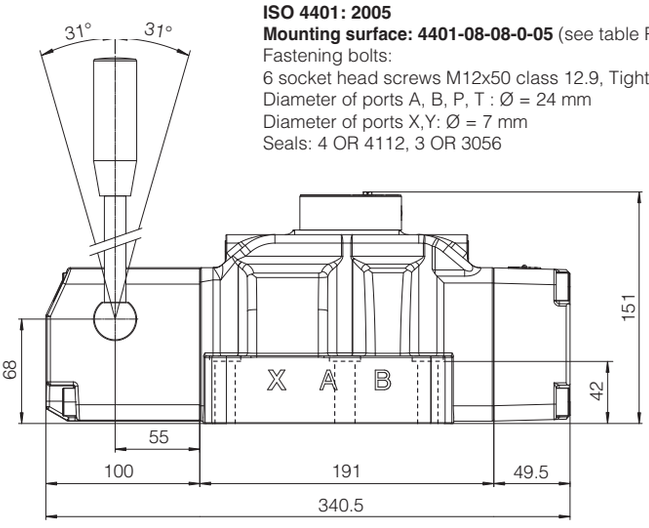




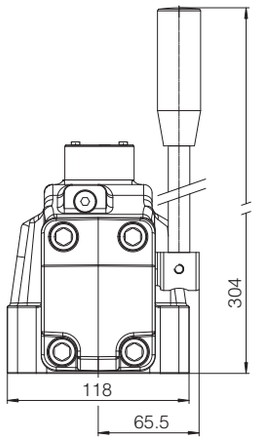
Mass: 9,7 Kg

9 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 25 [mm]

DP-41

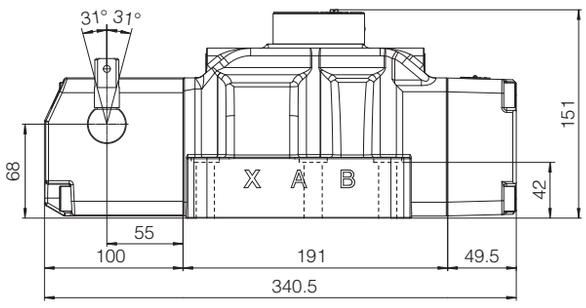


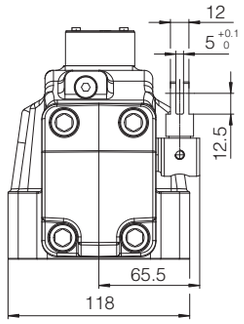
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)
Fastening bolts:
6 socket head screws M12x50 class 12.9, Tightening torque = 125 Nm
Diameter of ports A, B, P, T : Ø = 24 mm
Diameter of ports X,Y: Ø = 7 mm
Seals: 4 OR 4112, 3 OR 3056



Mass: 15,5 Kg

DP-40

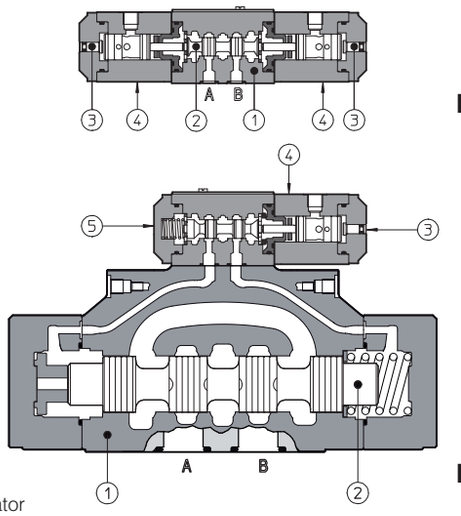




Mass: 15,2 Kg

Pneumatic operated directional valves

ISO 4401 sizes 06, 10, 16, 25 and 32



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		**	/	*

DH-0
Directional control valve, size:
DH-0 = 06
DK-1 = 10
DPH-2 = 16
DPH-4 = 25
DPH-6 = 32

8
Type of actuator:
8 = single actuator
9 = double actuator

1
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

3
Spool type, see sections 4 and 5

A
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

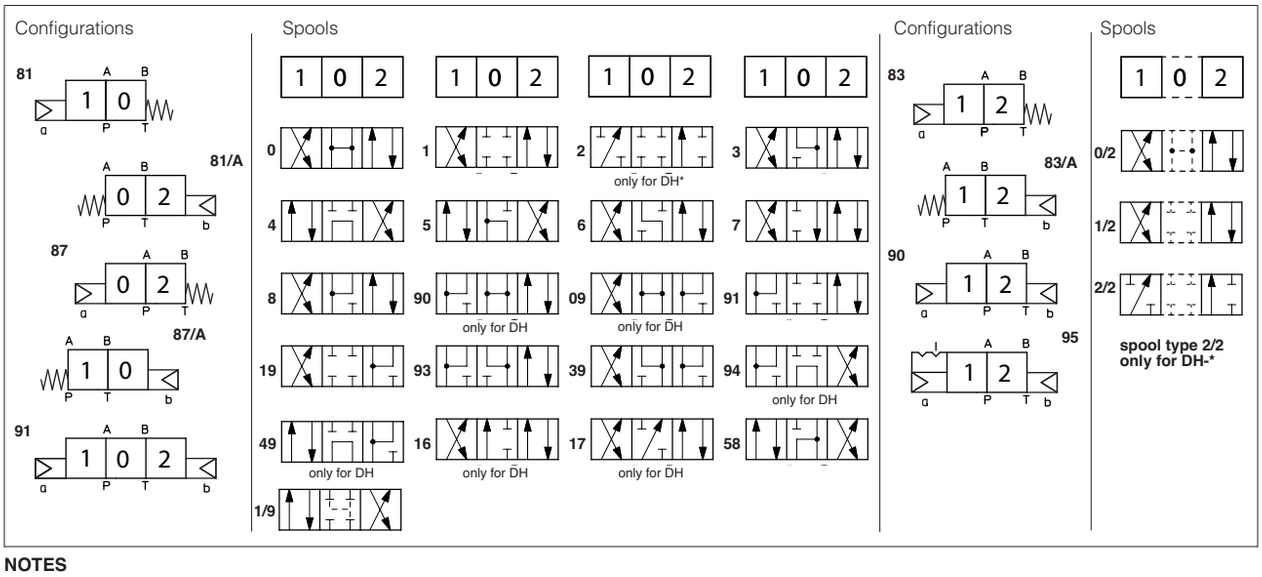
Valve model		DH-0	DK-1	DPH-2	DPH-4	DPH-6
Max recommended flow	[l/min]	50	160	300	700	1000
Max pressure on port P, A, B (also X for DP)	[bar]	350	315	350		
Max pressure on port T	[bar]		210	250		
Max pressure on port L and Y	[bar]	–		null pressure		
Recommended oil pressure on piloting line	[bar]	–		Min = 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, 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.		
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

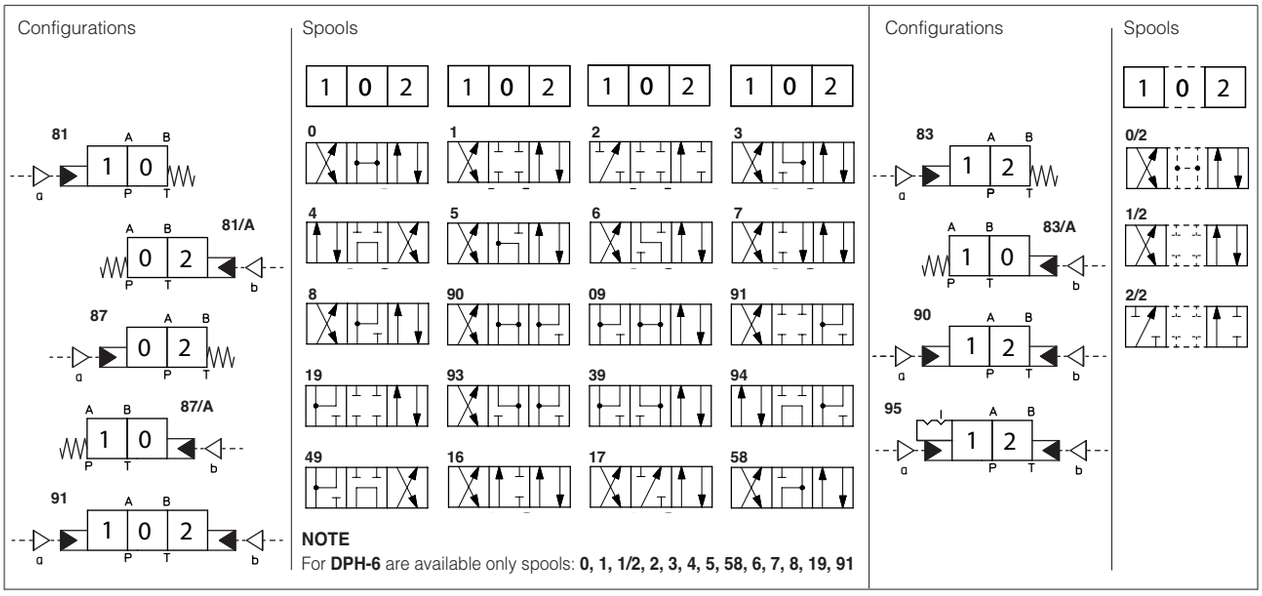
Assembly position / location	Any position for all valves except for type -*90 (without springs) that must be installed with horizontal axis if operated by impulses.		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Ambient temperature	Standard execution = -30°C ÷ +70°C; /PE option = -20°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		
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	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**, **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** (only for DH-0) to limit valve internal leakages.

5 CONFIGURATIONS and SPOOLS of valves type DPH-*



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** are properly shaped to reduce water-hammer shocks during the switching.

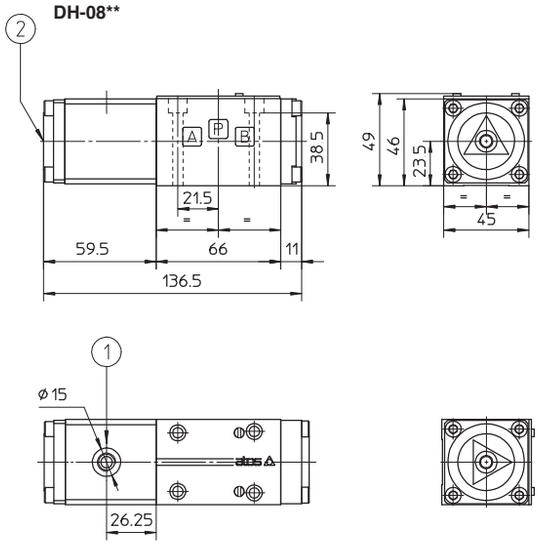
6 Q/Δp DIAGRAMS

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

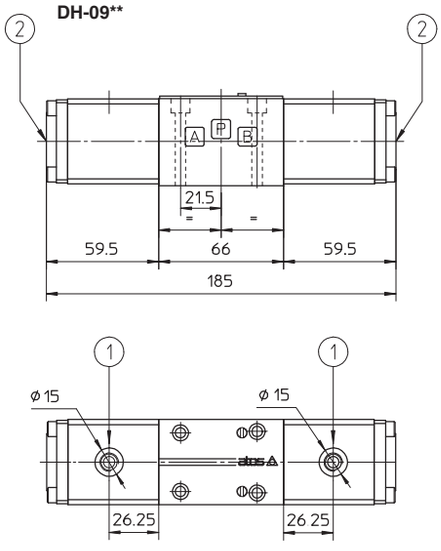
7 INSTALLATION DIMENSIONS of VALVES type DH and DK [mm]

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

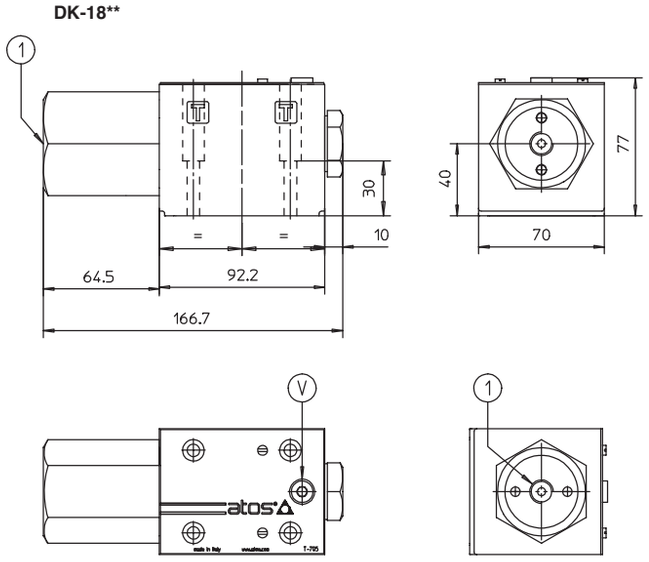
Mass: 1,6 Kg

① Pilot pressure port G1/8”
② Manual override

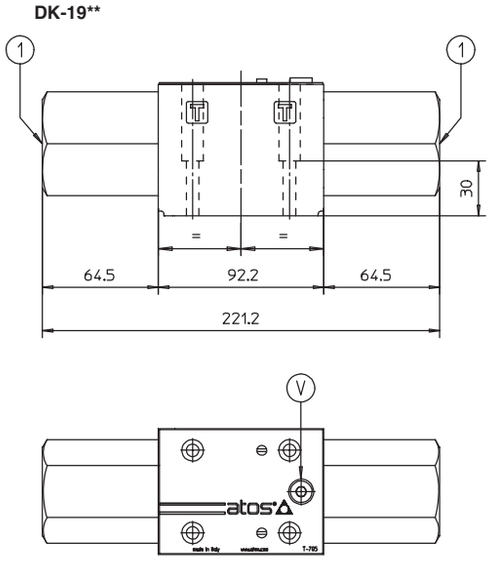
Mounting subplates: see tab. E010

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

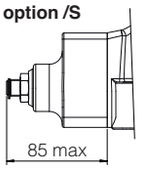
8 INSTALLATION DIMENSIONS of VALVES type DP [mm]

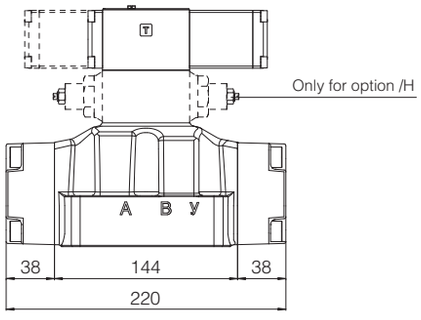
DPH-2

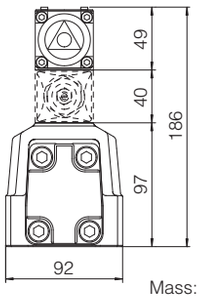
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05

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







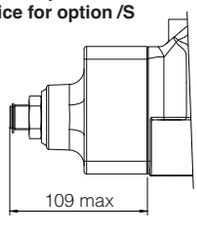
Mass: 11,5 Kg

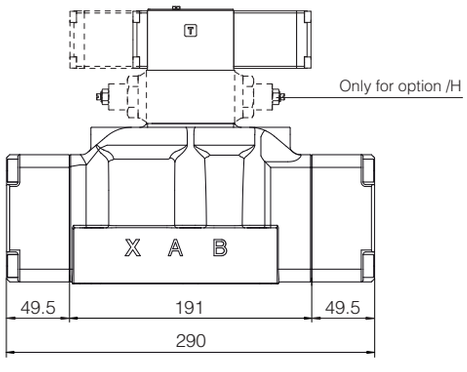
DPH-4

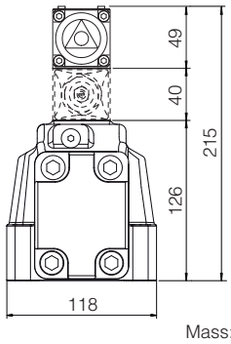
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05

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







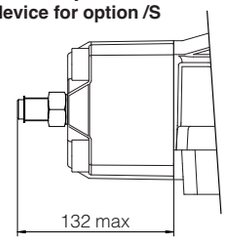
Mass: 18 Kg

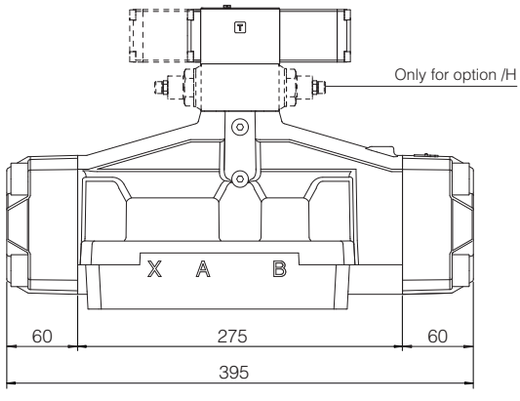
DPH-6

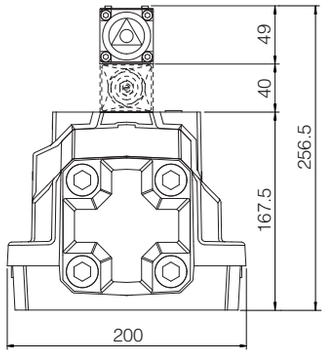
ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

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



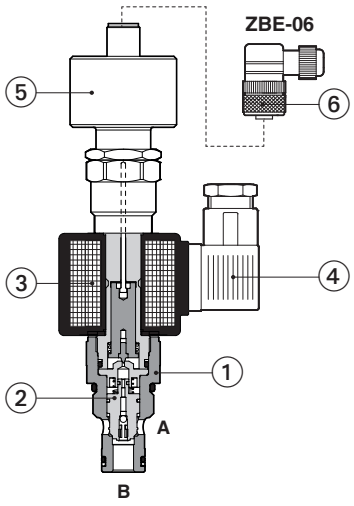




Mass: 39,5 Kg

Safety cartridge valves with optional poppet position monitoring

screw-in, 2-way, poppet type, leak free, conforming to Machine Directive 2006/42/CE - certified by TÜV



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, or normally open one NO configurations.

The /**FV** version integrates an 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	/	NC	-	X	24 DC	**	/	*

JO — 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

NC — Version:
NC = normally closed in rest position
NO = normally open in rest position
FV = normally closed in rest position, with inductive position switch (double contact)

X = Without connector, see section 5 for available connector

24 DC — Voltage code:
12DC = 12 VDC
24DC = 24 VDC

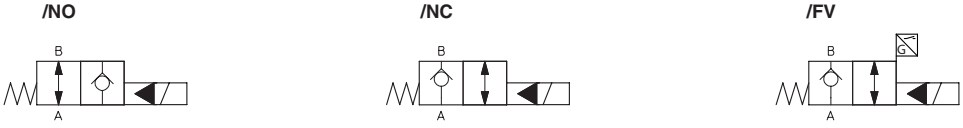
****** — Series number:
20 for FV
40 for NC and NO

***** — Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR **(1)**

Note (1): not for version /FV

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbols



Model			JO-DL-4-2/NC JO-DL-4-2/FV	JO-DL-4-2/NO	JO-DL-6-2/NC JO-DL-6-2/FV	JO-DL-6-2/NO	JO-DL-10-2/NC JO-DL-10-2/FV	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					

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 ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C - not for version /FV

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 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 (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

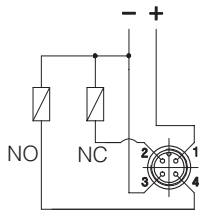
1) The assembling of cartridges inside manifolds must be done tightening the valve exagonal ring (for tightening torque, see section 10).
   Excessive values can cause anomalous deformation and poppet sticking.
   For the /FV versions avoid to tighten through the position sensor.
2) The CE certification 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

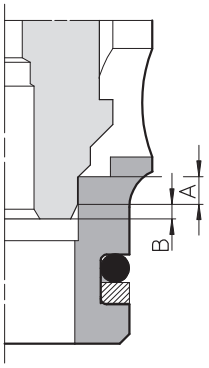
NOTE: the /FV position switch are not provided with a protective earth connection

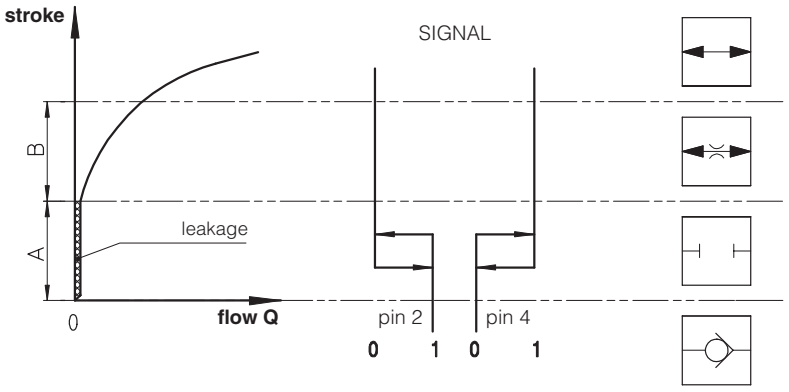
Connector type **ZBE-06**



1 = supply +24 VDC
2 = output signal NC
3 = GND
4 = output signal NO

8 SIGNAL STATUS - VERSIONS /FV





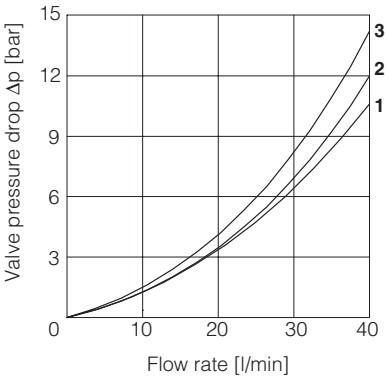
A: overlapping stroke
B: damping stroke

According the criteria of safety specifications, the poppet position signal must change its status inside the overlapping stroke (before the effective valve opening).

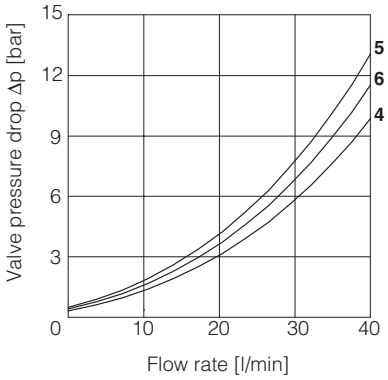
9 **DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

9.1 JO-DL-4

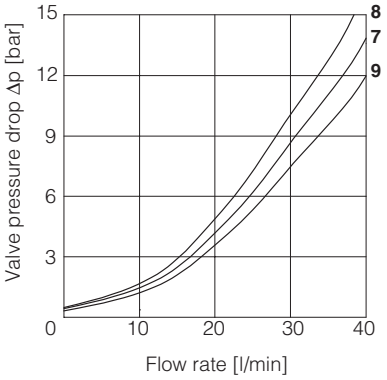
Valve pressure drop - NO version
1= A → B de-energized
2= B → A de-energized
3= B → A energized



Valve pressure drop - NC version
4= A → B energized
5= B → A de-energized
6= B → A energized

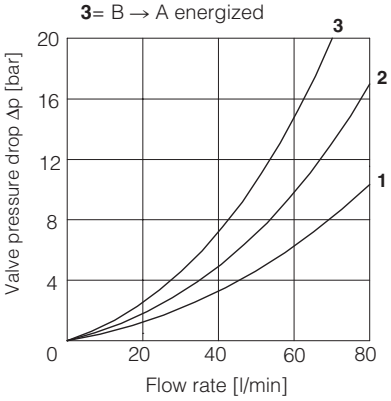


Valve pressure drop - FV version
7= A → B energized
8= B → A de-energized
9= B → A energized

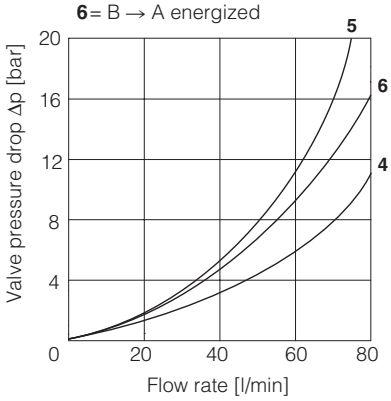


9.2 JO-DL-6

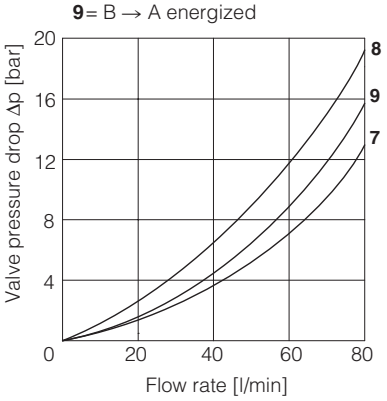
Valve pressure drop - NO version
1= A → B de-energized
2= B → A de-energized
3= B → A energized



Valve pressure drop - NC version
4= A → B energized
5= B → A de-energized
6= B → A energized

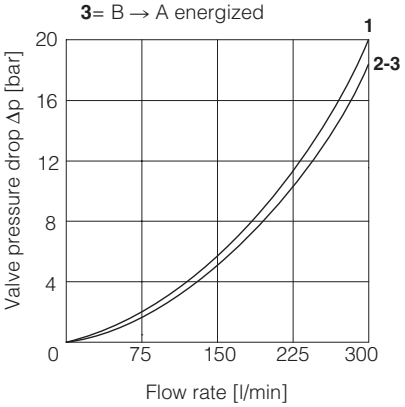


Valve pressure drop - FV version
7= A → B energized
8= B → A de-energized
9= B → A energized

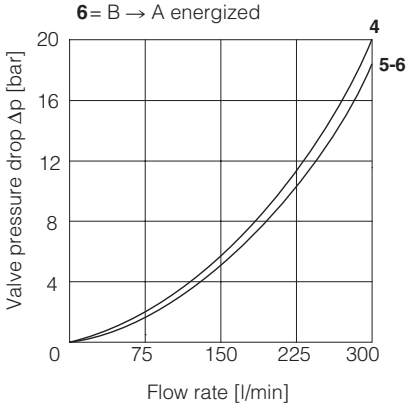


9.3 JO-DL-10

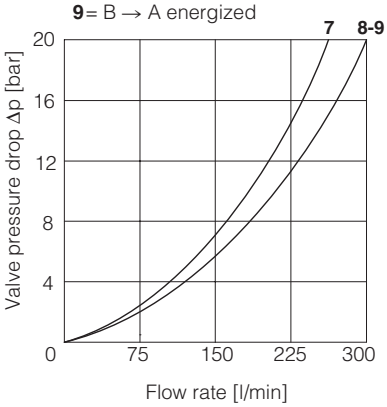
Valve pressure drop - NO version
1= A → B de-energized
2= B → A de-energized
3= B → A energized



Valve pressure drop - NC version
4= A → B energized
5= B → A de-energized
6= B → A energized



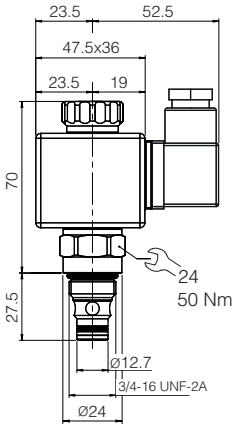
Valve pressure drop - FV version
7= A → B energized
8= B → A de-energized
9= B → A energized



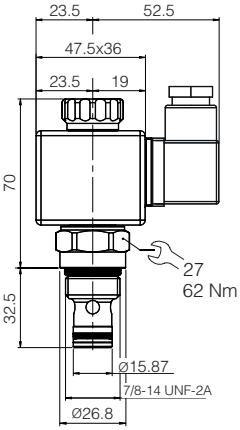
10 DIMENSIONS [mm]

Version /NO and /NC

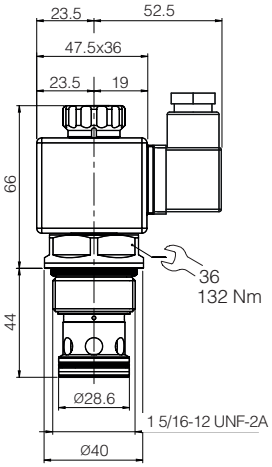
JO-DL-4-2/N*
Mass 0.35 Kg



JO-DL-6-2/N*
Mass 0.35 Kg

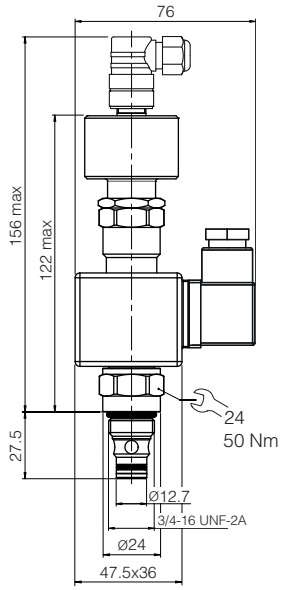


JO-DL-10-2/N*
Mass 0.4 Kg

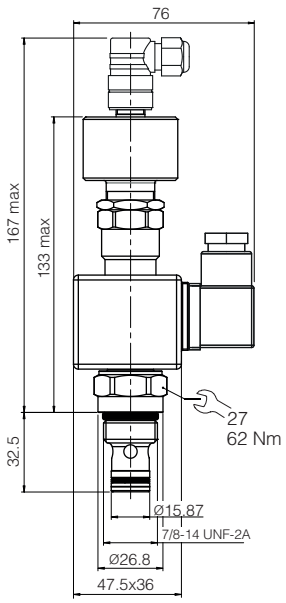


Version /FV

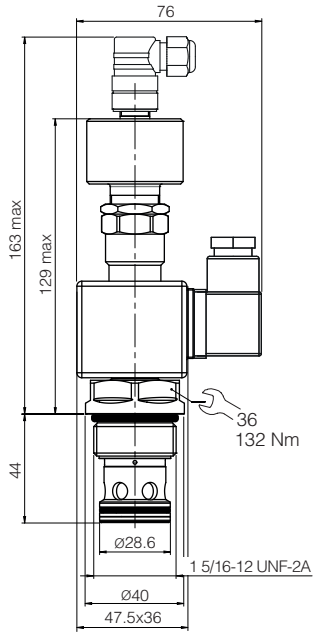
JO-DL-4-2-2/N*/FV
Mass 0.5 Kg



JO-DL-6-2/N*/FV
Mass 0.5 Kg

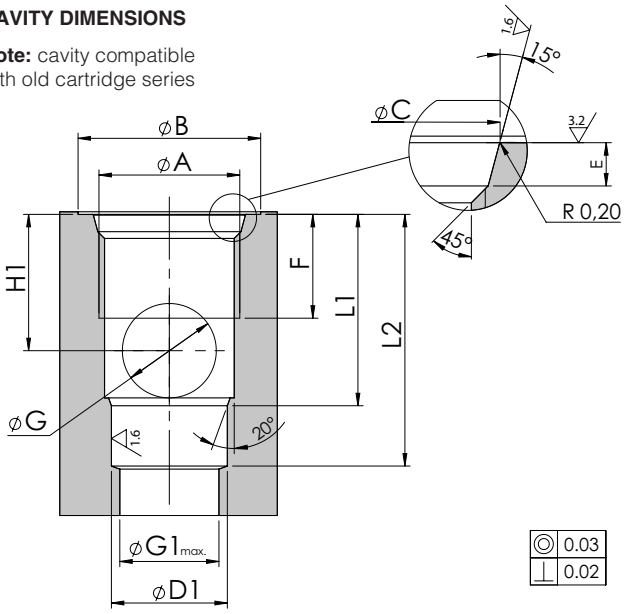


JO-DL-10-2/N*/FV
Mass 0.7 Kg



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

Basics for proportional electrohydraulics

1 WHAT IS PROPORTIONAL ELECTROHYDRAULICS?

Electrohydraulic proportional controls modulate hydraulic parameters according to the electronic reference signals.
They are the ideal interface between hydraulic and electronic systems and are used in open or in closed-loop controls, see section 3, to achieve the fast, smooth and accurate motions required by today's modern machines and plants.
The electrohydraulic system is a section of the overall automation architecture unit where information, controls, alarms can be transmitted in a "transparent" way to the centralized electronic control unit and viceversa also via standard fieldbus, see tab. F002 for "Basics for digital electrohydraulics".
Proportional electrohydraulics provides the following advantages in comparison with the electromechanical systems; intrinsic overload protection, automatic force adaption, fast operating response, self lubrification of the system, simple stepless variation in speed, energy storage capability, high power density, forces and torques, long service life and high reliability.

2 WHAT IS A PROPORTIONAL VALVE?

The core of electrohydraulic controls is the proportional valve that regulates a pressure P or a flow Q according to the reference input signal (normally ±10 V_{DC}) supplied by the machine CNC. Particularly the proportional valve must be operated by an electronic driver (see tab. G001) which regulates a proper electrical current supplied to the valve's solenoid according to the reference signal. The solenoid converts the electrical current into a mechanical force acting the spool against a return spring: rising of the current produces a corresponding increasing in the output force and consequent compression of the return spring, thus the movement of the spool. The proportional valves can be single stage or piloted, with or without pressure/position transducer. Proportional valves with transducer provide better regulation accuracy.
In pilot operated executions the proportional pilot valve regulates flow and pressure acting on the main operated stage.
When electrical failure occurs, return springs restore the neutral position according to valve configuration, to ensure a fail-safe operation, i.e. to ensure that in case of absence of reference signal or, generally, in case of electric system breakdown, the system configuration does not cause damages. Fail-safe can be realized directly by the proportional valve (fail-safe operation intrinsic in valve configuration) or it can be realized by consequential operation of a group of valves.

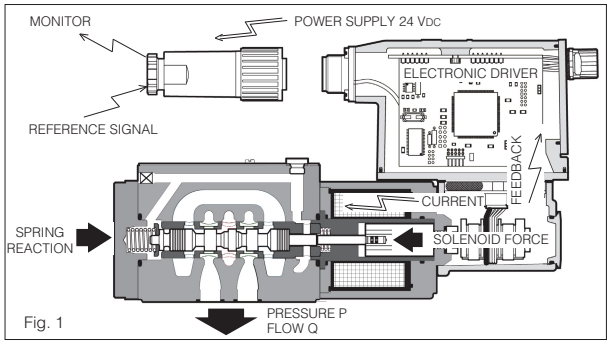


Fig. 1

3 CONTROL LOOPS

Today industrial machines are multi-axis machines, more and more electrohydraulically controlled by proportional devices. The axis motion can be operated in "open loop" or in "closed loop" control, depending to the accuracy level required in the application. In many applications the motion cycles do not require extreme accuracy, so they are performed in open loop, while each time the application requires the positioning of an actuator, a closed loop control must be provided.

OPEN LOOP MOTION CONTROL

Axis control is provided through the supply of a reference input signal to the driver of the proportional valve.
There is no feedback of the valve's regulated hydraulic parameter.
The accuracy of the open loop controls is strictly dependent of the good quality of the hydraulic system and particularly of the proportional valve and of the relevant driver.

CLOSED LOOP MOTION CONTROL

Axis control is provided through the supply of an input reference signal to a closed loop axis controller which receive the feedback signal from the actuator transducer. The controller compares the two signals and the resulting error is then processed to the proportional valve, in order to align its regulation to the PID control loop requirements.
The accuracy of the closed loop controls is much better respect to the open loop ones and it is less influenced by the external environmental disturbances, thanks to the presence of the feedback.
Anyway the best is the overall quality of the hydraulic system, the best is the accuracy of the axis control.

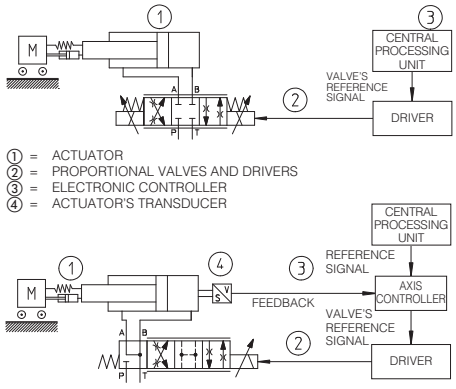


Fig 2: Electrohydraulic axes: a basic block diagrams

4 PROPORTIONAL VALVES AND DRIVERS

Atos valves may be spool type or cartridge execution and can be grouped in three different functional families:

- **pressure control valves: relief valves** and **reducing valves** regulate the hydraulic system pressure proportionally to the reference input signal;
- **4-way directional control valves:** direct and modulate the flow to an actuator proportionally to the reference input signal. These valves can be used in open or closed loop control system to determine the direction, speed and acceleration of actuators;
- **flow control valves:** 2 or 3-way, pressure compensated, to modulate the flow independently to the user loads.

Atos proportional valves are equipped with **ZO** and **ZOR**, efficient solenoids (30 W and 40 W) respectively designed for direct-acting valves of ISO 4401 size 06 and 10 and they are assembled in different options as follows:

ZO(R)-A: without integral transducer, open loop;
ZO(R)-AE, AES: as ZO-A plus integral electronic driver, analog or digital;
ZO(R)-T, -L: with integral LVDT single/double position transducer, closed loop, featuring high static and dynamic performances;
ZO(R)-TE, -LE, -LES: as ZO-T, -L plus integral electronic driver, analog or digital

In the new generation of -AE, -TE, -LE valves, the electronic driver is integral to the proportional valves and it is factory preset to ensure fine functionality plus valve-to-valve interchangeability and to simplify installation wiring and system set-up. Electronics are housed and resin encapsulated in a metal box to IP67, ensuring antivibration, antishock and weather-proof features; coils are fully plastic encapsulated.
For detailed information on Electronic drivers, see tab. G001

5 TYPICAL ELECTROHYDRAULIC TERMS

Repeatability: The maximum difference in the valve's hydraulic regulation repeating the same input reference signal. Repeatability is measured in percentage of the maximum value of the regulated hydraulic parameter.

Overlap: Percentage of spool stroke, starting from the central position, in which the valve remain closed.

Fail safe: spool's safety hydraulic configuration in absence of electrical power supply

Linear spool: provides linear correspondence between valves regulation and reference input signal

Progressive spool: provides progressive regulation for finest low flow control

Differential spool: as progressive but with P-B = 50% of P-A

Leakage: The flow passing through port P to tank port T with the valve spool in central position. It is directly connected with the quality of the valve's mechanical execution.

Reference input signal: The electric signal sent from machine CNC to the valve electronic driver to obtain the required regulation value.

Driving current: The current sent from the electronic driver to the valve's solenoid.

Bias current: Static offset added to the reference input signal required to compensate positive overlap spools.

Dither: The pulse frequency of the driver regulation used to minimize the valve hysteresis.

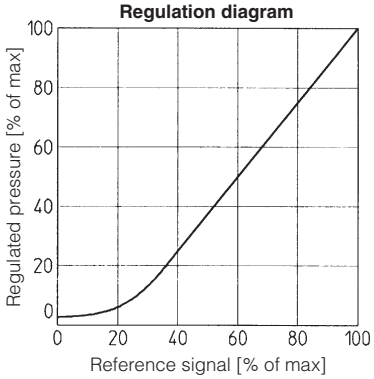
Regulation scale: Setting of the valve regulation with the max reference signal.

Ramp time: Time (in sec.) required to smoothly operate the valve in front of a step reference input signal.

6 TYPICAL DIAGRAMS OF PROPORTIONAL CONTROLS

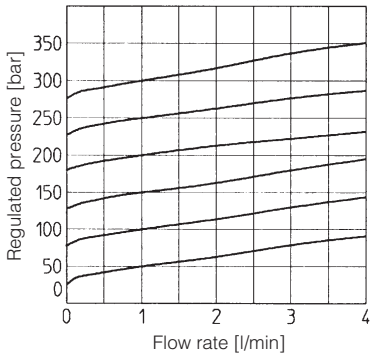
6.1 PRESSURE CONTROL VALVES

Regulation diagram



Valve's-regulated pressure variation according to the reference signal

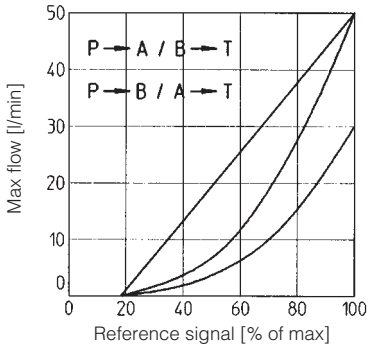
Operating diagram



Valve's-regulated pressure variation according to the flow passing through the valve

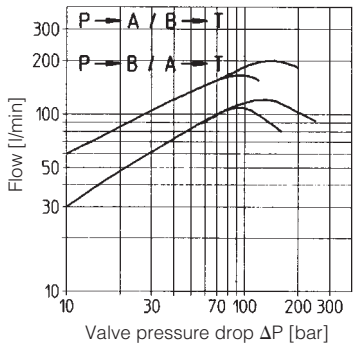
6.2 DIRECTIONAL AND FLOW CONTROL VALVES

Regulation diagram at characteristic Δp



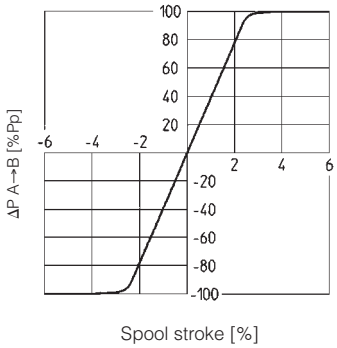
Valve's-regulated flow variation according to the reference input signal

Regulation diagram at max reference signal



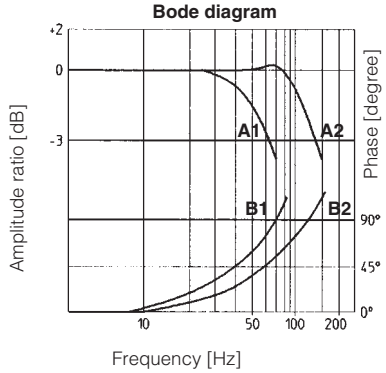
Regulated flow vs. functional Δp at max reference input signal

Pressure gain diagram



Pressure variation on use ports depending to the spool stroke (only for valves with zero overlapping in rest position).

Bode diagram

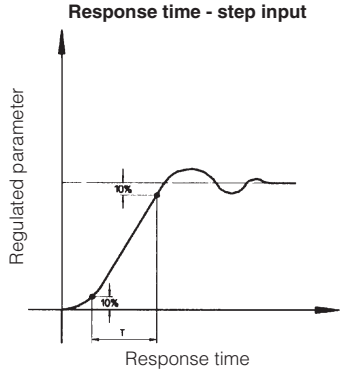


The curve shows for typical regulation ranges (±5% and ± 90%) at different sinusoidal reference input signal frequency:

A) amplitude ratio variation, between reference input signal and the regulated spool position output signal;

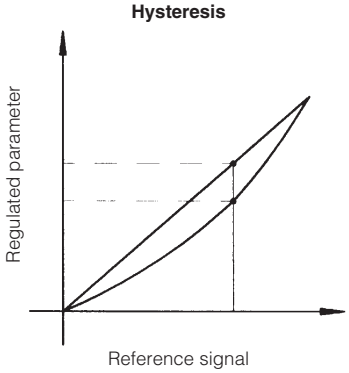
B) phase lag between reference input signal and the regulated spool position signal.

Response time - step input



The time lag required by the valve to reach the requested hydraulic ragulation in front of a step change in the reference input signal (usually 0÷100%).
Response time is measured in millisecond [ms] from 10 to 90 % of the step valve.

Hysteresis



The maximum difference in the valve regulation between reference input signal from 0 to maximum and than from maximum to zero.
Hysteresis is measured in percentage of the maximum value of the regulated hydraulic parameter.

Digital electrohydraulics

1 DIGITAL TECHNOLOGY FOR PROPORTIONAL VALVES

Modern world is driven by digital electronics: computers, automation systems, cars and missiles, telecomunications and advanced network are all based on digital technology… …thanks to its typical benefits in comparison with analog: fast and powerful data processing, easy programmability, high immunity to electromagnetic noise, process parameters and data storage.

In electrohydraulics, digital electronics gives important advantages:

- better performances of electrohydraulic components: hysteresis, response time, linearity;
- numerical software setting of hydraulic parameters (scale, bias, ramp, compensation of non-linearities) for full repeteability and easy data storage
- diagnostic (fault, monitor) and computer assisted maintenance of machines and systems;
- direct interfacing to field-bus networks.

Atos, leader in pioneering proportional electrohydraulics, is active from years on digital electrohydraulics including: simulation models of valves and systems, research and testing of new DSP microcontrolles, R&D of new solutions.

New digital electrohydraulics with on board electronics enable new funcionalities within the conventional control architectures and represent the foundamental premise to realize new compact machines with high technological contents.
The digital electronics integrate several logic and control functions (distributed intelligence) and make it feasible and inexpensive the introduction in the hydraulic system of the most modern fieldbus communication networks.

Atos digital driver's range replicate the analogue one:

- **E-RI-AES** for valves without transducer
- **E-RI-TES/LES** for valves with single/double LVDT transducer
- **E-RI-TERS** for valves with pressure transducer

2 COMMUNICATION INTERFACES

The communication interface is the channel trough which the valve receives commands and/or setting parameters and it returns information to the fieldbus controller.
Atos digital proportional valves are available with 3 optional communication interfaces:

- basic **-PS**: standard RS232 interface, to be coupled to an user-friendly PC software (E-SW-PS) optimized with grafic interface, for the management of all the functional parameters, see tab. G500.
  The main feature of this basic version is the full interchangeability with the corresponding analog executions, in fact the reference and the monitor signals are analog, whereas the serial interface allows to manage the diagnostics and to set the best configuration of the valve for the application's requirements.
  This approach enables a gradual introduction of the advantages of digital technology, without perturbing the whole application/machine's structure.
- option **-BC:** CANBus (CanOpen DS408 v1.5 protocol)
- option **-BP:** Profibus-DP (Fluid Power Technology protocol).

The valves with option -BC and -BP can be connected to the fieldbus network and thus digitally operated by the machine control unit.
The functional parameters can be set via fieldbus using the standard communication protocol implemented by Atos, or alternatively using the PC graphic software E-SW-PS with the relevant USB interface supplied with the software KIT (see fig. 2 and tab. G500). For start-up or maintenance operations, the valves with -BC or -BP interfaces can be operated with analogue signals via the 7 (or 12) pins power supply connector.

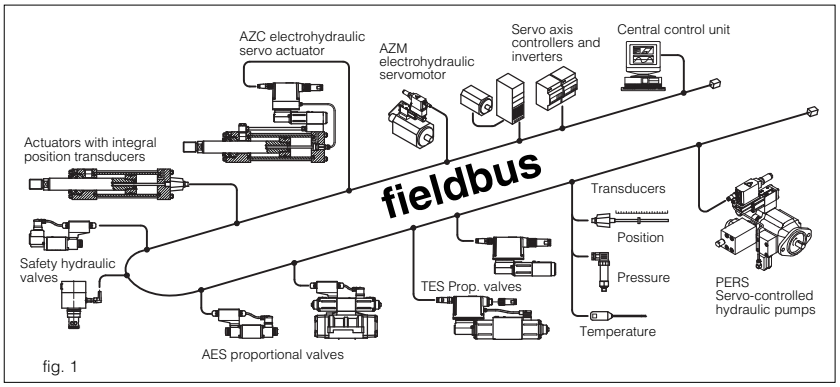
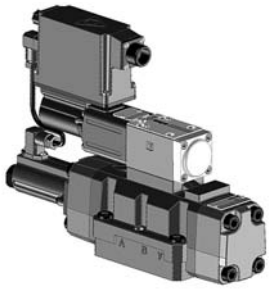


fig. 1

DKZOR-AES

AGMZO-TERS



DPZO-TES

LIQZO-LES

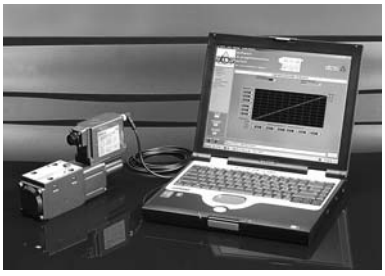


fig. 2 software setting of digital proportionals

3 DIGITAL SETTINGS AND DIAGNOSTICS

A large number of the functional parameters of the valve can be numerically set trough the communication interface, as:

- the bias and scale (fig. 4)
- the ramps, corresponding to the transition time from 0% to 100% of the valve's regulation (fig. 5)
- the linearization of the regulation curve, allows to modify the hydraulic regulation of any valve, as linearizing the characteristic of pressure control valve or change from linear to progressive the characteristic of a directional control valve (fig. 6).

Many other regulations are available like: customized configuration of the reference signal (standard ± 10 V), internal static self generation of the reference signal, dither signal, PID parameters for dynamic behaviour, alarm setting of the high/low limits of the electronics temperature, etc.

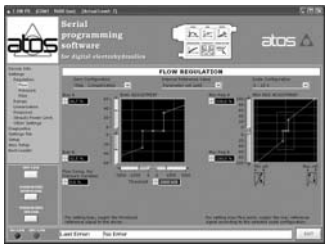


fig. 3 Software graphic interface

SCALE AND BIAS

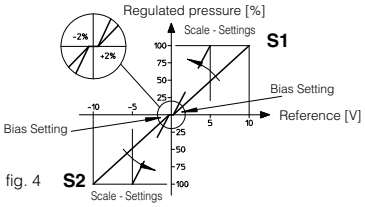


fig. 4

UP AND DOWN RAMPS

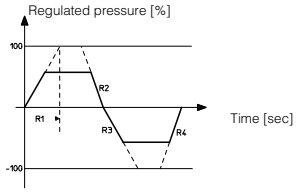


fig. 5

LINEARIZATION

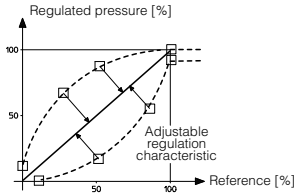


fig. 6

Detailed diagnostics information can be checked through the communication interface. They allow a complete analysis of the component state and of its eventual malfunctionings, as for example:

- real time monitoring of the reference signal, of the feedback signals and of the electronics temperature
- alarm in case one of the above parameters overcome the set limits
- alarm in case of interruption of the feedback cable

4 COMBINED P/Q CONTROLS FOR DIRECTIONAL VALVES AND PUMPS

The high computing capability of Atos digital electrohydraulic and its great flexibility allow to realize new functionalities:

- new drivers E-RI-TES with /SP and /ZP options perform the combined pressure and flow control on directional control valves. A remote pressure transducer must be installed on the system where is required the max pressure control and its feedback has to be interfaced to the valve. If the real value of the pressure in the system (measured by the pressure transducer) remains below the relevant reference signal, provided by the machine controller, then the digital driver regulates in closed loop the valve's spool position, according to the flow reference signal. When the real pressure become close to the relevant reference signal, the driver automatically performs the closed loop control of the pressure. This option allows to realize accurate dynamic pressure profiles. A multiple set of PID parameters can be real time selected during the axis motion via on-off signal to the 12 poles connector (option /SP) or through the - BC or -BP interfaces (option /ZP), to optimize the control performances in the different phases of the machine cycle.
- new drivers E-RI-PES for variable displacement axial piston pumps (see fig. 7), integrate the digital combined pressure and flow control (see above) with an 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 -BC or -BP interfaces (option /Z), to optimize the P/Q control performances.

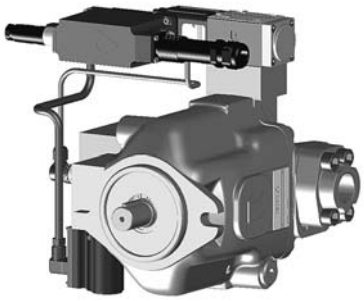


fig. 7

5 DIGITAL SOLUTIONS FOR BASIC SERVOSYSTEMS

The concept of distributed intelligence is applied in its easiest form to the drivers type E-RI-AEG, see fig. 8 and tab. G120.
This controller self-manages open loop "fast-slow" positioning cycles, interfacing up to five inductive proximity sensors.
For any of the cycle phases it is possible to set speed and ramps.
This solution has been developped for applications with repetitive cycles. The complete cycle is managed by the valve itself without auxiliary axis controller.

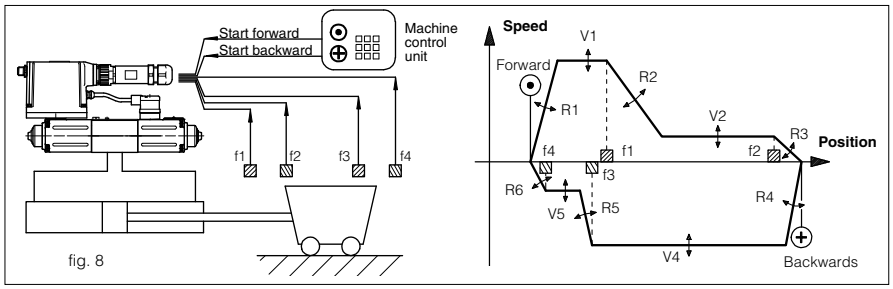


fig. 8

6 DIGITAL SERVOACTUATORS

Servoactuators integrate several control functions within the driver itself, thus realizing truly compact electrohydraulic motion units.

E-RI-TEZ drivers for servoactuators, see fig. 9, besides driving the valve on which they are integrated, also perform a position, speed and/or force control on the actuator itself.

For the end user, the main advantages of this kind of servosystems are:

- the self management of the motion control, with no need of using external axis cards
- the reduced number of wirings, thanks to the direct connection of the electronics to the peripherial sensors.

The distributed intelligence permits to locally manage the "fast" signals required by high performances closed loop controls, avoiding to unnecessarily overload the fieldbus communication line.

Application of such servoactuator solutions takes place for example:

- for closed loop speed/position and pressure control of the injection phase in plastic presses
- for speed and force control of the moulds closing in plastic presses
- for parison control is blow moulding machines
- for master/slave syncronism in wood machines and bending presses.

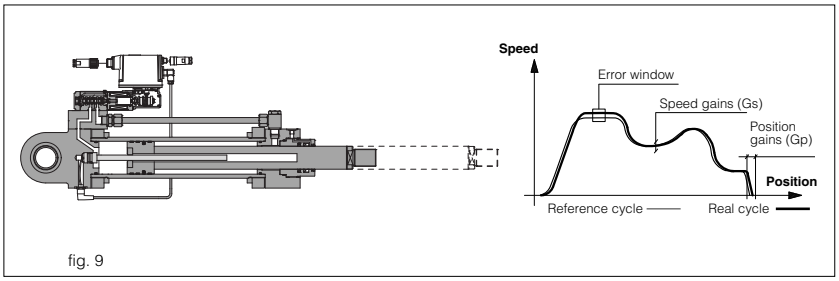


fig. 9

Electrohydraulic controls: commissioning and trouble shooting

The following notes give some general suggestions and cautions on the procedures to ensure the good operation of an electrohydraulic system, with particular reference to the closed-loop circuits, typical of modern electrohydraulic axes and of high-performances proportional components with integral analog and digital electronics. For more detailed information about specific components see the relevant technical tables. For proper operation of electrohydraulic components, following prescription must be respected.

1 HYDRAULIC SECTION

1.1 Power packs tank and tubes cleaning

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.

1.2 Hydraulic connections

The flexible hoses have to be armoured type on pressure line between powerpack and proportional valve and on return line from proportional valve. If their potential breackage may cause damages to any machine or system or can cause injure to the operator, a proper retention (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.

1.3 Hydraulic fluid

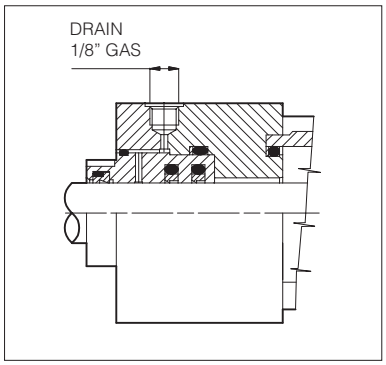
Use only good quality fluids according to DIN 51524..535, with high viscosity index. The recommended viscosity is 15÷100 mm²/sec at 40°C. When fluid temperature exceeds 60°C select viton seals for components; in any case the fluid temperature must not exceed 80°C.

1.4 Fluid filtration

The fluids filtration prevent the wearing of the hydraulic components caused by the contaminans present in the fluid.
Fluid contamination class must be in accordance to ISO 18/15 code by mounting in line pressure filter at 10∞m value and β_{10}=75.
In line filters must be mounted, if possible, immediately before proportional valve; the filtering element is high cracking pressure type with clogging electrical indicator, without by-pass valve.
The flushing (at least 15 min. long) has to be performed at the system commissioning to remove the contaminants from the whole circuit.
After this operation filtering elements and flushing accessories cannot be used again, if clogged.
Following additional warnings to be considered:
- make sure that the filters are of correct size to ensure efficiency;
- the main source of contamination of an hydraulic system is the air exchanged with the environment: proper air filters on the power unit tank to be always provided;
- filter the fluid when filling the tank (new fluid is contaminated) with filtration Group GL-15 (table L150) or similar.

1.5 Hydraulic drains and return lines

The function of drains is essential in all systems, because they define the minimum pressure level.
They must be connected to the tank without counter-pressures.
Drain connections is provided on tie rod side of the servocylinder, see figure.



Return line from proportional valve to tank has to be sized in order to avoid variable counter pressure < 1 bar; for this reason it is recommended to use multiple separated return lines directly connected to tank.

1.6 Fluid conditioning

A high-performance system must be thermally conditioned to ensure a limited fluid temperature range (generically between 40 and 50°C) so that the fluid viscosity remains constant during operation.
The operating cycle should start after the prescribed temperature has been reached.

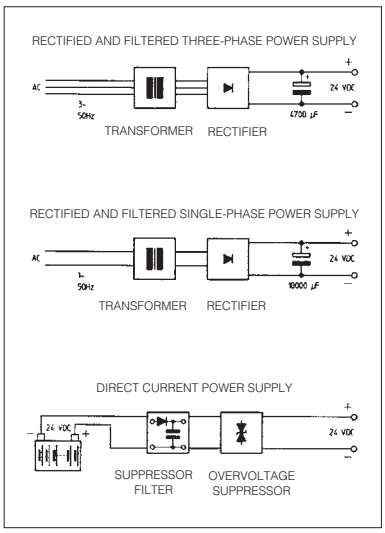
1.7 Air bleeds

Air in the hydraulic circuits affects hydraulic stiffness and it is a cause of malfunctioning.
Air bleeds are provided in the proportional valves and servocylinders; air dump valves must be inserted at possible air accumulation points of the hydraulic system.
Following additional warnings to be considered:
on starting the system all the bleeds must be released to allow removal of air. In particular for servocylinders be careful to bleed the transducer chamber, which is done by releasing the dump valve at the rod end;
- for the piping untight the connections;
- the system must be bled on first start-up or after maintenance;
- use a precharged check valve (e.g. to 4 bars) on the oil general return line to tank to avoid emptying of the pipes following a long out of service.

2 ELECTRONIC SECTION

2.1 Power supply

The voltage values to be within the following range (depending on the type of supply devices):
nominal voltage: V = 24 V_{DC};
filtered and rectified voltage: Vrms=21÷33 V (ripple max = 2Vpp);
The supply device must be sized in order to generate the correct voltage when all utilities require max current at same time; in general 50W max intake electrical power can be considered for each supplied valve.
Following additional notes to be considered, see figure below:
- 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;
- rectified AC power supply: the average value to be within the limit Vrms = 21÷28 Volts, with a supply capacitor equal to 10000 µF for each 3A of current expected when single-phase power supply; 4700 µF when three-phase power supply.



2.2 Electrical wiring

The power cables (coils, electronic adjusters or other loads) to be separated from the control cables (references and feed-backs, signal grounds) to avoid interferences.
The electrical cables of the electronic signals must be shielded as indicated in section 5 with shield or cablebraid connected to the ground (according to CEI 11-17).
Recommended cable cross section;

- Supply and earth: 0,75 mm^2;
- Coils: 1mm^2 (Lmax = 20 m); 1,5 mm^2 (for longer distance) of shielded type;
- Voltage reference and LVDT feedback: 0,25mm^2 (Lmax = 20m) of shielded type;

Note: current reference signals options must be provided when greater lengths apply to reference and feedback connections;
suitable electronic units and transducers or voltage to current converters are available.

- Service signal: 0,25mm^2 (Lmax = 20 m) of shielded type;
- Electronic transducers: 0,25mm^2 (Lmax = 20 m) of shielded type;

2.3 Suppression of interferences by electrical noise

When starting the system, it is always advisable to check that feedbacks, references and signal grounds are free from interferences and electrical noise which can affect the characteristics of the signals and generate instability in the whole system.
Electrical noises are high non-stationary oscillations both on amplitude and frequency around the signal average value; they can be suppressed by shielding and grounding the signal cables, see section 5.
Most of electrical noises are due to external magnetic fields generated by transformers, electric motors, switchboards, etc.

2.4 Integral drivers service signals and options

- **Monitor signal (standard)**
  The output signal (0÷5V, ±10V) is available to monitor the current to the solenoid (AE, AES) or the spool position of the valve (TE, LE, TES, TERS). Both signals can be connected to main control unit for sequence operations and diagnostics.
  Note: electrical monitor signals taken via valve electronics must not be used to switch off the machine safety functions. This is in accordance with the European regulations standard (Safety requirements fluid Technology systems and components);
- **Current reference signal (option /I)**
  It provides the 4÷20 mA current reference signal and the current feedback signals instead of the standard 0÷10V (± 10V). 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. In case of breakage of the reference signal cable, the valve functioning is disabled.
- **Fault signal (option /F)**
  Safety option providing an output signal which switches to zero in case of interruption of the transducer feedback cable. In this condition the valve functioning is disabled.
- **Enabling contact (option /Q)**
  Safety option providing the possibility to enable or disable the valve functioning without cutting the power supply.
- **Fail safe conditions**
  In case of no feedback signal due to shortcircuit or break in the transducer cabling, an automatic inhibition of the control card operates and zero current is fed to valves. At the same time a LED (inside the housing for the integral electronics) is signalling the emergency condition.
- **Logic state signals for E-RI-TE and E-RI-LE (option /S)**
  This function gives three output signal in order to control in real time the valve's spool position to allow the diagnostic controls. The signal "**Zero position**" is "on" (22V 20 mA) when the spool is in the central position, while the other two signals ("**Position S1**" and "**Position S2**") are "on" when the spool is moving according to the excitation of the S1 or S2 solenoid, respectively. This safety signals can be used to switch-off the machine safety functions.
- **Enable fault and monitor for E-RI-TE and E-RI-LE (option /Z)**
  Option providing the same characteristics of **/F** and **/Q** plus the monitor signal 0 ÷ 10 V (or ± 10 V) of the spool position.
- **Double power supply enable and fault for E-RI-TES, E-RI-TERS, E-RI-LES (option /Z)**
  Safety option, specifically introduced for -BC and -BP fieldbus interfaces, provides two separated power supplies for the digital electronic circuits and for the solenoid power supply stage. The Enable and Fault signals are also available. The option **/Z** allows to interrupt the valve functioning by cutting the solenoid power supply (e.g. for emergency, as provided by the European Norms EN954-1 for components with safety class 2), but keeping energized the digital electronic circuits, thus avoiding fault conditions of the machine fieldbus controller.
- **P/Q control for E-RI-TES-PS and E-RI-LES-PS (option /SP)**
  Option providing in addition to the standard valve functions, a closed loop control of the max pressure regulated by the proportional valve in the system, thus realizing a P/Q regulation. A remote pressure transducer must be installed on the system and its feedback has to be interfaced to the valve. If the real value of the pressure in the system remains below the relevant reference signal, the driver regulates in closed loop the valve's spool position, according to the flow reference signal. When the real pressure become close to the relevant reference signal, the driver automatically performs the closed loop control of the pressure. This option permits to realize accurate dynamic pressure profiles. Up to 4 set of PID pressure parameters can be real time selected during the axis motion via on-off signals to the main 12 poles connector to optimize the control performances in the different phases of the machine cycle.
- **P/Q control for E-RI-TES-BC (-BP) and E-RI-LES-BC (-BP) (option /ZP)**
  Integral digital P/Q controller providing the same characteristics of option **/SP** plus additional double power supply, enable and fault. In this option the multiple set of PID pressure parameters can be real time selected during the axis motion through the -BC or -BP interfaces.
- **Current feedback signal for E-RI-PES (option /C)**
  The pump electronics is set to receive 4÷20 mA feedback signal from the remote pressure transducer, instead of the standard 0÷10 V.
- **P/Q control for E-RI-PES-PS (option /S)**
  Option providing up to 4 set of PID pressure parameters can be real time selected during the axis motion via on-off signals to the 12 poles connector to optimize the control performances in the different phases of the machine cycle.
- **P/Q control for E-RI-PES-BC (-BP) (option /Z)**
  Integral digital P/Q controller providing the same characteristics of option **/SP** plus additional double power supply, enable and fault. In this option the multiple set of PID pressure parameters can be real time selected during the axis motion through the -BC or -BP interfaces.

2.5 Electronic calibrations

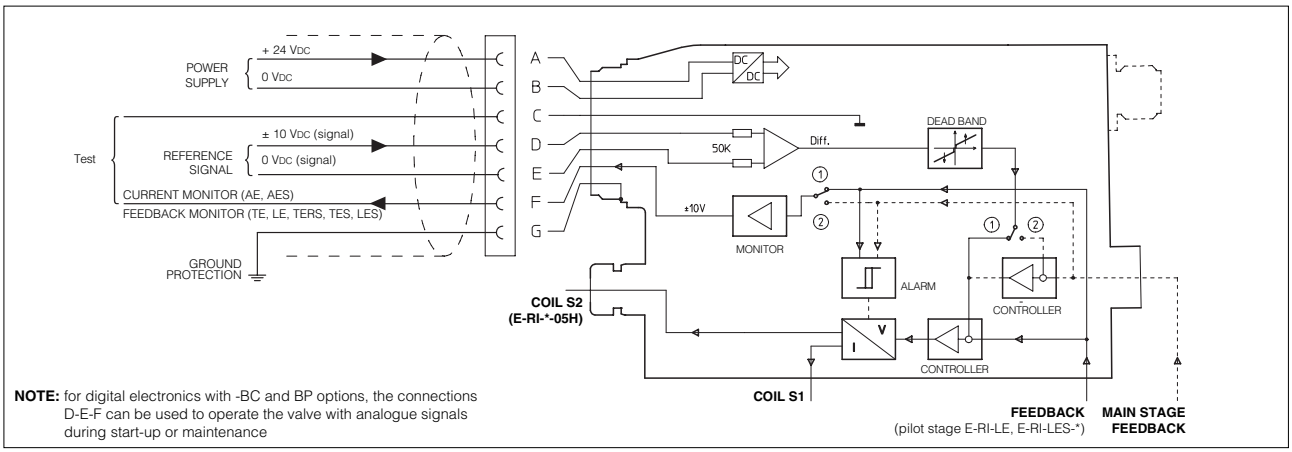
The valves with integral electronics normally don't need any calbration by final customer because these operations have been already performed before delivery of component (the valves with integral electronics are used more and more for their easier servicing and improved reliability).
However Bias adjustment is allowed, to permit the regulation between the input reference electrical zero and the spool center position (actuator in a steady position); a new calibration can be executed with particular hydraulic conditions (i.e. cylinder with high differential ratio value and/or high Δp pressure operations). When electronic regulators in Eurocard or other format are installed in the control unit, the setting procedures are shown on related technical tables; consult them carefully before proceeding with the start-up. Personalised calibrations in case of particular requirements can be carried out with the collaboration of Atos technical dept.

2.6 Temperatures and environments

Always chek that the operating environment is compatible with the data given in the product tables. If necessary provide conditioning of the electronic cabinet.
In particular the integral electronics cannot be used when ambient temperature is higher than +60°C or lower than -20°C (-20°C to +50 °C for digital -TERS execution).

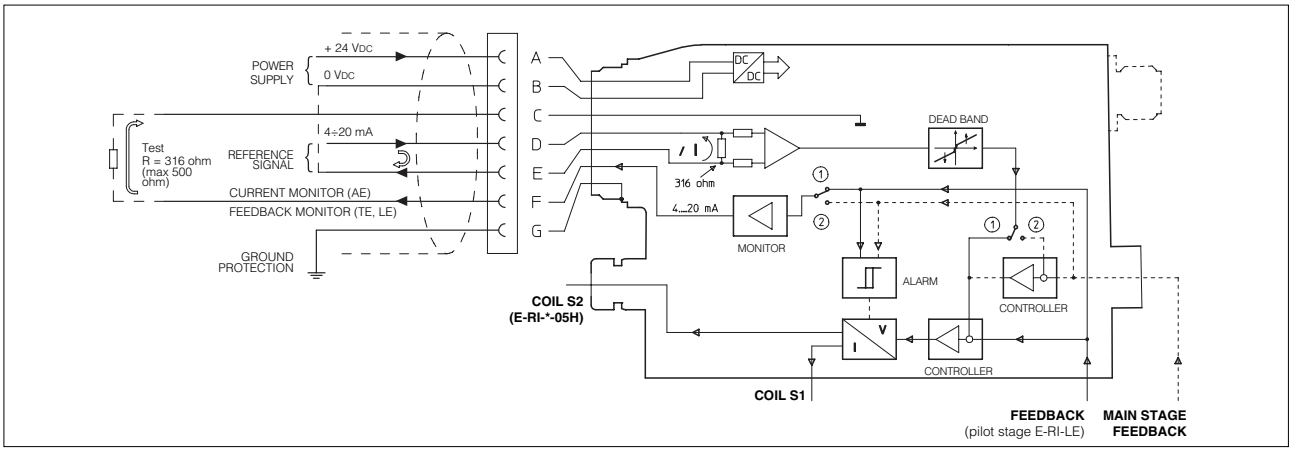
3 ELECTRONICS WIRING

3.1 E-RI-AE (-AES), E-RI-TE (-TES), E-RI-LE (-LES), E-RI-TERS Standard versions

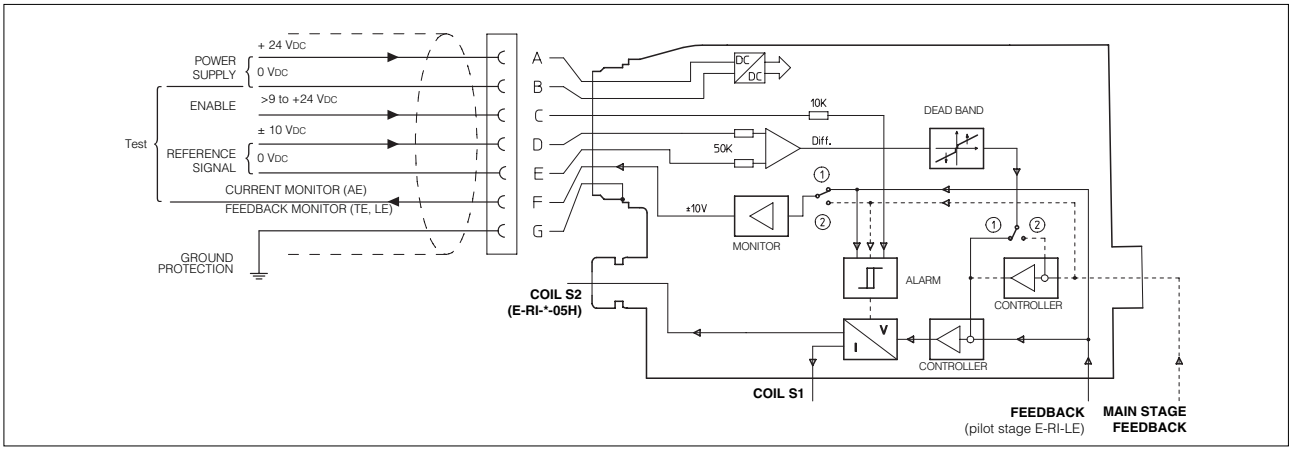


NOTE: for digital electronics with -BC and BP options, the connections D-E-F can be used to operate the valve with analogue signals during start-up or maintenance

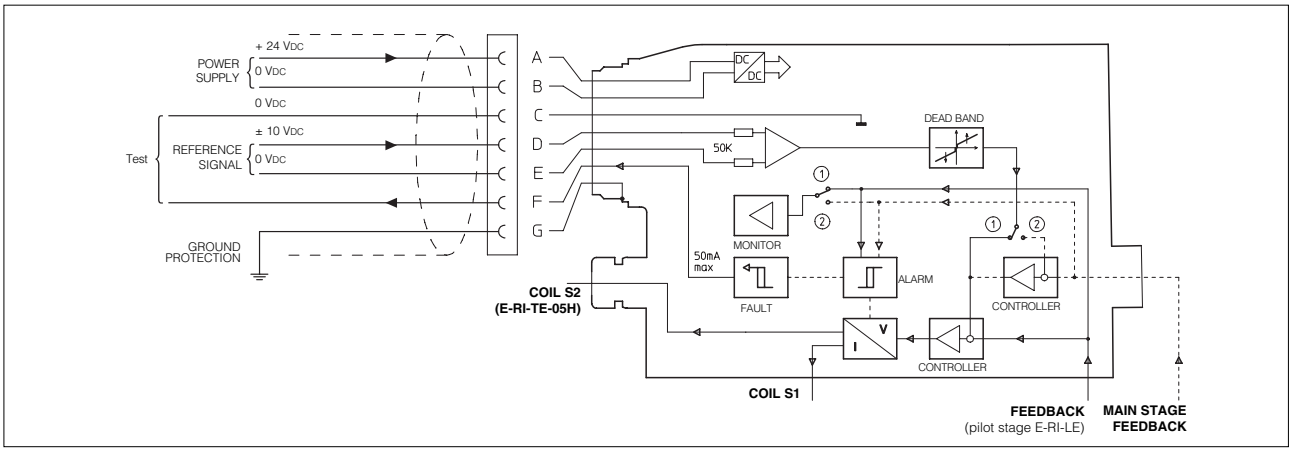
3.2 E-RI-AE, E-RI-TE, E-RI-LE, E-RI-TERS Option /I



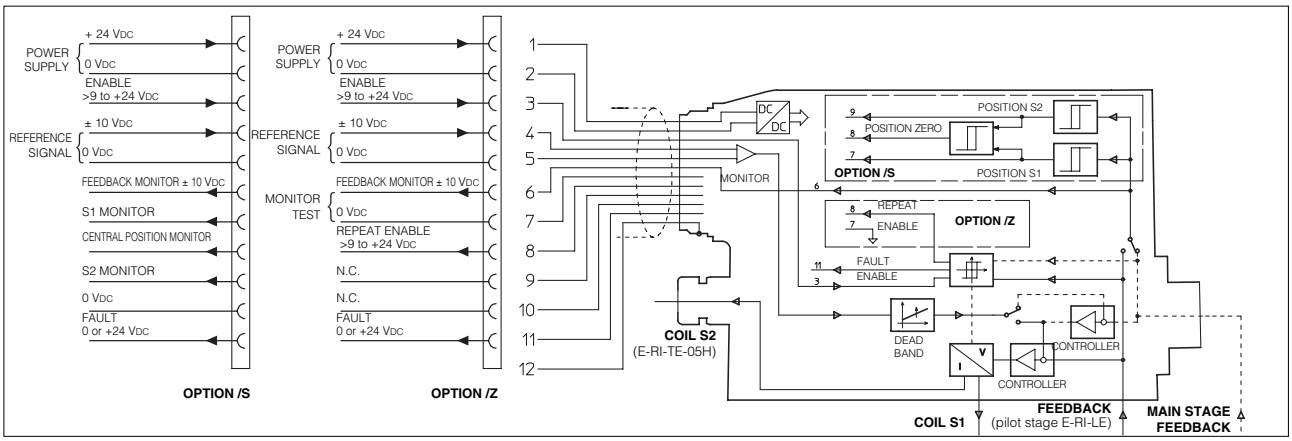
3.3 E-RI-AE, E-RI-TE, E-RI-LE Option /Q



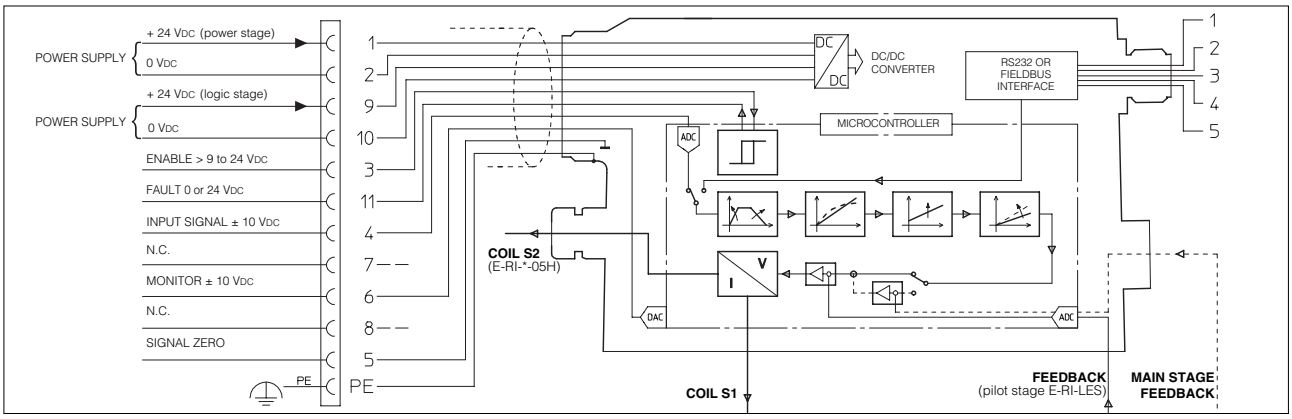
3.4 E-RI-TE, E-RI-LE Option /F



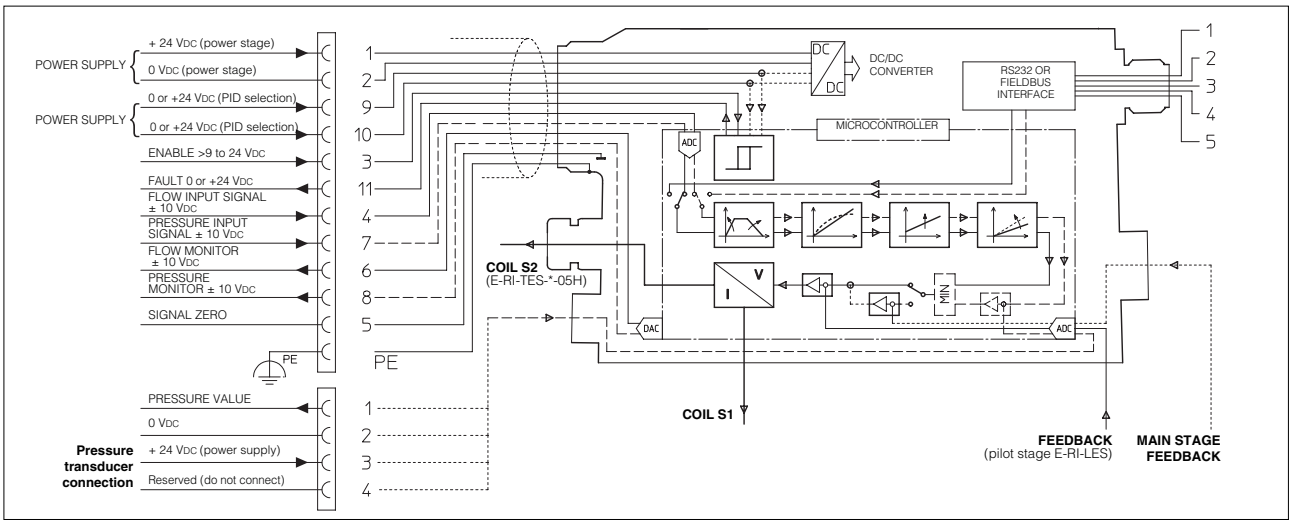
3.5 E-RI-TE, E-RI-LE Option /S and /Z (12 pin connector)



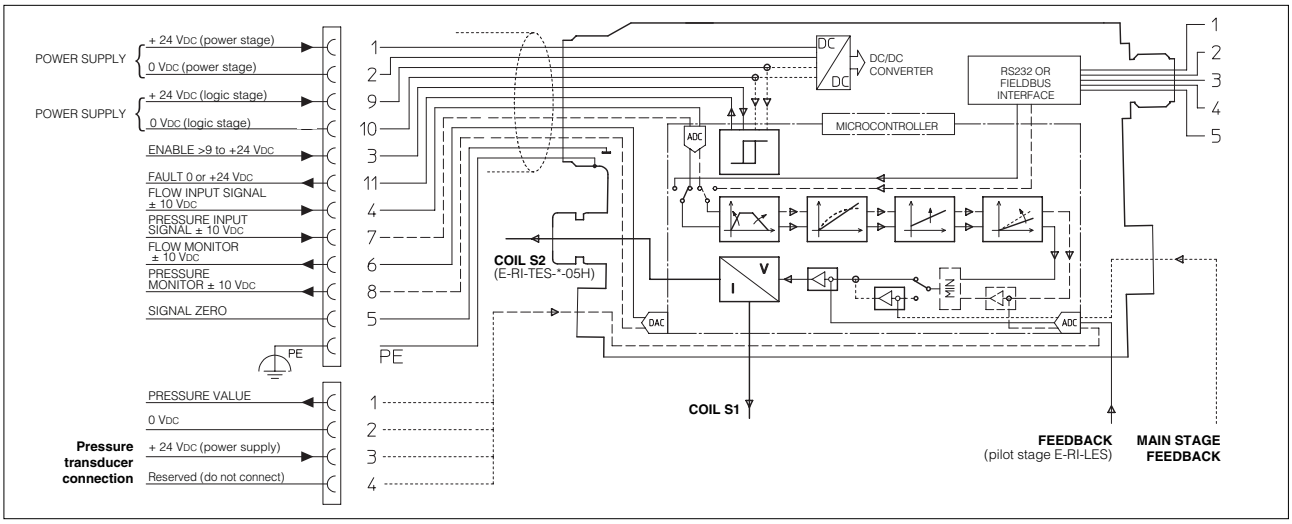
3.6 E-RI-AES, E-RI-TES, E-RI-LES Option /Z (12 pin connector)



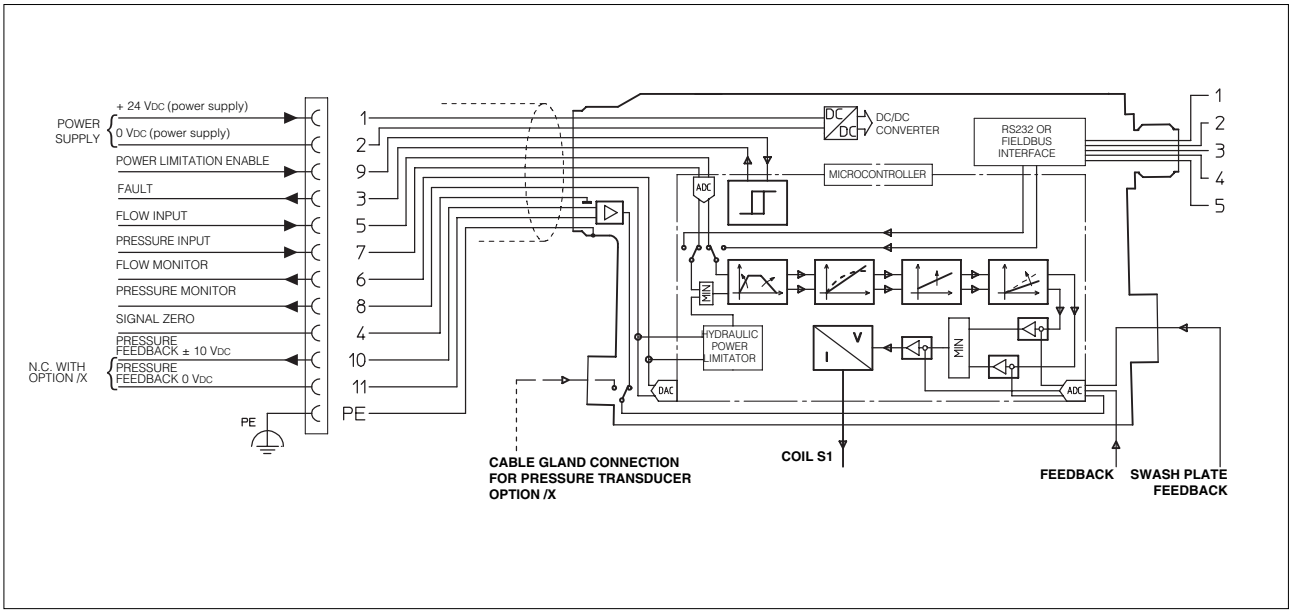
3.7 E-RI-TES, E-RI-LES Option /SP (12 pin connector)



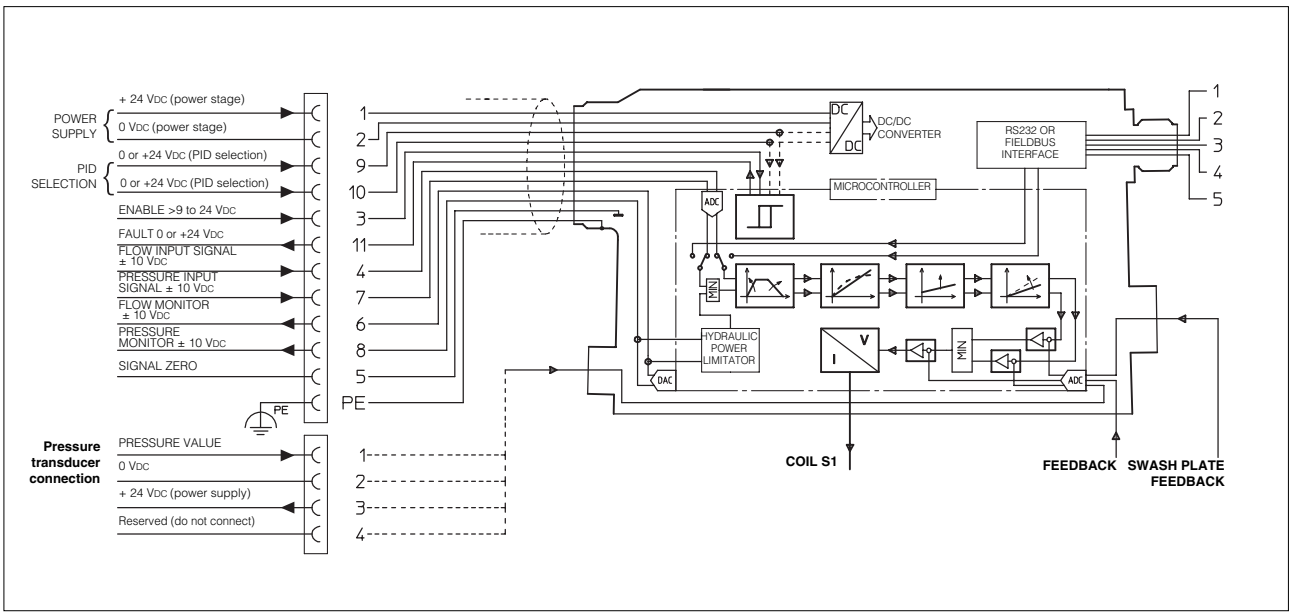
3.8 E-RI-TES, E-RI-LES Option /ZP (12 pin connector)



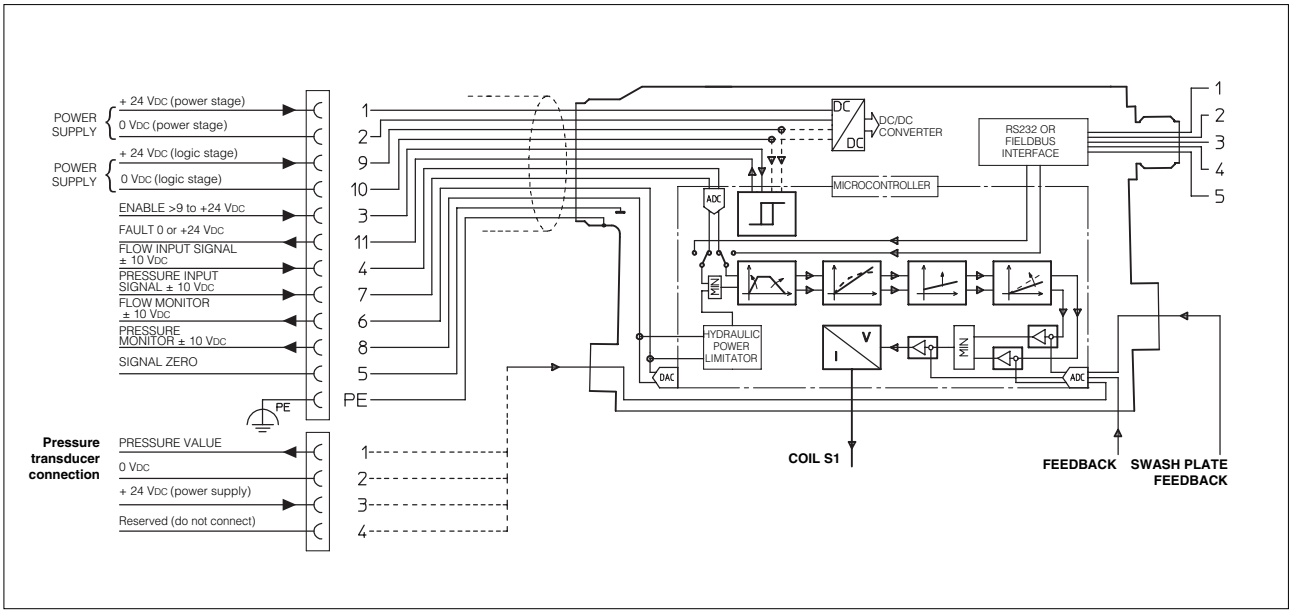
3.9 E-RI-PES Standard and option /X



3.10 E-RI-PES Option /S



3.11 E-RI-PES Option /Z



4 COMMAND SIGNAL WIRING

The connection of the command signal to the electronics is depending to the type of signal generated from the PLC or CNC.
The following figures show the typical connections in case of common zero or differential command situations.

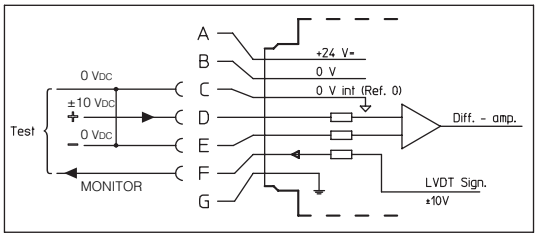


Fig. A Power supply and signal common zero

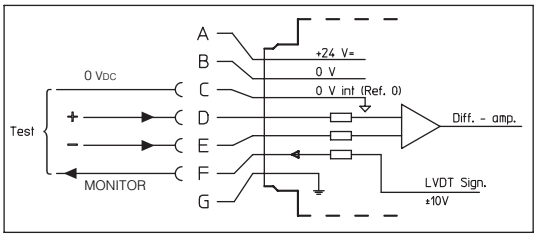


Fig. B Differential signals not connected with zero (floating)

COMMAND SIGNAL FOR OPTION /I

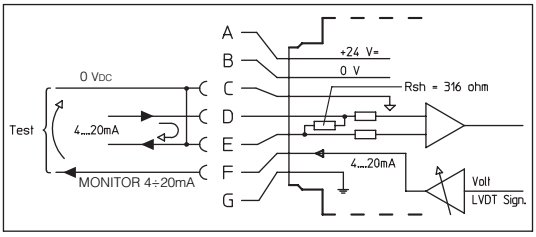


Fig. C Common zero

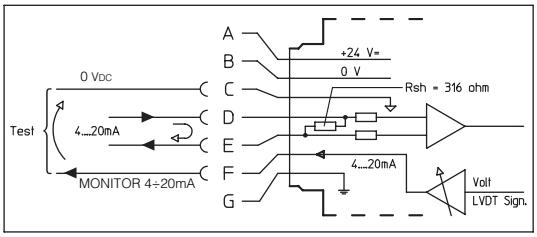


Fig. D Differential input signals

5 SHIELD CONNECTIONS

The correct shielding of signal cables has to be provided to protect the electronics from electrical noise disturbances, which could affect the valve functioning.
Examples of correct shielding criteria are shown in the following fig. E and F.
The shield connections of fig. G and H must be avoided because they could generate ground loops which enhance the noise effect.

CORRECT SHIELD CONNECTIONS

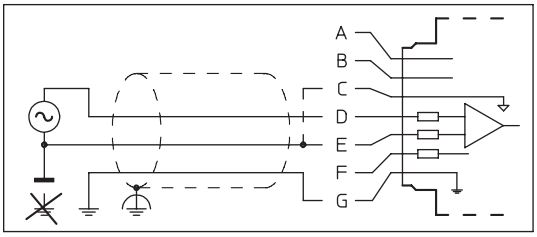


Fig. E Shield connected to the protected earth

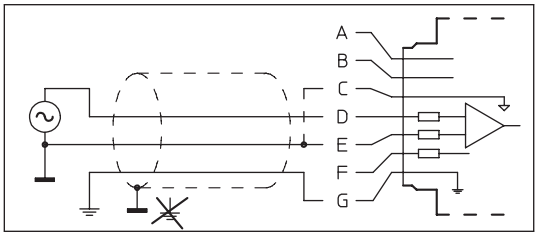


Fig. F Shield connected to the same power supply GND

WRONG SHIELD CONNECTIONS

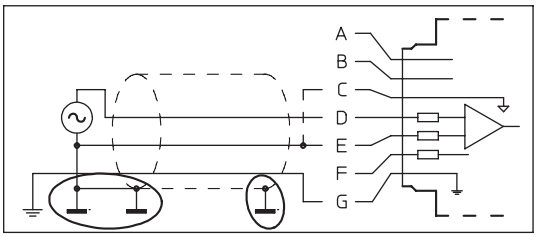


Fig. G Never connect the shield on both sides

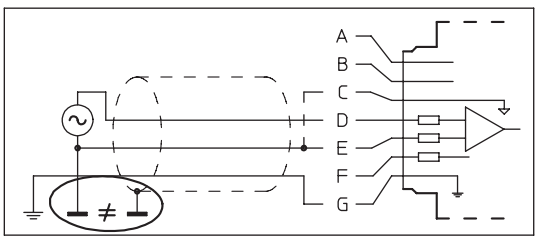


Fig. H Never connect the shield to grounding facilities having different potential

Symbols: Standard earth Supply GND Protected earth

6 TROUBLE SHOOTING TABLES

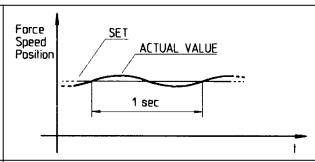
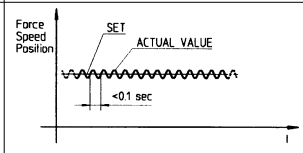
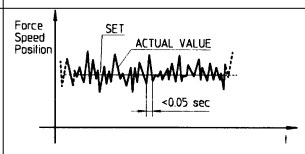
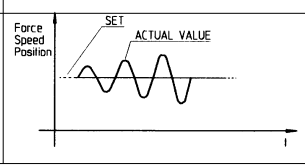
To evaluate the fault and to find the defective component within an electrohydraulic system it is necessary a good cooperation between electronic and hydraulic engineers.
Besides a good knowledge of the technical tables for each component, for performing analysis of the system it is necessary to evaluate the hydraulic scheme and the electric wiring diagram related to operation cycle.
There is no general recipe for succes in fault finding due to quite diverse nature of the electrohydraulic systems; however the following table provides a useful start point.

Notes:
- Most problems are solved by the replacement of defective components on site. The defective components can be repaired by the manufacturer.
- Following tables don't consider a system design fault

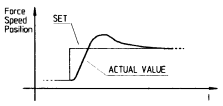
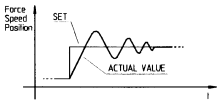
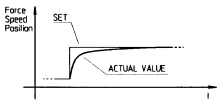
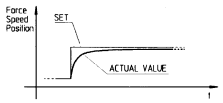
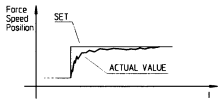
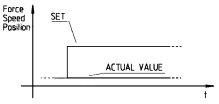
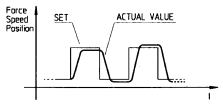
6.1 Open loop applications

PROBLEMS	CAUSES OF THE FAULTS	
	Mechanical/Hydraulic	**Electrical /Electronic**
Unstable axes movement Pressure and/or flow fluctuations	Defective pump Air in the circuit Fluid contaminated Insufficient piloting pressure of double stage valves Stick-slip effect due to excessive friction of cylinder seals Speed below minimum for hydraulic motors	Insufficient powered electrical supply Noisy signals-bad grounding or shielding Electrical or electromagnetic disturbances
Actuator overrun	Hoses too elastic Remote controlled check valve not closing immediately Insufficient bleeding Internal leakages	Bias current set too high Ramp time too long Limit switch overrun Electrical switching time too slow
Standstill or not controllable axes	Defective pump Proportional control valve blocked (dirt) Hand valves and settings not in correct position	Cabling error Open circuit in electrical control leads Signalling devices incorrectly set or defectives Lack of electrical power and/or reference signal Transducers mechanically uncalibrated
Actuator running too slow	Internal pump leaks due to wear Flow control valve set too low	Reference signal not correct Scale adjustment not correct
Insufficient output forces and torques	Excessive resistance in the return and delivery lines Operating pressure setting of control valves too low Excessive pressure drop across control valves Internal leaks of pump and valves due to wear	Reference signal not correct Scale adjustment not correct
Line hammer during control operation	Switching time of proportional control valves too rapid Throttles or orifices damaged No throttling before accumulator system Excessive masses and forces applied to drive	Ramp time too short or absent
Excessive operating temperature	Insufficient lines cross section Excessive continuous delivery Pressure setting too high Cooling system not operative Zero pressure circulation inoperative during working intervals	
Excessive noise	Filters blocked Foaming of the fluid Pump or motor mounting loose Excessive resistance in the suction line Proportional control valves buzz Air in the valve solenoid	Dither adjustment not correct

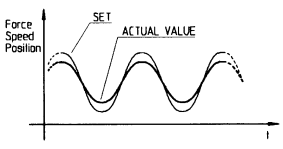
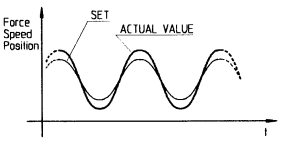
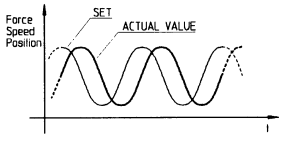
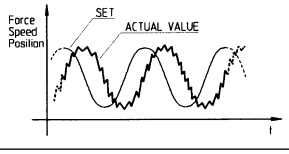
6.2 Closed loop applications - static conditions

PROBLEMS		CAUSES OF THE FAULTS	
		Mechanical/Hydraulic	**Electrical /Electronic**
Low frequency oscillations		Insufficient hydraulic power supply Insufficient piloting pressure Proportional valve defective due to wear or dirt	Axes card proportional and integral Gains set too low Axes card Sampling time too long
High frequency vibration		Foaming of the fluid Prop. valve defective due to wear or dirt Too high Δ pressure across valve Air in the solenoid of the proportional valve	Axes card proportional Gain set too high Electrical noises
Short time peak (random) in one direction or both		Mechanical couplings not rigid Air in the solenoid of the proportional valve Proportional valve defective due to wear or dirt	Driver's bias current not correct Electromagnetic disturbances
Self amplificating oscillations		Hydraulic hoses too elastic Mechanical couplings not rigid Too high Δ pressure across prop. valve Too high hydraulic proportional valve gain	Axes card proportional and integral Gains too high

6.3 Closed loop applications - dynamic conditions: step response

PROBLEMS		CAUSES OF THE FAULTS	
		Mechanical/Hydraulic	**Electrical /Electronic**
Overshoot in one direction		Too high Δ pressure across valve	Axes card Derivative Gain set too low
Overshot in both directions		Mechanical couplings not rigid Hoses too elastic Proportional control valve mounted too far from the actuators	Axes card Proportional Gain set too high Axes card Integral Gain set too low
Slow approach to set		Pressure Gain of the proportional control valve too low	Axes card Proportional Gain set too low Driver's Bias current not correct
Drive unable to reach the set		Insufficient hydraulic pressure or flow	Axes card Integral Gain set too high Proportional and Derivate Gains set too low Driver's Scale and Bias not correct
Unstable control		Actuator's feedback transducer connection intermittent Hoses too elastic Air in the solenoid of the proportional valve to high friction	Proportional Gain set too high Integral Gain set too low Electrical noises
Inhibited control		Actuator's feedback transducer mechanically uncalibrated Lack of hydraulic power	Lack of electrical power Lack of reference or feedback signal Cabling error
Bad repeatability and high hysteresys		Actuator's feedback transducer connection intermittent	Axes card Proportional Gain set too high Integral Gain set too low

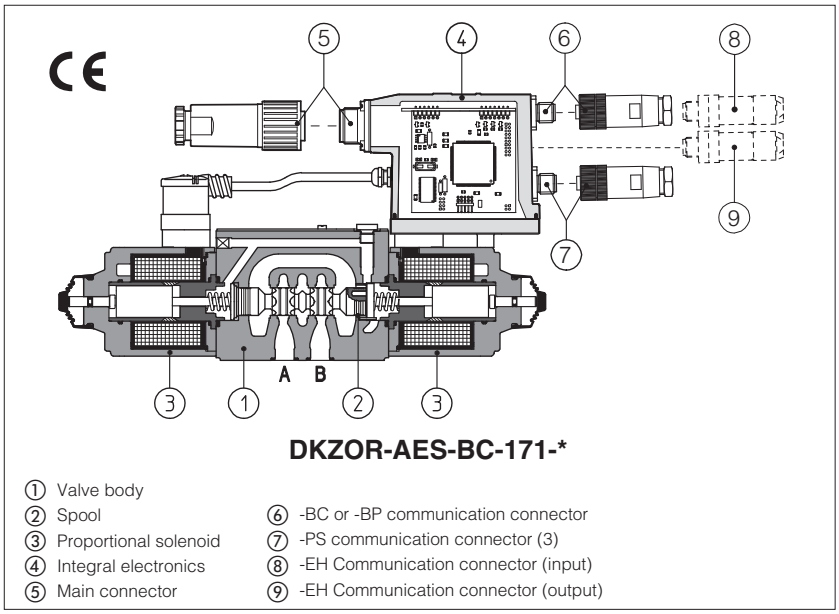
6.4 Closed loop applications - dynamic conditions: frequency response

PROBLEMS		CAUSES OF THE FAULTS	
		Mechanical/Hydraulic	**Electrical /Electronic**
Amplitude damping		Insufficient pressure and flow	Axes card Proportional Gain too low Driver's scale adjustments set too low
Wave amplifier		Hoses too elastic Proportional control valve too far from drive	Driver's scale adjustment not correct
Time delay		Insufficient pressure and flow	Ramp time inserted Axes card derivative gain set too low
Vibrating control		Air in the solenoid of proportional valve	Axes card proportional and Derivative Gains too high Electrical noises Derivative Gain set too high

Proportional directional valves type DHZO-AES and DKZOR-AES

direct operated, without position transducer, ISO 4401 size 06 and 10

AES execution included in this table is available only for running supplies or spare parts
For new applications it is suggested new AEB and AES executions, see table FS160



DKZOR-AES-BC-171-*

① Valve body
② Spool
③ Proportional solenoid
④ Integral electronics
⑤ Main connector
⑥ -BC or -BP communication connector
⑦ -PS communication connector (3)
⑧ -EH Communication connector (input)
⑨ -EH Communication connector (output)

DHZO-A* and DKZOR-A* are proportional valves, direct operated without position transducer, which provide both directional and non-compensated flow control according to the electronic reference signal.
They operate in association with electronic drivers, see section 2, which supply the proportional valves with proper current to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -A, without position transducer;
- -AE, -AES as -A plus analogue (AE) or digital (AES) integral electronics ④;

The 4-way spool ②, sliding into a 5-chambers body ①, is directly operated by proportional solenoids ③.
The integral electronics ④ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.
The electronic main connector ⑥ is fully interchangeable for -AE and -AES executions.
Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.
12 pin connector is used for options /Z and /W (AES).

Following communication interfaces ⑥, ⑦ are available for the digital -AES execution:
- -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software - always present also for -BC, -BP and -EH options.
- -BC, CANopen interface
- -BP, PROFIBUS DP interface
- -EH, EtherCAT interface

The valves with -BC, -BP and -EH interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

The coils are fully plastic encapsulated with insulation class H.

Mounting surface: **ISO 4401 sizes 06 and 10**

Max flow respectively up to **50 l/min** and **105 l/min** with valve differential pressure Δp = 30 bar, see table 3.

Max pressure = **350 bar** for DHZO;
315 bar for DKZOR.

1 MODEL CODE

DHZO - AES - PS - 0 7 1 - S 5 / * / * ** / *

DHZO
size 06
DKZOR
size 10

A = without position transducer
AE = as A plus integral electronics
AES = as A plus integral digital electronics

Communication interfaces only for AES **(1)**
PS = Serial
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size - ISO 4401
0 = size 06 **1** = size 10

Configuration, see section 3
5 = external plus central position, spring centered
7 = 3 position, spring centered

Spool overlapping in central position, see sect. 3
1 = P, A, B, T positive overlapping (20% of spool stroke)
3 = P positive overlapping; (20% of spool stroke) A, B, T, negative overlapping

Spool type (regulating characteristics)
L = linear; **S** = progressive;
D = differential-progressive
(as **S**, but with P-A= Q, P-B= Q/2)

Spool size: **14, 1, 3, 5** = see section 3

Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR (only **-A**)

Series number

Coil voltage (only for -A execution) see section 7:
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

Hydraulic options, see section 6:
B = solenoid and integral electronics at side of port A
Y = external drain

Options for -A execution see sect. 7:
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
N = manual micrometric adjustment
NV = as N plus handwheel and graduated scale

Electronics options for -AE execution see section 9:
I = current reference input (4÷20 mA)
Q = enable signal

Electronics options for -AES execution see section 11:
Q = enable signal
Z = double power supply, enable fault and monitor (12 pin connector)
W = power limitation function (12 pin connector) see section 11.3

Note: (1) Serial communication interface always present, also for -BC, -BP and -EH options

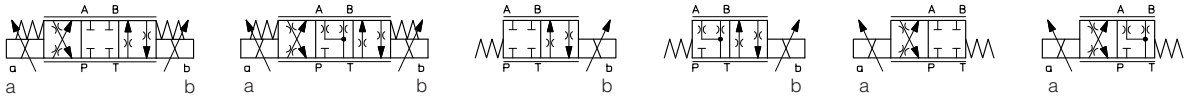
2 ELECTRONIC DRIVERS FOR DHZO-A*

Valve model	-A						-AE	-AES
Drivers model	E-MI-AC-0*F	E-MI-AS-IR	E-BM-AC-0*F	E-BM-AS-PS	E-ME-AC-0*F	E-RP-AC-0*F	E-RI-AE	E-RI-AES
Data sheet	G010	G020	G025	G030	G035	G100	G110	G115

Note: For power supply and communication connector see section 14

3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols



Valve model	DHZO					DKZOR	
Spool overlapping	**1, 3**	**1, 3**	**1, 3**	**1, 3**	**1, 3**	**1, 3**	**1, 3**
Spool type and size	**L14**	**L1**	**S2**	**S3, L3, D3**	**S5, L5, D5**	**S3, L3, D3**	**S5, L5, D5**
Pressure limits [bar]	ports P, A, B = 350; T = 210 (250 with external drain /Y)					ports P, A, B = 315; T = 210 (250 /Y)	
Max flow (1) [l/min]							
at Δp = 10 bar (P-T)	1	4,5	8	17	28	45	60
at Δp = 30 bar (P-T)	2	8	14	30	50	80	105
at Δp = 70 bar (P-T)	3	12	21	45	74	120	160
Response time (2) [ms]	< 30					< 40	
Hysteresis [%]	≤ 5%					≤ 5%	
Repeatability	± 1%					± 1%	

Notes:
- 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 tab. D150).

(1) For different Δp, the max flow is in accordance to the diagrams in sections 14.2 and 15.2

(2) 0-100% step signal

4 MAIN CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)					
MTTFd valves according to EN ISO 13849	150 years, for further details, see technical table P004					
Ambient temperature	-A execution = -20°C ÷ +70°C (storage -20°C ÷ +80°C) /BT option -40°C ÷ +60°C (storage -20°C ÷ +70°C) -AE execution = -20°C ÷ +60°C (storage -20°C ÷ +70°C) -AES execution = -20°C ÷ +60°C (storage -20°C ÷ +70°C)					
Fluid	Hydraulic mineral oil HL, HLP as per DIN 51524					
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 ($\beta_{10} \geq 75$ recommended)					
Fluid temperature	-20°C +60°C (standard seals) -20°C +80°C (/PE option) -40°C +60°C (/BT option)					
Coil code	DHZO-A*			DKZOR-A*		
	standard	option /6	option /18	standard	option /6	option /18
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
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A
Max. power	30 Watt for DHZO-A execution; 35 Watt for DKZOR-A execution; 50 Watt for -AE and -AES executions					
Protection degree (CEI EN-60529)	IP65 for -A execution; IP67 for -AE and -AES, executions					
Duty factor	Continuous rating (ED=100%)					

5 GENERAL NOTES

DHZO and DKZOR proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

The electrical signals of the valve (e.g. 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).

6 HYDRAULIC OPTIONS

6.1 Option /B Solenoid (for valve configuration *5*), and integral electronics at side of port A. For hydraulic configuration vs. reference signal, see section 14.1 and 15.1

6.2 Option /Y External drain advisable when the valve is used in double flow path, see section 14.5 and 15.5. Option /Y is mandatary if the pressure in port T exceeds 160 bar.

7 OPTIONS FOR -A EXECUTION

7.1 Option /6 optional coil to be used with Atos drivers with power supply 12 VDC

7.2 Option /18 optional coil to be used with electronic drivers not supplied by Atos

7.3 Auxiliary hand lever

this option is available 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 table E138

- **Option /MO** horizontal hand lever
- **Option /MV** vertical hand lever
- **Option /BMO** horizontal hand lever installed at side of port A
- **Option /BMV** vertical hand lever installed at side of port A

The following supplementary options allow to operate the valve in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see table TK500

7.4 Option /N manual micrometric adjustment

7.5 Option /NV as /N plus handwheel and graduated scale

8 CONNECTIONS FOR -A EXECUTION

SOLENOID POWER SUPPLY CONNECTOR		
PIN	Signal description	
1	SUPPLY	
2	SUPPLY	
3	GND	

9 ANALOG INTEGRAL DRIVERS -AE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10 VDC nominal range (pin D, E), proportional to desired coil current

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Following options are available to adapt standard execution to special application requirements:

9.1 Option /I

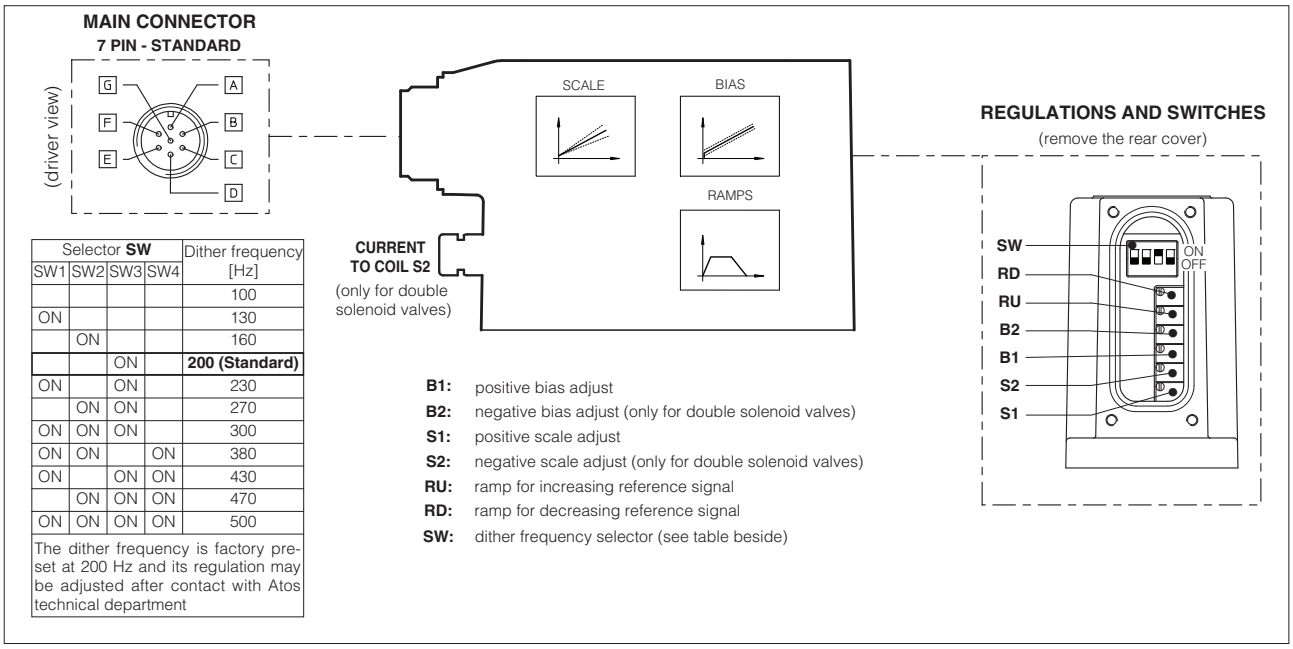
It provides the 4÷20 mA current reference signal instead of the standard ±10 VDC. Monitor output signal is still the standard ±10 VDC
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

9.2 Option /Q

It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

9.2 Possible combined option: /IQ

10 ANALOG INTEGRAL DRIVERS -AE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



Selector **SW**				Dither frequency
SW1	SW2	SW3	SW4	[Hz]
				100
ON				130
	ON			160
		ON		**200 (Standard)**
ON		ON		230
	ON	ON		270
ON	ON	ON		300
ON	ON		ON	380
ON		ON	ON	430
	ON	ON	ON	470
ON	ON	ON	ON	500

The dither frequency is factory preset at 200 Hz and its regulation may be adjusted after contact with Atos technical department

B1: positive bias adjust
B2: negative bias adjust (only for double solenoid valves)
S1: positive scale adjust
S2: negative scale adjust (only for double solenoid valves)
RU: ramp for increasing reference signal
RD: ramp for decreasing reference signal
SW: dither frequency selector (see table beside)

10.1 7 PIN MAIN CONNECTOR

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	V+	Power supply 24 VDC for solenoid power stage and driver logic	Input - power supply
B	V0	Power supply 0 VDC for solenoid power stage and driver logic	Gnd - power supply
C (1)	AGND	Ground - signal zero for MONITOR signal	Gnd - analog signal
	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q option)	Input - on/off signal
D	INPUT+	Reference analog differential input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) Default setting for single solenoid valves: 0÷+10 VDC Default setting for double solenoid valves: ±10 VDC	Input - analog signal
E	INPUT -		
F	MONITOR	Monitor analog output: ±5 VDC maximum range; 1 V = 1 A	Output - analog signal
G	EARTH	Internally connected to the driver housing	

Note: (1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is referred to pin B.

A minimum time of 60ms to 160ms 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 DIGITAL INTEGRAL DRIVERS -AES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired coil current (4÷20 mA with cable break detection, ±10 mA, ±20 mA or 0÷20 mA software selectable)

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Following options are available to adapt standard execution to special application requirements:

11.1 Option /Q

To enable the driver, supply 24Vdc on pin C referred to pin B: when the enable signal is set to zero the valve status is software selectable, by factory default the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active. For the complete list of selectable status, see tab. G115.

11.2 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Logic power supply

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).
Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal

To enable the driver, supply 24Vdc on pin 3 referred to pin 2: when the enable signal is set to zero the valve status is software selectable, by factory default the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active. For the complete list of selectable status, see tab. G115.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

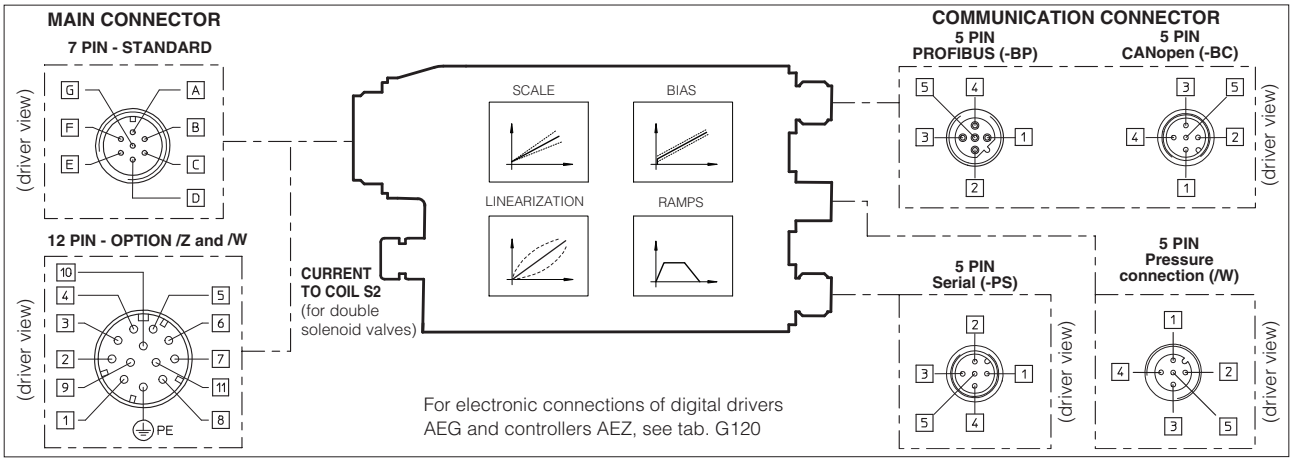
11.3 Option /W - only for valves coupled with pressure compensator type HC-011 or KC-011 (see tab. D150).

It provides, on the 12 pin main connector, the above option /Z features plus the hydraulic power limitation function.
The driver receives the flow reference signal by the analog external input INPUT+ and a pressure transducer remotely 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:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} \; ; \text{Flow Reference [INPUT+]} \right)$$

For detailed information on hydraulic power limitation, see tab. G115

12 DIGITAL INTEGRAL DRIVERS -AES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



12.1 7 or 12 PIN MAIN CONNECTOR (-AES standard, /Q, /Z, /W options)

Standard 7pin	/Z, /W options 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
C (option /Q)	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: ±10 VDC / ±20 mA maximum range software selectable Default setting for single solenoid valves: 0÷+10 VDC, differential input Default setting for double solenoid valves: ±10 VDC, differential input /Z and /W options: common mode INPUT+ referred to AGND	Input - analog signal
E	-	INPUT -		
C	5	AGND	Ground - signal zero for MONITOR signal (INPUT+ signal only for /Z and /W options)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: ±5 VDC maximum range; Default setting 1V = 1A	Output - analog signal
-	7	NC	do not connect	
-	8	MONITOR 2	2nd monitor analog output: ±5 VDC maximum range **(only for /W option)**	Output - analog signal
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 270 to 340 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.

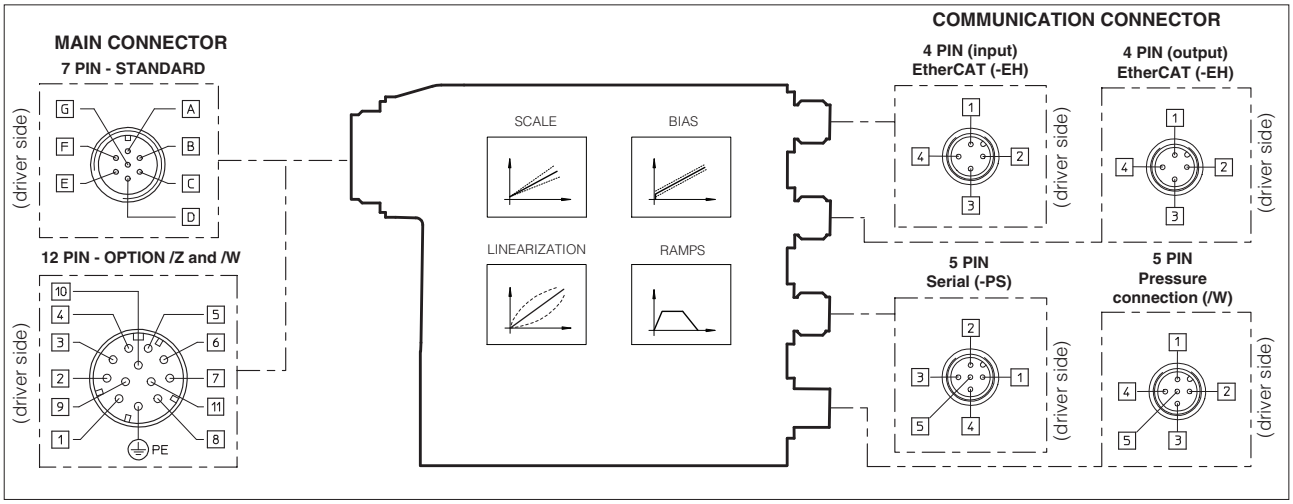
12.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION AND PRESSURE TRANSDUCER CONNECTORS

	Serial (-PS)		CANopen (-BC)		PROFIBUS DP (-BP)	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**	**SIGNAL**	**TECHNICAL SPECIFICATION**	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	do not connect

12.3 5 PIN M12 PRESSURE CONNECTOR (only for /W option)

PIN	Input Voltage (Software selectable)		Input Current (Software selectable)	
1	VT	Remote transducer power supply 24 VDC	VT	Remote transducer power supply 24 VDC
2	TR	Remote transducer signal (0 ÷ 10 VDC)	TR	Remote transducer signal (0 ÷ 20 mA)
3	AGND	signal zero for power supply and signal	NC	do not connect
4	NC	do not connect	NC	do not connect
5	NC	do not connect	NC	do not connect

13 DIGITAL INTEGRAL DRIVER -AES-EH - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



Note: for the electronic connections of 7 or 12 pin main connector, see section 12.1
for pressure transducer electronic connector (option /W) see section 12.3)

13.1 4 & 5 PIN M12 COMMUNICATION CONNECTORS

Serial (-PS)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	NC	do not connect
2	NC	do not connect
3	RS_GND	Signal zero data line
4	RS_RX	Valves receiving data line
5	RS_TX	Valves transmitting data line

EtherCAT (-EH)		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	Shield	Positioned on control cabinet side

14 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

VALVE VERSION	-A	-AE, -AES		-AES/Z	-AES/W -AEZ	-Serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)	EtherCAT (-EH)
CONNECTOR CODE	666	ZH-7P	ZM-7P	ZH-12P	ZH-5PM	ZH-5P	ZH-5P/BP	ZM-4PM/EH
PROTECTION DEGREE	IP65	IP67	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500	G110, G115, K500			G115, K500	G115, K500		

connectors supplyed with the valve

15 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the Atos E-SW programming software, available in four different versions according to the driver's communication execution: **E-SW-PS** (Serial), **E-SW-BC** (CANopen), **E-SW-BP** (PROFIBUS DP), **E-SW-EH** (EtherCAT). Programming software E-SW-BC, E-SW-BP, E-SW-EH for BC, BP and -EH drivers, can be also used to modify the valve's parameterization through the serial communication interface, without disconnecting the valve from the machine's bus line.

For a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table **G500**.

Programming software, must be ordered separately:

E-SW-* (mandatory - first supply) = Dvd including E-SW-* software installer and operator manuals; it allows the registration to Atos digital service

E-SW-*-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com.
Once the registration is completed, the password will be sent by email.

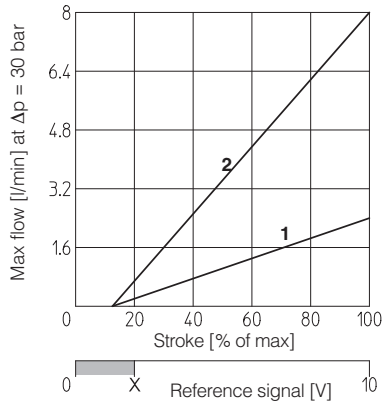
The software remains active for 10 days from the installation date and then it stops until the user inputs his password.

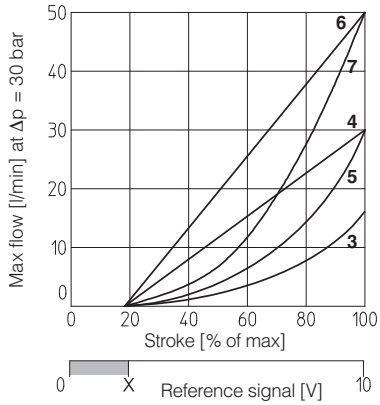
With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

16 DIAGRAMS FOR DHZO (based on mineral oil ISO VG 46 at 50 °C)

5.1 Regulation diagrams

1 = linear spool L14
2 = linear spool L1
3 = progressive spool S2
4 = linear spool L3
5 = progressive spool S3, D3
6 = linear spool L5
7 = progressive spool S5, D5





Note: hydraulic configuration vs reference signal for double solenoid valves (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

X = Threshold for bias activation depending to the valve type and amplifier type

Hydraulic configuration vs reference signal for single solenoid valves:

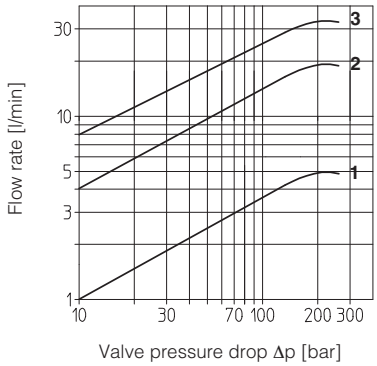
Reference signal:

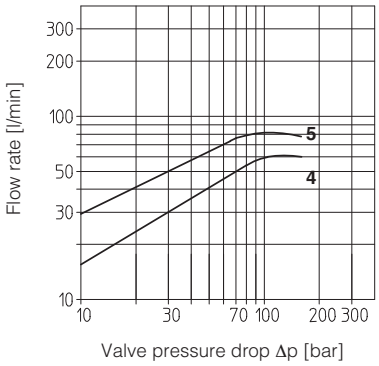
0 ÷ +10 V } P → A / B → T (standard)
4 ÷ 20 mA } P → B / A → T (option /B)

16.2 Flow /Δp diagrams

stated at 100% of valve stroke

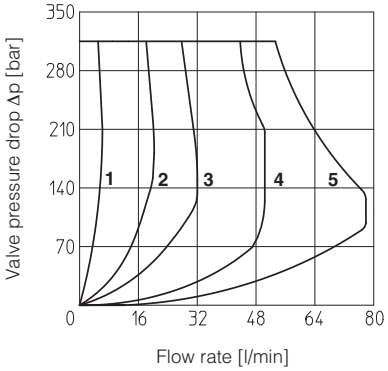
1 = spool L14
2 = spool L1
3 = spool S2
4 = spool S3, L3, D3
5 = spool S5, L5, D5





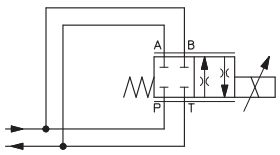
16.3 Operating limits

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5



16.4 Operation as throttle valve

Single solenoid valves (DHZO-*-051) can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



	SPOOL TYPE						
	L14	**L1**	**S2**	**L3**	**S3**	**L5**	**S5**
Max flow Δp= 70bar [l/min]	6	20	40	80		100	

17 DIAGRAMS FOR DKZOR (based on mineral oil ISO VG 46 at 50 °C)

17.1 Regulation diagrams

1 = linear spool L3
2 = progressive spool S3, D3
3 = linear spool L5
4 = progressive spool S5, D5

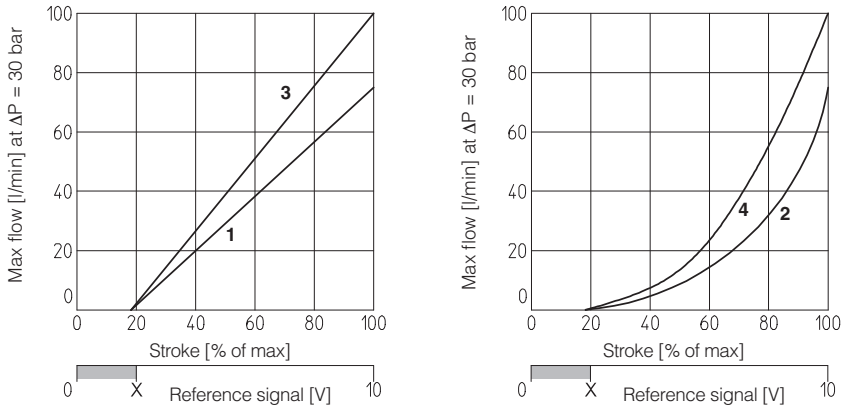
Note:
Hydraulic configuration vs reference signal for double solenoid valves (standard and option /B)

Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ -10 V / 4 ÷ 12 mA } P → B / A → T

Hydraulic configuration vs reference signal for single solenoid valves:

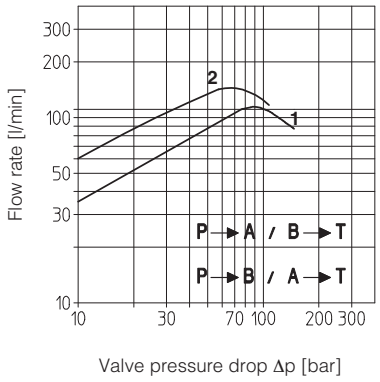
Reference signal:
0 ÷ +10 V / 4 ÷ 20 mA } P → A / B → T (standard)
P → B / A → T (option /B)



X = Threshold for bias activation depending to the valve type and amplifier type

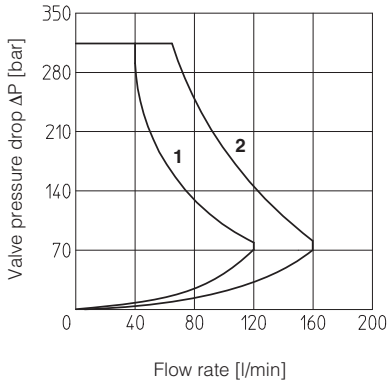
17.2 Flow /Δp diagrams
stated at 100% of valve stroke

1 = spool S3, L3, D3
2 = spool S5, L5, D5



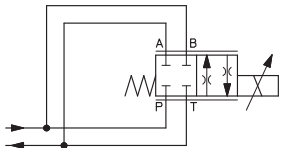
17.3 Operating limits

1 = spool L3, S3, D3
2 = spool L5, S5, D5



17.4 Operation as throttle valve

Single solenoid valves (DKZOR-*-151) can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)

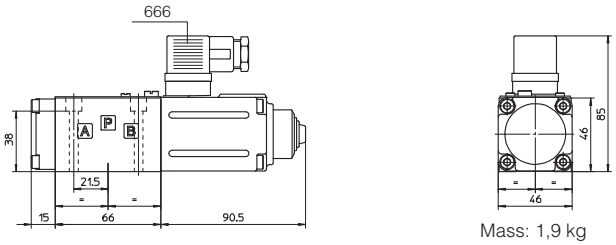


	SPOOL TYPE			
	L3	**S3**	**L5**	**S5**
Max flow Δp= 30 bar [l/min]	100		160	

18 INSTALLATION DIMENSIONS FOR DHZO [mm]

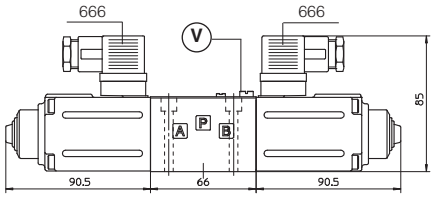
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y version, surface 4401-03-03-0-05 without X port)
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108; 1 OR 2025
Diameter of ports A, B, P, T: Ø 7,5 mm (max)
Diameter of port Y: Ø = 3,2 mm (only for /Y option)

DHZO-A-05



Mass: 1,9 kg

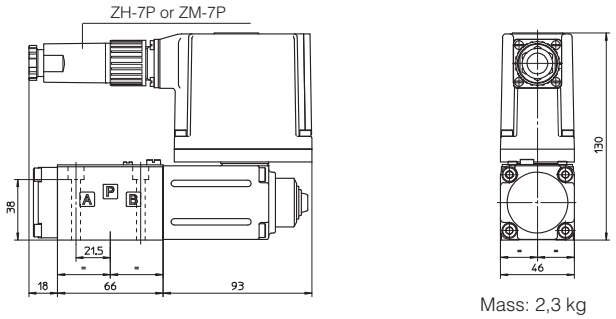
DHZO-A-07



Mass: 2,6 kg

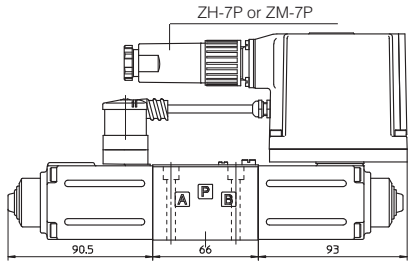
Note: for option /B the solenoid is at side of port A

DHZO-AE-05



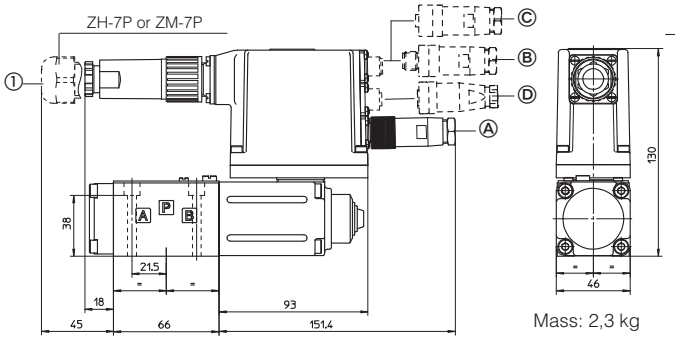
Mass: 2,3 kg

DHZO-AE-07



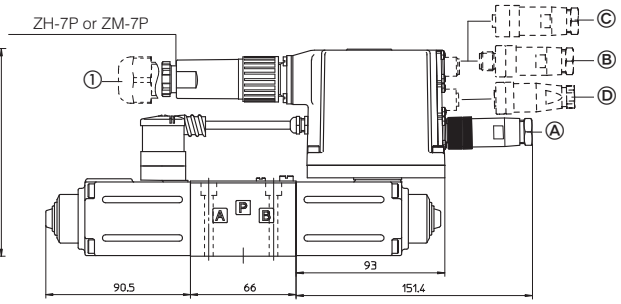
Mass: 3,1 kg

DHZO-AES-05



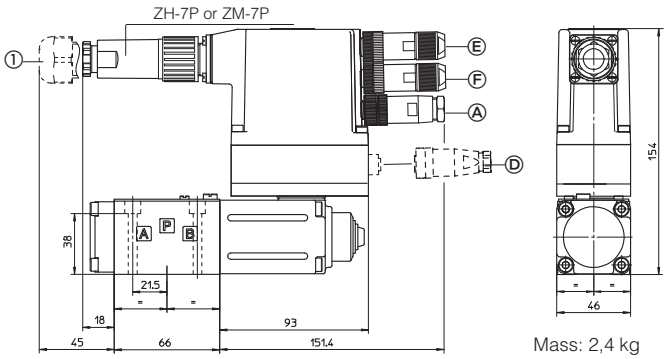
Mass: 2,3 kg

DHZO-AES-07



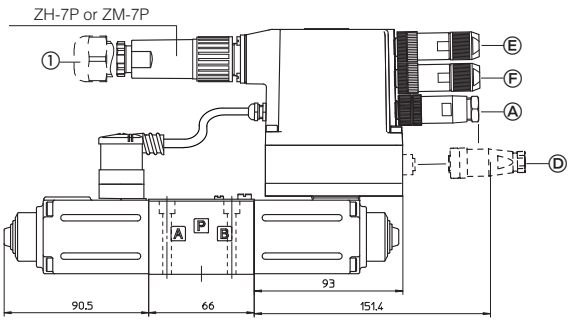
Mass: 3,1 kg

DHZO-AES-EH-05



Mass: 2,4 kg

DHZO-AES-EH-07



Mass: 3,2 kg

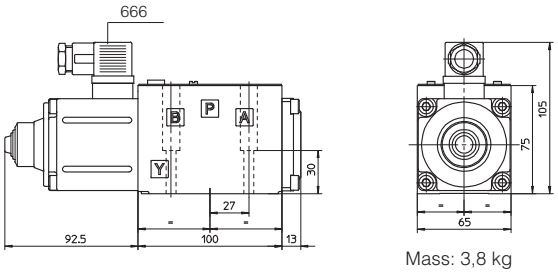
Ⓐ -PS communication interface, ZH-5P connector
Ⓑ -BP communication interface, ZH-5P/BP connector
Ⓒ -BC communication interface, ZH-5P connector
Ⓓ -Option /W pressure transducer interface, ZH-5PM connector
Ⓔ -EH communication interface (input), ZM-4PM/EH connector
Ⓕ -EH communication interface (output), ZM-4PM/EH connector

① dotted line = 12 pin connector ZH-12P for option /Z, /W

19 INSTALLATION DIMENSIONS FOR DKZOR [mm]

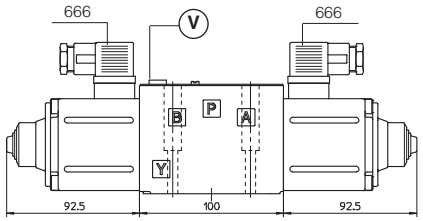
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y version, surface 4401-05-05-0-05 without X port)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 1 OR 108
Diameter of ports A, B, P, T: Ø 11,2 mm (max)
Diameter of port Y: Ø = 5 mm (only for /Y option)

DKZOR-A-15



Mass: 3,8 kg

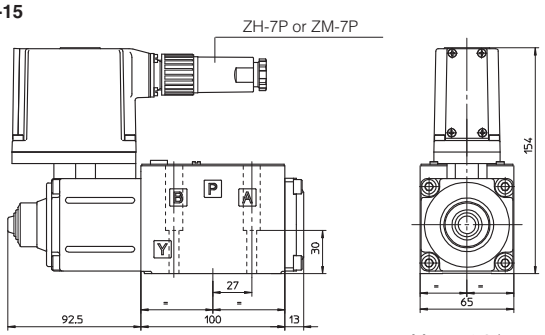
DKZOR-A-17



Mass: 4,5 kg

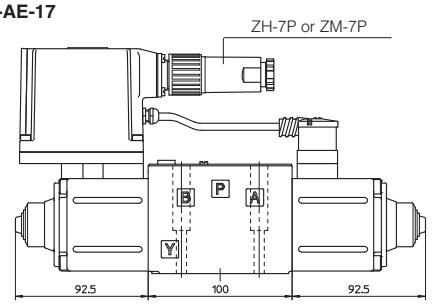
Note: for option /B the solenoid is at side of port A

DKZOR-AE-15



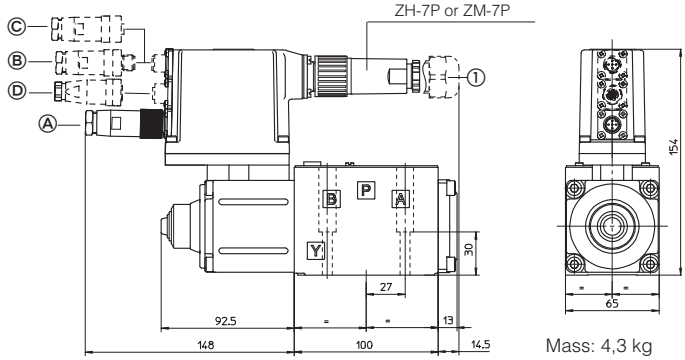
Mass: 4,3 kg

DKZOR-AE-17



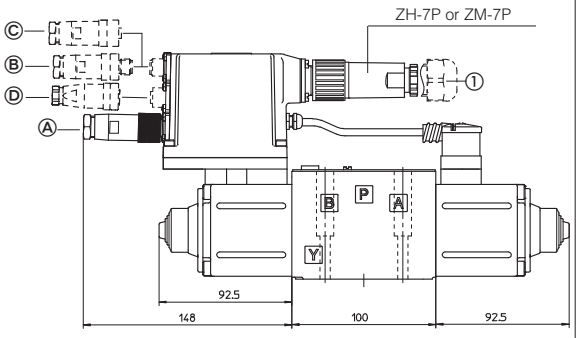
Mass: 5,0 kg

DKZOR-AES-15



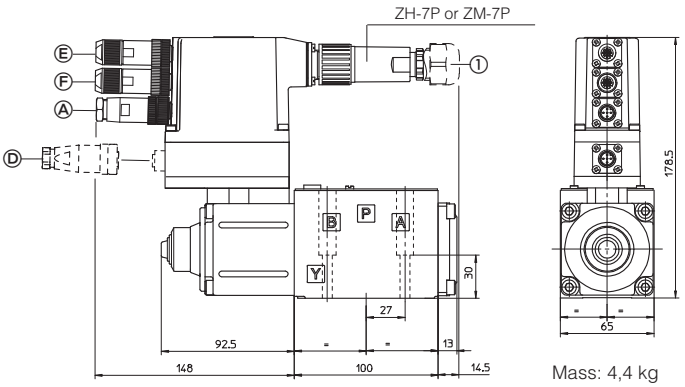
Mass: 4,3 kg

DKZOR-AES-17



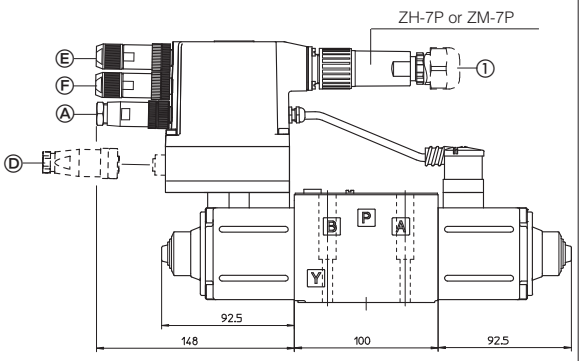
Mass: 5,0 kg

DKZOR-AES-EH-15



Mass: 4,4 kg

DKZOR-AES-EH-17



Mass: 5,1 kg

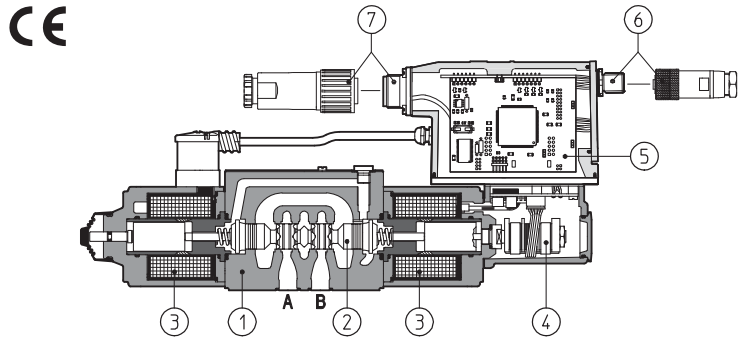
Ⓐ -PS communication interface, ZH-5P connector
Ⓑ -BP communication interface, ZH-5P/BP connector
Ⓒ -BC communication interface, ZH-5P connector
Ⓓ -Option /W pressure transducer interface, ZH-5PM connector
Ⓔ -EH communication interface (input), ZM-4PM/EH connector
Ⓕ -EH communication interface (output), ZM-4PM/EH connector

① dotted line = 12 pin connector ZH-12P for option /Z, /W

Proportional directional valves type DHZO-TES and DKZOR-TES

direct operated, with position transducer, ISO 4401 size 06 and 10

TE and TES executions included in this table are available only for running supplies or spare parts
For new applications it is suggested new TEB and TES executions, see table FS165



DKZOR-TES-PS-171

① Valve body
② Spool
③ Proportional solenoid
④ Position transducer
⑤ Integral electronics
⑥ Communication connector
⑦ Main connector

DHZO-T* and DKZOR-T* are proportional valves, direct operated, with LVDT position transducer, which provide both directional and non-compensated flow control according to the electronic reference signal.
They operate in association with electronic drivers, see section [2], which supply the proportional valves with proper current to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -T, with integral position transducer ④;
- -TE, -TES as -T plus analog (TE) or digital (TES) integral electronics ⑤.

The 4-way spool ②, sliding into a 5-chambers body ①, is directly operated by solenoids ③ and it is controlled in closed loop position by means of the LVDT position transducer ④

The integral electronics ⑤ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.

The electronic main connector ⑦ is fully interchangeable for -TE and -TES executions.

Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.

12 pin connector is used for options /Z and /S*.

The special /S* options add a closed loop control of pressure (/SP) or force (/SF and /SL) to the basic closed loop spool position one.

Following communication interfaces ⑥ are available for the digital -TES execution:
- -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software
- -BC, CANopen interface
- -BP, PROFIBUS DP interface

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

The coils are fully plastic encapsulated (insulation class H) and the valves have antivibration, antishock and weather-proof features.

Mounting surface: ISO 4401 sizes 06 and 10.

Max flow respectively up to 50 l/min and 130 l/min with valve differential pressure Δp = 30 bar, see table [3].

Max pressure = 350 bar for DHZO;
315 bar for DKZOR.

1 MODEL CODE

DHZO - TES - PS - 0 7 1 - S 5 / * / ** / *

DHZO = size 06
DKZOR = size 10

T = with position transducer
TE = as T plus integral analog electronics
TES = as T plus integral digital electronics
TEZ = as TES plus digital axis controller (1)

Communication interfaces (only for TES)
PS = Serial
BC = CANopen
BP = PROFIBUS DP

Valve size
0 = ISO 4401 size 06
1 = ISO 4401 size 10

Configuration, see section [3]
5 = external plus central position, spring centered
7 = 3 position, spring centered

Spool overlapping in central position, see section [3]
0 = zero overlapping (0 to 5 % spool stroke) (2)
1 = P,A,B,T positive overlapping (20% of spool stroke)
2 = P,A,B,T positive overlapping with A-B draining (3)
3 = P positive overlapping (20% of spool stroke); A, B, T, negative

Spool type (regulating characteristics)
L = linear;
S = progressive;
D = differential-progressive (as **S**, but with P-A = Q, P-B = Q/2)
Q = linear spool, for alternate P/Q controls (3)
V = differential-progressive, for alternate P/Q controls (4)

Spool size: **14, 1, 2, 3, 5, 9** = see section [3]

Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FPM

Hydraulic options, see section [4]:
B = solenoid, integral electronics and position transducer at side of port A
Y = external drain

Electronics options, for -TE execution see section [7]:
F = fault signal
I = current reference input and monitor (4÷20 mA)
Q = enable signal
Z = enable, fault and monitor signals (12 pin connector)

Electronics options, for -TES execution see section [9]:
I = current reference input and monitor (4÷20 mA)
Z = double power supply, enable fault and monitor signals (12 pin connector)

Special options for -TES execution see section [9]:
SF = additional closed loop force control, with two remote pressure transducers
SL = additional closed loop force control with one remote load cell
SP = additional closed loop pressure control with one remote pressure transducer
C = current feedback interface for transducer(s) **only for options /SF, /SL, /SP**

Notes: (1) For detailed description of proportional valves with TEZ digital axis controller, see table F230
(2) For zero overlapping spool **0L3**, **0L5**, **0D5**, the valve offset position (with switch-off power supply) is 1 ÷ 6% P-B/A-T
(3) 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.
(4) The spool type **Q** and **V** are specific for alternate P/Q controls and they can be used in combination with option /S* of digital integral drivers (see section 13.1, 14.1 and G212), or digital axis controllers type Z-RI-TEZ (see tab. F230) or Z-ME-KZ (see tab. G340)

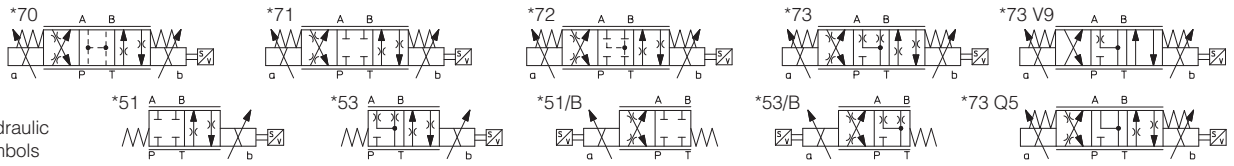
2 ELECTRONIC DRIVERS

Valve model	-T	-TE	-TES	-TES / SF, SL, SP
Drivers model	E-ME-T	E-RI-TE	E-RI-TES	E-RI-TES/SF, SL, SP
Data sheet	G140	G200	G210	G212

Note: For power supply and communication connector see section [16] and [18]

3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols



Valve model	DHZO-T*								DKZOR-T*					
Spool overlapping	1, 3	1, 3	1, 3	1, 3	0	0	1, 3	3	1, 3	0	0	2	1, 3	3
Spool type and size	L14	L1	S2	S3, L3, D3	L3	L5, D5	S5, L5, D5	Q5, V9	S3, L3, D3	L3	L5, D5	S5	S5, L5, D5	Q5, V9
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)					
Max flow (1) [l/min]														
at Δp = 10 bar (P-T)	1	4,5	8	17		28		30	45		75			
at Δp = 30 bar (P-T)	2	8	14	30		50		52	80		130			
at Δp = 70 bar (P-T)	3	12	21	45		74		80	120		170			
Response time (2) [ms]	< 15								< 20					
Hysteresis [%]	≤ 0,2%								≤ 0,2%					
Repeatability [%]	± 0,1%								± 0,1%					
Thermal drift	zero point displacement < 1% at ΔT = 40°C													

Notes:
- For version DHZO-TE and DKZOR-TE, configuration /B, see the notes at sections 13.1 and 14.1
- Above performance data refer to valves coupled with Atos electronic drivers, see sections [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 tab. D150).

(1) For different Δp, the max flow is in accordance to the diagrams in sections 13.2 and 14.2
(2) 0-100% step signal

4 HYDRAULIC OPTIONS

4.1 Option /B Solenoid (for valve configuration *5*), integral electronics and position transducer at side of port A. For version -T and -TE see section 13.1 and 14.1

4.2 Option /Y External drain advisable when the valve is used in double flow path, see section 13.5 and 14.5. Option /Y is mandatary if the pressure in port T exceeds 160 bar.

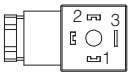
5 GENERAL NOTES

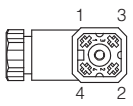
DHZO and DKZOR proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

The electrical signals of the valve (e.g. 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-892).

6 CONNECTIONS FOR -T EXECUTION

SOLENOID POWER SUPPLY CONNECTOR		
PIN	Signal description	
1	SUPPLY	
2	SUPPLY	
3	GND	

POSITION TRANSDUCER CONNECTOR		
PIN	Signal description	
1	OUTPUT SIGNAL	
2	SUPPLY -15 VDC	
3	SUPPLY +15 VDC	
4	GND	

7 ANALOG INTEGRAL DRIVERS -TE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply. Apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10 VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10 VDC nominal range

Following options are available to adapt standard execution to special application requirements:

7.1 Option /F
It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

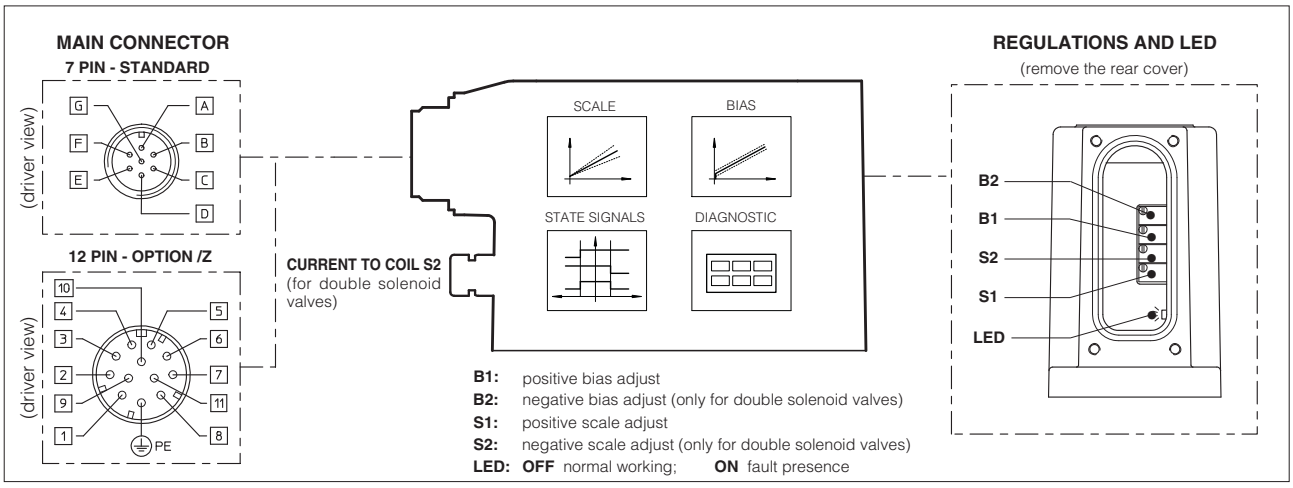
7.2 Option /I
It provides the 4÷20 mA current reference and monitor signals instead of the standard ±10 VDC
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

7.3 Option /Q
It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

7.4 Option /Z
This option includes **/F** and **/Q** features, plus the Monitor output signal.
When the driver is disabled (0 VDC on enable signal) Fault option is forced to 0 VDC.

7.5 Possible combined options: /FI and /IZ

8 ANALOG INTEGRAL DRIVERS -TE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



8.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage and driver logic	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage and driver logic	Gnd - power supply
C (1)	7	AGND	Ground - signal zero for MONITOR signal (for standard, /Z option)	Input - analog signal
	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q and /Z options)	Input - on/off signal
D	4	INPUT+	Reference analog differential input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) For single solenoid valves the reference input is 0÷+10 VDC (4 ÷ 20 mA for /I option) For double solenoid valves the reference input is ±10 VDC (4 ÷ 20 mA for /I option)	Input - analog signal
E	5	INPUT -		
F (2)	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
	11	FAULT	Fault (0V) or normal working (24V) (for /F and /Z options)	Output - on/off signal
-	8	R_ENABLE	Repeat Enable - output repetition of Enable input	Output - on/off signal
-	9	NC	do not connect	Output - on/off signal
-	10	NC	do not connect	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Notes

(1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B

(2) with /F option FAULT signal replaces MONITOR on pin F.

- A minimum time of 50ms to 100ms 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 DIGITAL INTEGRAL DRIVERS -TES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10VDC nominal range

Following options are available to adapt standard execution to special application requirements:

9.1 Option /I

It provides 4÷20 mA current reference and monitor signals instead of the standard ±10 V.

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.

9.2 Option /Z

It provides on the 12 pin main connector the following additional features:

Logic power supply

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).
Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal

To enable the driver, supply 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

9.3 Options /SP, /SF and /SL

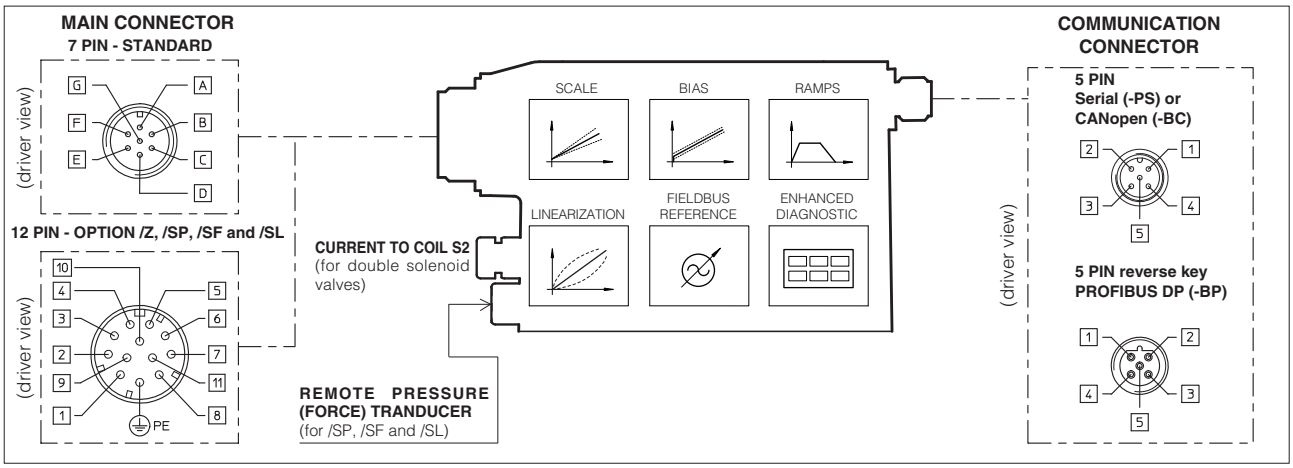
These options add the closed loop control of pressure (/SP) or force (/SF and /SL) to the basic functions of proportional directional valves: a dedicated software alternates pressure (force) and valve's spool position controls depending on the actual hydraulic system conditions.
A dedicated connector is available for the additional transducers that are required to be interfaced to the valve's driver (1 pressure transducer for /SP, 2 pressure transducers for /SF or 1 load cell for /SL).
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control: one for reference (pin 7) and one for monitor (pin 8).
For futher details please refer to the driver technical table **G212.**

9.4 Options /C

Options /CSP, /CSF and /CSL are available to connect pressure (force) transducers with 4 ÷ 20mA current output signal.

9.5 Possible combined options: /ISP, /ISF, /ISL, /CSP, /CSF, /CSL, /CISP, /CISF, /CISL and /IZ

10 DIGITAL INTEGRAL DRIVERS -TES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



10.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
-	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) For single solenoid valves the reference input is 0÷+10 VDC (4 ÷ 20 mA for /I option) For double solenoid valves the reference input is ±10 VDC (4 ÷ 20 mA for /I option) standard: differential input; /Z option: common mode INPUT+ referred to AGND	Input - analog signal
E	-	INPUT -		
C	5	AGND	Ground - signal zero for MONITOR signal signal zero for INPUT+ signal (only for /Z option)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
-	7	NC	do not connect (pressure/force input for /SP, /SF and /SL options, see 9.3)	
-	8	NC	do not connect (pressure/force monitor for /SP, /SF and /SL options, see 9.3)	
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0V) or normal working (24V)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 300 to 500 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.

10.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION CONNECTORS

	-PS Serial		-BC CANopen		-BP PROFIBUS DP	
PIN	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	

11 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the Atos E-SW programming software, available in three different versions according to the driver's communication execution: **E-SW-PS** (Serial), **E-SW-BC** (CANopen) and **E-SW-BP** (PROFIBUS DP).

For a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table **G500**.

Programming software, must be ordered separately:

E-SW-* (mandatory - first supply) = Dvd including E-SW-* software installer and operator manuals; it allows the registration to Atos digital service

E-SW-*-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com.
Once the registration is completed, the password will be sent by email.

The software remains active for 10 days from the installation date and then it stops until the user inputs his password.

With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

12 MAIN CHARACTERISTICS OF PROPORTIONAL DIRECTIONAL VALVES

Assembly position	Any position	
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)	
Ambient temperature	-20°C ÷ +70°C for -T execution; -20°C ÷ +60°C for -TE and TES executions	
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1	
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)	
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 µm ($\beta_{10} \geq 75$ recommended)	
Fluid temperature	-20°C +60°C (standard seals and water glycol) -20°C +80°C (/PE seals)	
Valve model	**DHZO-T***	**DKZOR-T***
Coil resistance R at 20°C	3 ÷ 3,3 Ω	3,8 ÷ 4,1 Ω
Max. solenoid current	2,6 A	3 A
Max. power	35 Watt	40 Watt
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 (CEI EN-60529)	IP65 for -T execution; IP67 for -TE and -TES executions	
Duty factor	Continuous rating (ED=100%)	

13 DIAGRAMS FOR DHZO (based on mineral oil ISO VG 46 at 50 °C)

13.1 Regulation diagrams

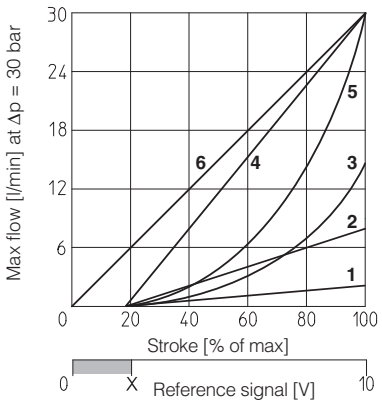
1 = linear spool L14
2 = linear spool L1
3 = progressive spool S2
4 = linear spool L3
5 = progressive spool S3, D3
6 = linear spool, zero overlapping 0L3
7 = linear spool L5
8 = linear spool, zero overlapping 0L5
9 = progressive spool S5, D5
10= progressive spool, zero overlapping 0D5

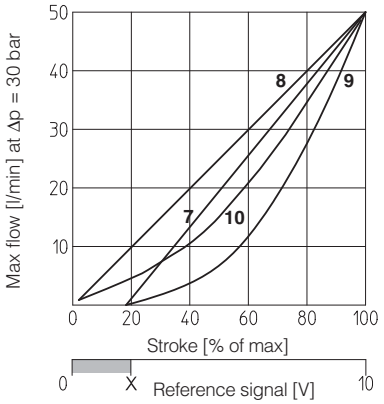
Note:
Hydraulic configuration vs. reference signal for double solenoid valves (also for option /B)

Reference signal 0 ÷ +10 V / 12 ÷ 20 mA P → A / B → T
Reference signal 0 ÷ -10 V / 4 ÷ 12 mA P → B / A → T

Hydraulic configuration vs. reference signal for mono solenoid valves **option /B**

Reference signal 0 ÷ +10 V / 12 ÷ 20 mA P → B / A → T

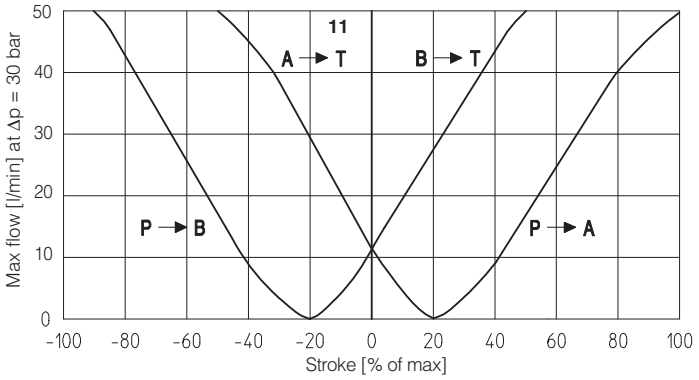




X = Threshold for bias activation depending to the valve type and amplifier type

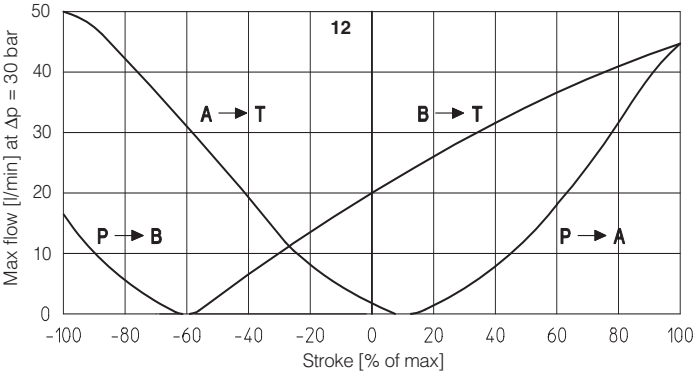
11 = linear spool Q5

Q5 spool type is specific for alternate P/Q controls and it can be used in combination with /S* option of digital integral drivers, see tab. G212, or digital position controllers type Z-RI-TEZ (see tab. G330) or Z-ME-KZ (see tab. G340).
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.



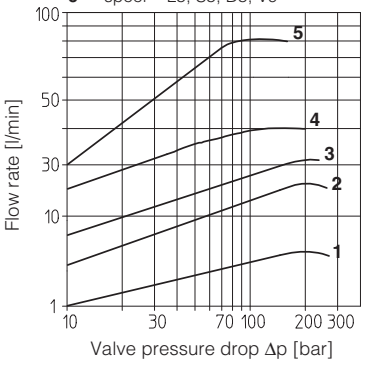
12 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls and it can be used in combination with /S* option of digital integral drivers, see tab. G212, or digital position controllers type Z-RI-TEZ (see tab. G330) or Z-ME-KZ (see tab. G340).
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



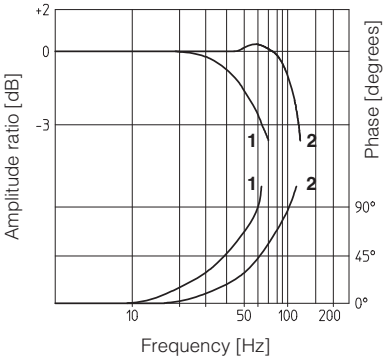
13.2 Flow /Δp diagrams

stated at 100% of valve stroke
1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9



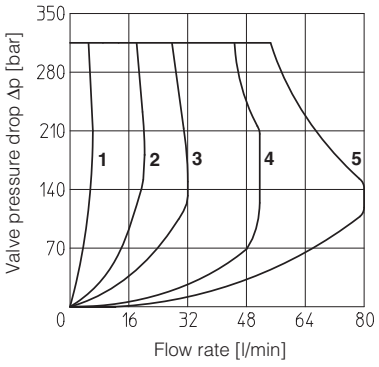
13.3 Bode diagrams

1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke



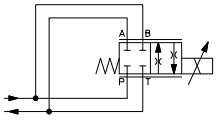
13.4 Operating limits

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9



13.5 Operation as throttle valve

Single solenoid valves (DHZO-*-051) can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



	SPOOL TYPE						
	L14	**L1**	**S2**	**L3**	**S3**	**L5**	**S5**
Max flow Δp= 70bar [l/min]	6	20	40	80		100	

13.6 Dynamic response

The response times in section 3 and the frequency responses in the bode diagrams 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.

14 DIAGRAMS FOR DKZOR (based on mineral oil ISO VG 46 at 50 °C)

14.1 Regulation diagrams

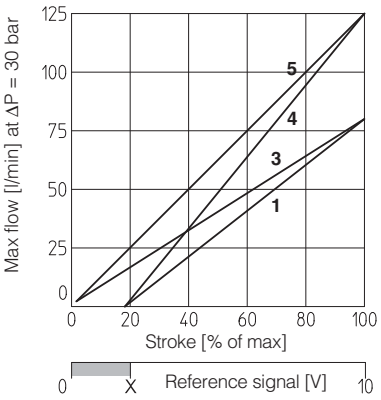
1 = linear spool L3
2 = progressive spool S3, D3
3 = linear spool, zero overlapping 0L3
4 = linear spool L5
5 = linear spool, zero overlapping 0L5
6 = progressive spool S5, D5
7 = progressive spool, zero overlapping 0D5

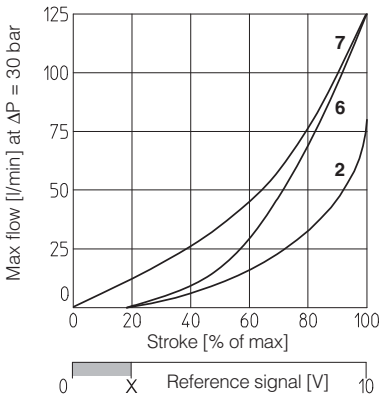
Note:
Hydraulic configuration vs. reference signal for double solenoid valves (also for option /B)

Reference signal	0 ÷ +10 V 12 ÷ 20 mA	P → A / B → T
Reference signal	0 ÷ -10 V 4 ÷ 12 mA	P → B / A → T

Hydraulic configuration vs. reference signal for mono solenoid valves option /B

Reference signal	0 ÷ +10 V 12 ÷ 20 mA	P → B / A → T

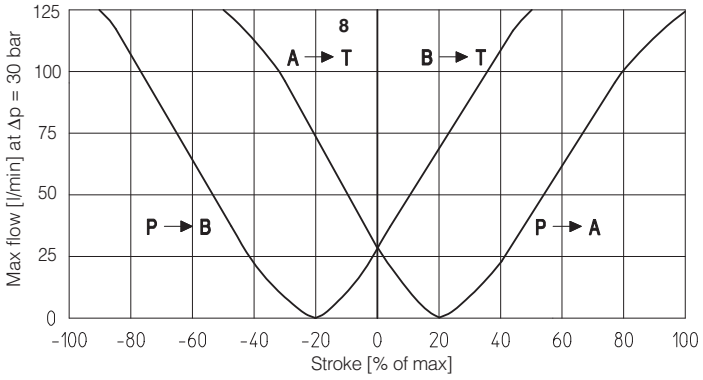




X = Threshold for bias activation depending to the valve type and amplifier type

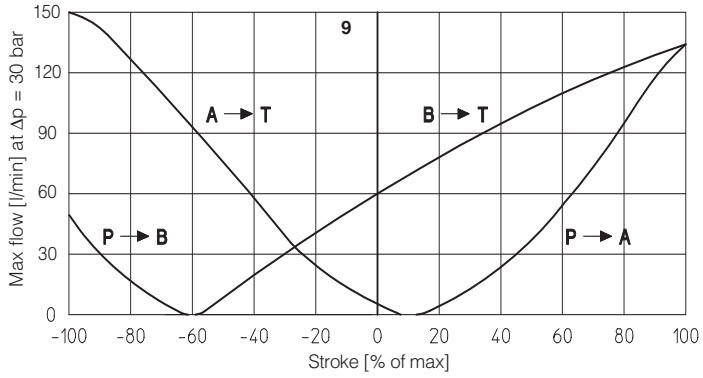
8 = linear spool Q5

Q5 spool type is specific for alternate P/Q controls and it can be used in combination with /S* option of digital integral drivers, see tab. G212, or digital position controllers type Z-RI-TEZ (see tab. G330) or Z-ME-KZ (see tab. G340).
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.



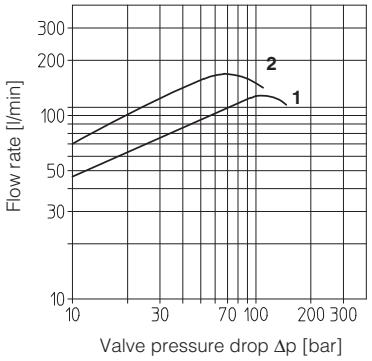
9 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls and it can be used in combination with /S* option of digital integral drivers, see tab. G212, or digital position controllers type Z-RI-TEZ (see tab. G330) or Z-ME-KZ (see tab. G340).
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



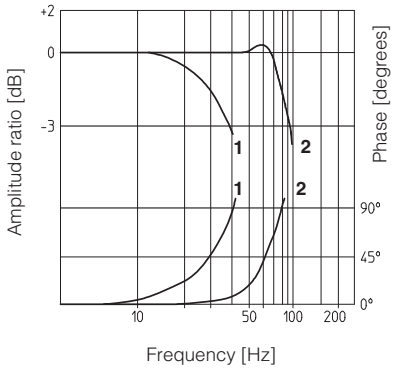
14.2 Flow /Δp diagrams

stated at 100% of valve stroke
1 = spool S3, L3, D3
2 = spool S5, L5, D5, V9



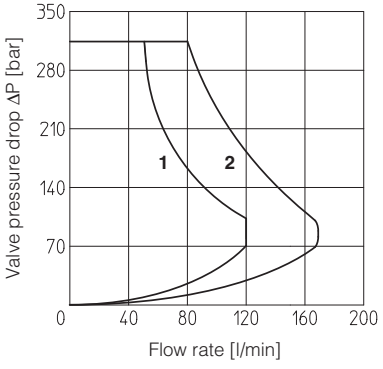
14.3 Bode diagrams

1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke



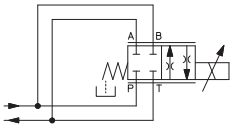
14.4 Operating limits

1 = spool L3, S3, D3
2 = spool L5, S5, D5, V9



14.5 Operation as throttle valve

Single solenoid valves (DKZOR-*-151) can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



	SPOOL TYPE			
	L3	**S3**	**L5**	**S5**
Max flow Δp= 30 bar [l/min]	150		250	

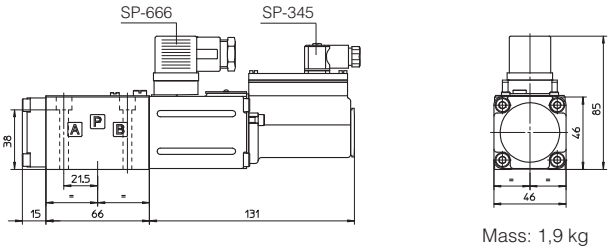
14.6 Dynamic response

The response times in section 3 and frequency responses in the bode diagrams 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.

15 INSTALLATION DIMENSIONS FOR DHZO [mm]

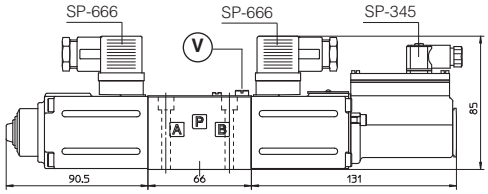
ISO 4401: 2000
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108; 1 OR 2025
Diameter of ports A, B, P, T: Ø 7,5 mm (max)
Diameter of port Y: Ø = 3,2 mm (only for /Y option)

DHZO-T-05



Mass: 1,9 kg

DHZO-T-07



Mass: 2,6 kg

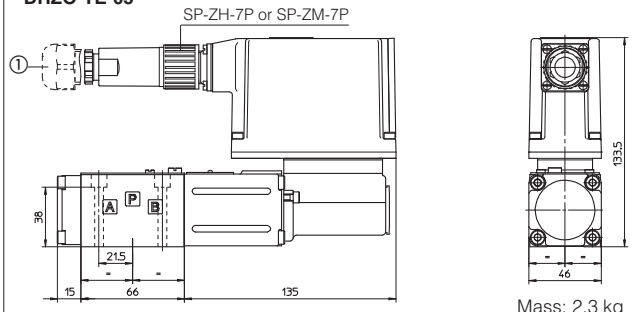
Note: for option /B the solenoid and the position transducer are at side of port A

(V) = Air bleed off

-TE EXECUTION

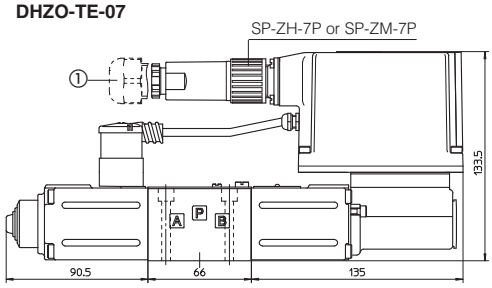
① Dotted line =12 pin connector SP-ZH-12P for option /Z

DHZO-TE-05



Mass: 2,3 kg

DHZO-TE-07

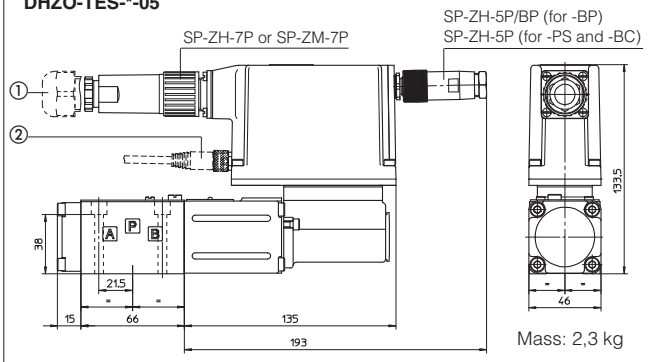


Mass: 3,1 kg

-TES EXECUTION

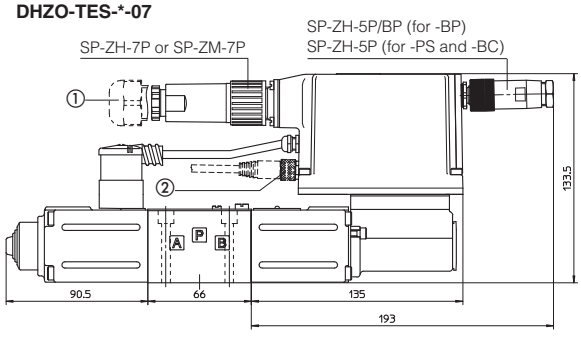
① Dotted line =12 pin connector SP-ZH-12P for options /SF, /SL, /SP, /Z
② Dotted line = M8 connector SP-ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector SP-ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

DHZO-TES-*-05



Mass: 2,3 kg

DHZO-TES-*-07



Mass: 3,1 kg

Note: for option /B the solenoid, the position transducer and the integral electronics are at side of port A

16 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

VALVE VERSION	-T		-TE, -TES		-TE /Z -TES /Z, /SF, /SL, /SP	serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)	TES /SF, /SL, /SP (transducer)
	Power supply	Transducer						
CONNECTOR CODE	SP-666	SP-345	SP-ZH-7P	SP-ZM-7P	SP-ZH-12P	SP-ZH-5P	SP-ZH-5P/BP	SP-ZH-4P-M8/* (1)
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500		G200, G210, K500			G210, K500		G212, K500

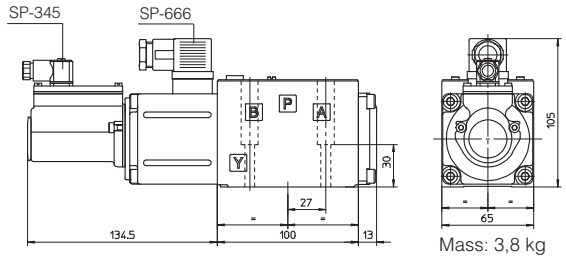
(1) M8 connector SP-ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector SP-ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

connectors supplied with the valve

17 INSTALLATION DIMENSIONS FOR DKZOR [mm]

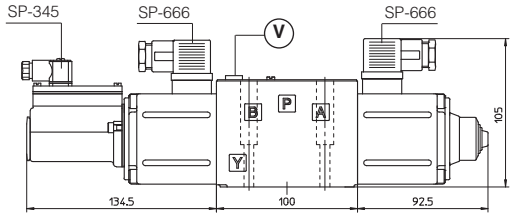
ISO 4401: 2000
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 1 OR 108
Diameter of ports A, B, P, T: Ø 11,2 mm (max)
Diameter of port Y: Ø = 5 mm (only for /Y option)

DKZOR-T-15



Mass: 3,8 kg

DKZOR-T-17



Mass: 4,5 kg

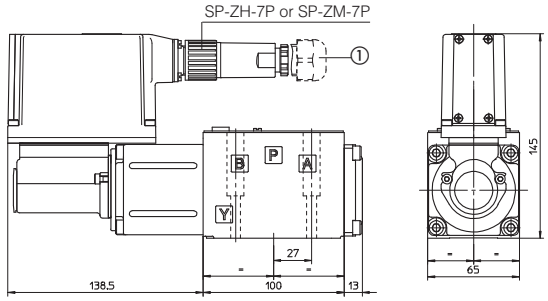
Note: for option /B the solenoid and the position transducer are at side of port A

(V) = Air bleed off

-TE EXECUTION

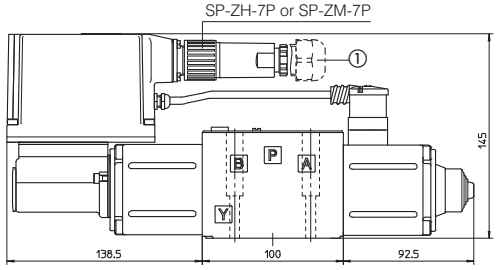
① Dotted line =12 poles connector SP-ZH-12P for option /Z

DKZOR-TE-15



Mass: 4,3 kg

DKZOR-TE-17

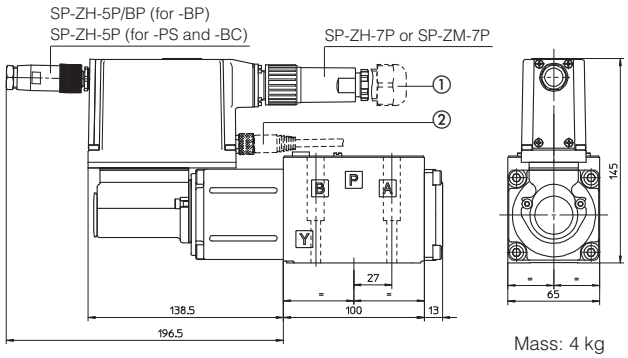


Mass: 5,0 kg

-TES EXECUTION

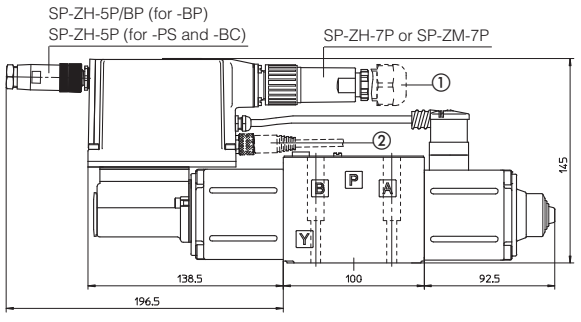
① Dotted line =12 pin connector SP-ZH-12P for options /SF, /SL, /SP, /Z
② Dotted line = M8 connector SP-ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector SP-ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

DKZOR-TES-*-15



Mass: 4 kg

DKZOR-TES-*-17



Mass: 4,7 kg

Note: for option /B the solenoid, the position transducer and the integral electronics are at side of port A

18 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

VALVE VERSION	-T		-TE, -TES		-TE /Z -TES /Z, /SF, /SL, /SP	serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)	TES /SF, /SL, /SP (transducer)
	Power supply	Transducer						
CONNECTOR CODE	SP-666	SP-345	SP-ZH-7P	SP-ZM-7P	SP-ZH-12P	SP-ZH-5P	SP-ZH-5P/BP	SP-ZH-4P-M8/* (1)
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500		G200, G210, K500			G210, K500		G212, K500

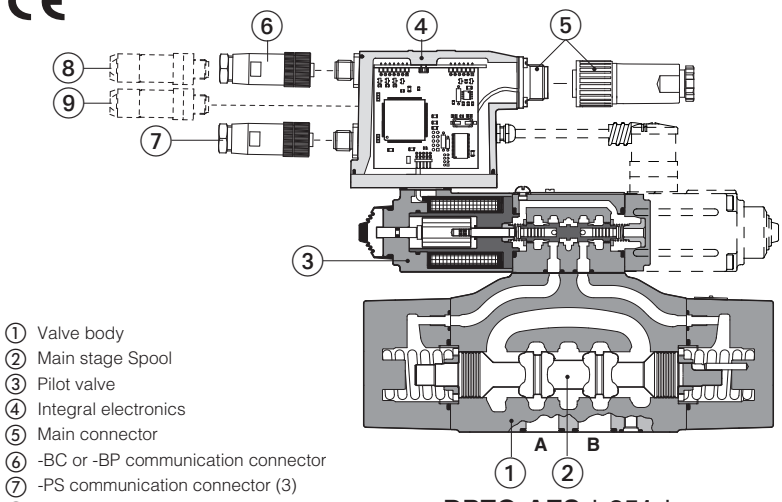
(1) M8 connector SP-ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector SP-ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

connectors supplied with the valve

Proportional directional valves type DPZO-AES

two stage without position transducer, ISO 4401 sizes 10, 16, 25 and 32

AES execution included in this table is available only for running supplies or spare parts
For new applications it is suggested new AEB and AES executions, see table FS170



① Valve body
② Main stage Spool
③ Pilot valve
④ Integral electronics
⑤ Main connector
⑥ -BC or -BP communication connector
⑦ -PS communication connector (3)
⑧ -EH Communication connector (input)
⑨ -EH Communication connector (output)

DPZO-AES-*-251-*
DPZO-AES-*-271-* (dotted line)

DPZO-A* are two stage proportional valves without position transducer, which provide both directional and non compensated flow control according to the electronic reference signal.

They operate in association with electronic drivers, see section 2, which supply the proportional valves with correct current signal to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -A, without position transducer;
- -AE, -AES as -A plus analogue (AE) or digital (AES) integral electronics ④;

The 4-way spool ②, sliding into a 5-chambers body ①, is piloted in open loop by the proportional pressure reducing valve ③ type DHRZO.

The integral electronics ④ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.

The electronic main connector ⑤ is fully interchangeable for -AE and -AES executions.

Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.

12 pin connector is used for options /Z, /W (AES).

Following communication interfaces ⑥, ⑦ are available for the digital -AES execution:
- standard -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software - always present, also for -BC, -BP and -EH options
- optional -BC, CANopen interface
- optional -BP, PROFIBUS DP interface
- -EH, EtherCAT interface

The valves with -BC, -BP and -EH interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

Surface mounting: **ISO 4401**
Size **10, 16, 25** and **32**.

Max flow respectively up to:
160 l/min, **430 l/min**, **720 l/min** and **1000 l/min** with valve differential pressure Δp = 30 bar, see section 3.

Max pressure: **350 bar**

1 MODEL CODE

DPZO - AES- PS - 2 7 1 - D 5 / * * * /*

Piloted proportional directional valve

A = without position transducer
AE = as A plus integral electronics
AES = as A plus integral digital electronics

Communication interfaces only for AES **(1)**
PS = USB
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration, see section 3:
5 = external plus central position, spring centered
7 = 3 positions; spring centered

Spool overlapping in central position, see sect. 3:
1 = P, A, B, T positive overlapping **(2)**
3 = P positive overlapping A, B, T negative overlapping

Spool type
L = linear
S = progressive
D = as **S**, but with P-A = Q, P-B = Q/2

Spool size: **3** and **5**, see section 3

Seals material, see section 4:
- = NBR
PE = FKM
BT = HNBR (only **-A**)

Series number

Coil voltage (only for -A execution)
see section 8:
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

Hydraulic options, see sect. 6:
B = solenoid and integral electronics at side of port B of the main stage (side A of pilot valve);
D = internal drain
E = external pilot
G = pressure reducing valve for piloting

Electronics options for -AE execution, see section 10:
I = current reference input (4÷20 mA)
Q = enable signal

Electronics options for -AES execution, see section 12:
Q = enable signal
Z = double power supply, enable fault and monitor (12 pin connector)
W = power limitation function (12 pin connector) see sect. 11.3

Notes:
(1) USB interface always present, also for -BC and -BP and -EH options
(2) Overlapping = 20% of spool stroke for type **S** and **D**, 10% of spool stroke for type **L**

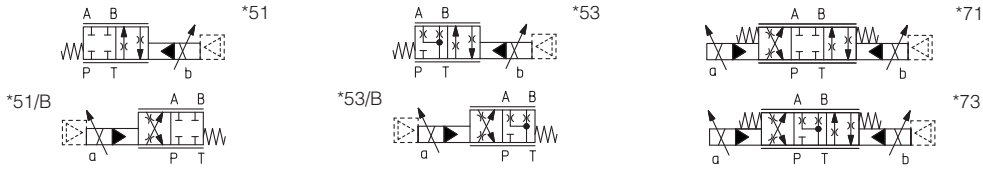
2 ELECTRONIC DRIVERS FOR DPZO-A*

Valve model	-A						-AE	-AES
Drivers model	E-MI-AC-0*F	E-MI-AS-IR	E-BM-AC-0*F	E-BM-AS-PS	E-ME-AC-0*F	E-RP-AC-0*F	E-RI-AE	E-RI-AES
Data sheet	G010	G020	G025	G030	G035	G100	G110	G115

Note: for main and communication connector see section 14

3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols

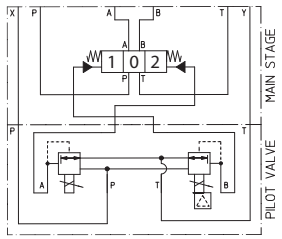


Valve model	DPZO-1			DPZO-2					DPZO-4			DPZO-6		
Spool overlapping	1, 3			1, 3					1, 3			1, 3		
Spool type and size	L5	S5	D5	S3	D3	L5	S5	D5	L5	S5	D5	L5	S5	D5
Max flow (1) [l/min]														
at Δp = 10 bar (P-T)	100	100	100:60	160	160:98	250	225	225:160	420	400	400:245	600	600	600:370
at Δp = 30 bar (P-T)	160	160	160:100	270	270:160	430	390	390:280	720	690	690:420	1000	1000	1000:620
max permissible flow	180	180	180:110	400	400:245	550	550	550:390	900	900	900:550	1600	1600	1600:990
Pressure limits (2) [bar]	ports P, A, B, X = 350; T = 250 (5 for option /D); Y = 5													
Response time [ms] (3)	< 80			< 100					< 120			< 180		
Hysteresis [%]	≤ 5%													
Repeatability	± 1%													

Notes:
- For version DPZO-A and DPZO-AE, configuration /B, see the notes at section 6.1
- Above performance data refer to valves coupled with Atos electronic drivers, see section 2.
- In case of long time shutdown of the hydraulic supply to the pilot valve, the driver has to be switched off to avoid its overheating.
- 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 tab. D150).

(1) For different Δp, the max flow is in accordance to the diagrams in section 13.2
(2) Minimum piloting pressure = 30 bar
(3) 0-100% step signal

FUNCTIONAL SCHEME
example of configuration 7
(3 positions, spring centered)



4 MAIN CHARACTERISTICS

Assembly position	Any position		
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)		
MTTFd valves according to EN ISO 13849	75 years, for further details, see technical table P007		
Ambient temperature	-A execution = -20°C ÷ +70°C (storage -20°C ÷ +80°C) /BT option -40°C ÷ +60°C (storage -40°C ÷ +70°C) -AE execution = -20°C ÷ +60°C (storage -20°C ÷ +70°C) -AES execution = -20°C ÷ +60°C (storage -20°C ÷ +70°C)		
Fluid	Hydraulic mineral oil HL, HLP as per DIN 51524		
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 ($\beta_{10} \geq 75$ recommended)		
Fluid temperature	-20°C +60°C (standard seals) -20°C +80°C (/PE option) -40°C +60°C (/BT option)		
Coil code	Standard	Option /6	Option /18
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Max. solenoid current	1,9 A	2,35 A	0,9 A
Max. power	-A execution = 35 Watt -AE and -AES executions = 50 Watt		
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 execution = IP65 -AE, and -AES executions = IP67		
Duty factor	Continuous rating (ED=100%)		

5 GENERAL NOTES

DPZO-A* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

The electrical signals of the valve (e.g. 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).

6 HYDRAULIC OPTIONS

6.1 Option /B DPZO-*-*5 = solenoid and integral electronics at side of port B of the main stage.
DPZO-*-*7 = integral electronics at side of port B of the main stage.
For hydraulic configuration vs. reference signal, see section 13.1

6.2 Pilot and drain configuration -The pilot / drain configuration can be modified as shown in the table E085 section 12.
The valve's standard configuration provides internal pilot and external drain. For different pilot / drain configuration select:

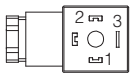
Option /E External pilot (through port X).

Option /D Internal drain.

Option /G Pressure reducing valve with fixed setting (= 40 bar for DPZO-1 and -2; 100 bar for DPZO-4 and -6) installed between pilot valve and main body.
It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.

7 CONNECTIONS FOR -A EXECUTION

SOLENOID POWER SUPPLY CONNECTOR	
PIN	Signal description
1	SUPPLY
2	SUPPLY
3	GND

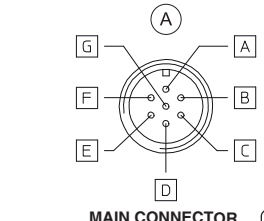


8 OPTIONS FOR -A EXECUTION

Option /6 optional coil to be used with Atos drivers with power supply 12 VDC

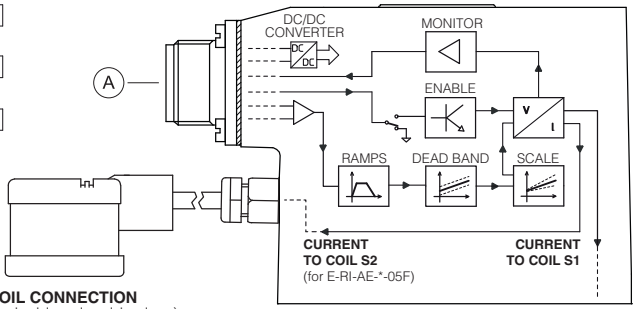
Option /18 optional coil to be used with electronic drivers not supplied by Atos

9 ANALOG INTEGRAL DRIVER -AE -ELECTRONIC CONNECTIONS AND SETTINGS

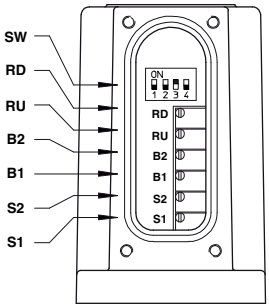


MAIN CONNECTOR
(male)

Note:
Connector front view



COIL CONNECTION
(only for double solenoid valves)



SETTINGS
remove the rear cover

Selector SW				Dither frequency [Hz]
SW1	SW2	SW3	SW4	
OFF	OFF	OFF	OFF	100
ON	OFF	OFF	OFF	130
OFF	ON	OFF	OFF	160
OFF	OFF	ON	OFF	**200** (*)
ON	OFF	ON	OFF	230
OFF	ON	ON	OFF	270
ON	ON	ON	OFF	300
ON	ON	OFF	ON	380
ON	OFF	ON	ON	430
OFF	ON	ON	ON	470
ON	ON	ON	ON	500

B1: positive bias adjust
B2: negative bias adjust (only for double solenoid valves)
S1: positive scale adjust
S2: negative scale adjust (only for double solenoid valves)
RU: ramp for increasing reference signal
RD: ramp for decreasing reference signal
SW: dither frequency selector (see table beside)

(*) Dither frequency is factory preset at 200 Hz and its regulation may be adjusted after contact Atos technical office.

9.1 MAIN CONNECTOR - 7 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	V+	Power supply 24 VDC for solenoid power stage and driver logic	Input - power supply
B	V0	Power supply 0 VDC for solenoid power stage and driver logic	Gnd - power supply
C	AGND	Ground - signal zero for MONITOR signal	Gnd - analog signal
	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q option) With /Q option:ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B	Input - on/off signal
D	INPUT+	Reference analog differential input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) For single solenoid valves the reference input is 0 ÷ 10 VDC (4 ÷ 20 mA for /I option)	Input - analog signal
E	INPUT -	For double solenoid valves the reference input is ±10 VDC (4 ÷ 20 mA for /I option)	
F	MONITOR	Monitor analog output: ±5 VDC maximum range (1V monitor = 1A coil current) For single solenoid valves: 0 ÷ 5 VDC referred to pin C (for /I option) 0 ÷ 5 VDC referred to pin B (for /Q option) For double solenoid valves: ±5 VDC referred to pin C (for /I option) ±5 VDC referred to pin B (for /Q option)	Output - analog signal
G	EARTH	Internally connected to the driver housing	

- A minimum time of 60ms to 160ms 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 ANALOG INTEGRAL DRIVERS -AE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10 VDC nominal range (pin D,E), proportional to desired coil current.

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Following options are available to adapt standard execution to special application requirements:

10.1 Option /I

It provides the 4÷20 mA current reference signal instead of the standard ±10 VDC. Monitor output signal is still the standard ±10 VDC.
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.

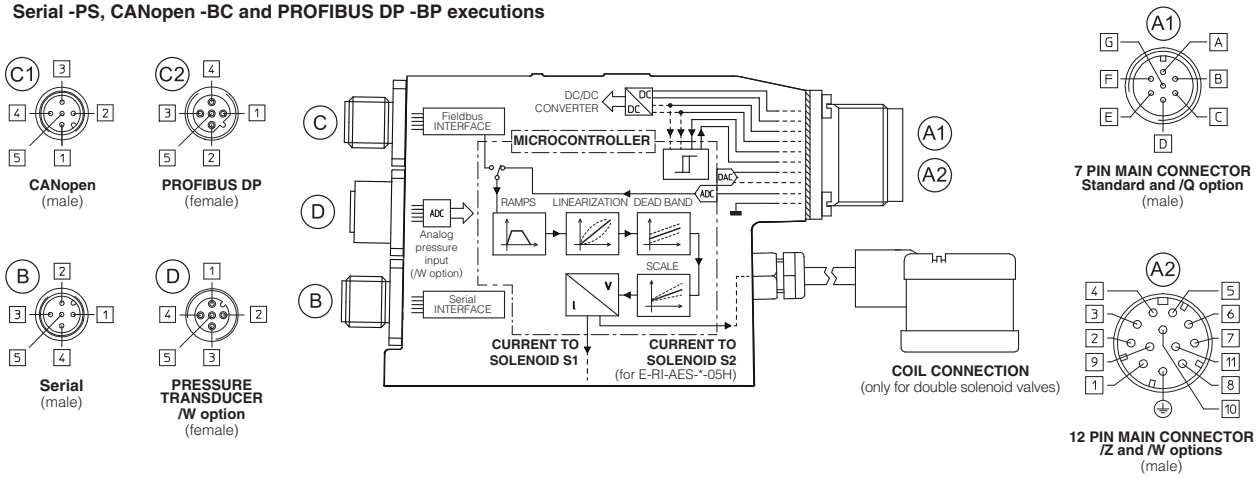
10.2 Option /Q

It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

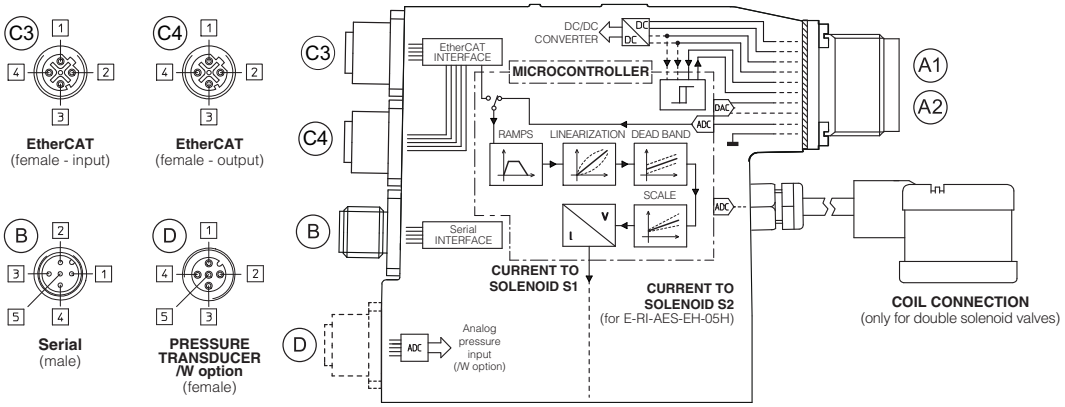
10.3 Possible combined options: /IQ

11 CONNECTIONS

Serial -PS, CANopen -BC and PROFIBUS DP -BP executions



EtherCAT -EH execution



Note: Connectors front view

11.1 Main connector - 7 pin - Standard and /Q option (A1)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	V+	Power supply 24 VDC for solenoid power stage	Input - power supply
B	V0	Power supply 0 VDC for solenoid power stage	Gnd - power supply
C	AGND	Ground - signal zero for MONITOR signal (applying 24 VDC to AGND electronics will damaged)	Gnd - analog signal
	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q option)	Input - on/off signal
D	INPUT+	Reference analog differential input: ±10 VDC / ± 20 mA maximum range software selectable (see 4.2) - default settings are 0 ÷ 10 VDC for directional valves 2 positions, pressure or flow controls and ±10 VDC for directional valves 3 positions	Input - analog signal
E	INPUT -		
F	MONITOR	Monitor analog output: ±5 VDC maximum range	Output - analog signal
G	EARTH	Internally connected to driver housing	

11.2 Main connector - 12 pin - /Z and /W options (A2)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 VDC for solenoid power stage	Input - power supply
2	V0	Power supply 0 VDC for solenoid power stage	Gnd - power supply
3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
4	INPUT+	Reference analog input: ±10 VDC / ± 20 mA maximum range software selectable	Input - analog signal
5	AGND	Ground - signal zero for INPUT+ signal	Gnd - analog signal
6	MONITOR	Monitor analog output: ±5 VDC maximum range	Output - analog signal
7	NC	do not connect	
8	NC	do not connect (for /Z option)	
	MONITOR2	2nd monitor analog output: ±5 VDC maximum range (for /W option)	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	Driver status : Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: A minimum time of 270 to 340 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.

11.3 COMMUNICATION CONNECTORS (B) (C)

(B)		-PS serial execution - M12 - 5 pin (1)
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (2)
1	NC	do not connect
2	NC	do not connect
3	RS_GND	Signal zero data line
4	RS_RX	Valves receiving data line
5	RS_TX	Valves transmitting data line

(C1)		-BC fieldbus execution - M12 - 5 pin
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (2)
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 - M12 - 5 pin
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (2)
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 - M12 - 4 pin
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (2)
1	TX+	Transmitter
2	RX+	Receiver
3	TX	Transmitter
4	RX-	Receiver
Housing	SHIELD	

Note: (1) USB communication not insulated
(2) Shield connection on connector's housing is recommended

11.4 PRESSURE TRANSDUCER CONNECTOR - M12 - 5 pin (only for /W option) (D)

	Voltage Input (*)		**Current Input** (*)	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	VT	Remote transducer power supply 24 VDC	VT	Remote transducer power supply 24 VDC
2	TR	Remote transducer signal (0 ÷ 10 VDC) - see 4.7	TR	Remote transducer signal (0 ÷ 20 mA) - see 4.7
3	AGND	Signal zero for power supply and signal	NC	do not connect
4	NC	do not connect	NC	do not connect
5	NC	do not connect	NC	do not connect

(*) Note: Analog input range is software selectable

12 DIGITAL INTEGRAL DRIVERS -AES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired coil current (4÷20 mA with cable break detection, ±10 mA, ±20 mA or 0÷20 mA software selectable)

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Following options are available to adapt standard execution to special application requirements:

12.1 Option /Q - To enable the driver, supply 24Vdc on pin C referred to pin B: when the enable signal is set to zero the valve status is software selectable, by factory default the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active. For the complete list of selectable status, see tab. G115.

12.2 Option /Z - It provides, on the 12 pin main connector, the following additional features:

Logic power supply
Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).
Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal
To enable the driver, supply 24Vdc on pin 3 referred to pin 2: when the enable signal is set to zero the valve status is software selectable, by factory default the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active. For the complete list of selectable status, see tab. G115.

Fault Output Signal
Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

12.3 Option /W - only for valves coupled with pressure compensator type HC-011 or KC-011 (see tab. D150).
It provides, on the 12 pin main connector, the above option /Z features plus the hydraulic power limitation function.
The driver receives the flow reference signal by the analog external input INPUT+ and a pressure transducer remotely 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:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}}\text{; Flow Reference [INPUT+]}\right)$$

For detailed information on hydraulic power limitation, see tab. G115

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

13.1 Regulation diagrams

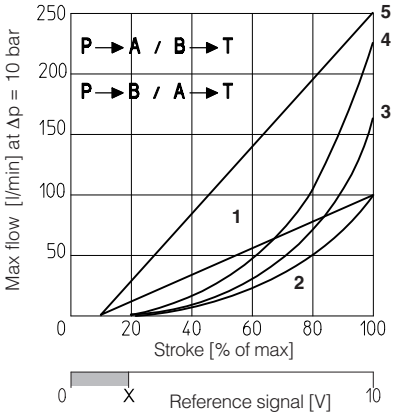
DPZO-1:
1 = linear spool L5
2 = differential spool S5, D5

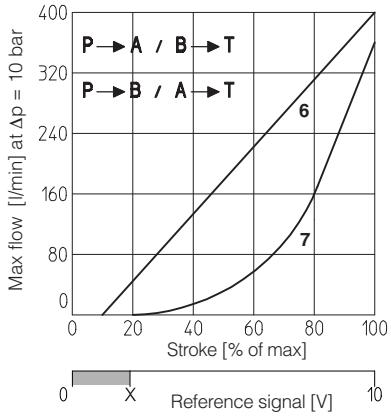
DPZO-2:
3 = progressive spool S3, D3
4 = progressive spool S5, D5
5 = linear spool L5

DPZO-3:
6 = linear spool L5
7 = progressive spool S5, D5

DPZO-4:
8 = linear spool L5
9 = progressive spool S5, D5

DPZO-6:
10=linear spool L5
11=progressive spool S5, D5





Note:
Hydraulic configuration vs reference signal for:
- double solenoid valves (standard and option /B)

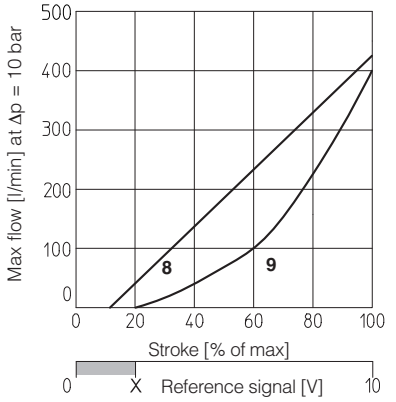
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

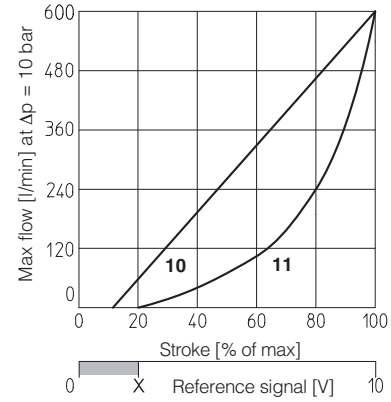
Reference signal 0 ÷ -10 V / 4 ÷ 12 mA } P → B / A → T

Hydraulic configuration vs reference signal for single solenoid valves:

Reference signal:
0 ÷ +10 V / 4 ÷ 20 mA } P → A / B → T (standard)
P → B / A → T (option /B)

X = Threshold for bias activation depending to the valve type and amplifier type





13.2 Flow /Δp diagram

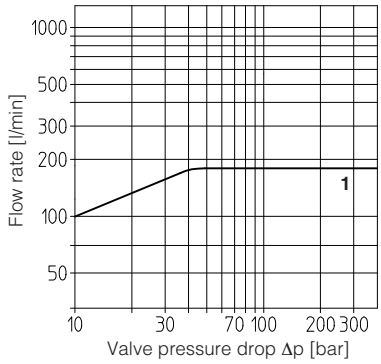
Stated at 100% of valve stroke

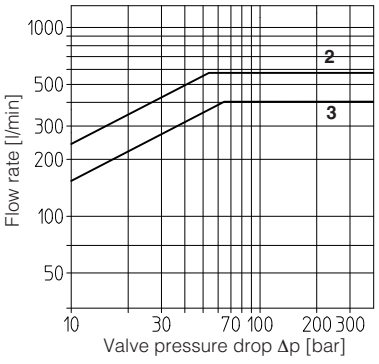
DPZO-1:
1 = spool L5, S5, D5

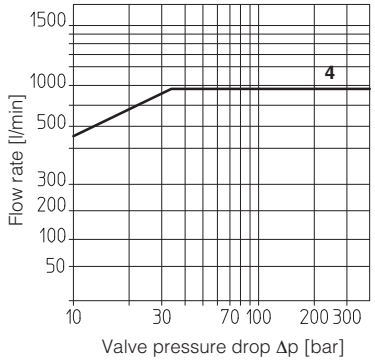
DPZO-2:
2 = spool L5, S5, D5
3 = spool S3, D3

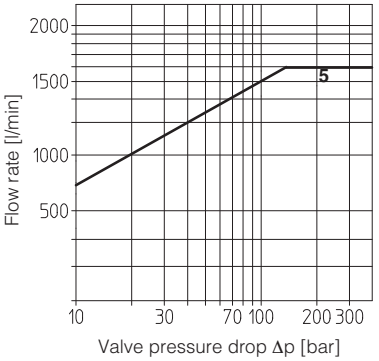
DPZO-4:
4 = spool L5, S5, D5

DPZO-6:
5 = spool L5, S5, D5



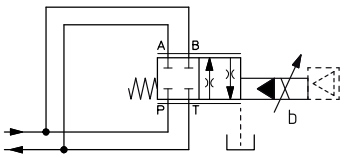






13.3 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar
For this application, the use of valve -T, -TE or -TES (see tab. F172 and F175) is advisable (consult our technical office)



DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min]	320	850	1400	2000
Δp [bar]	30	30	30	30

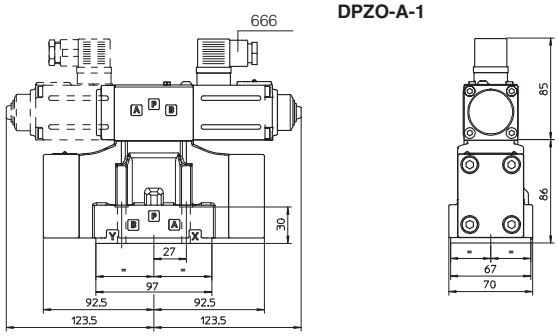
DPZO-A(*)-1 (dotted line = double solenoid version)

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
Seals: 5 OR 2050; 2 OR 108
Diameter of ports A, B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;

Mass [kg]

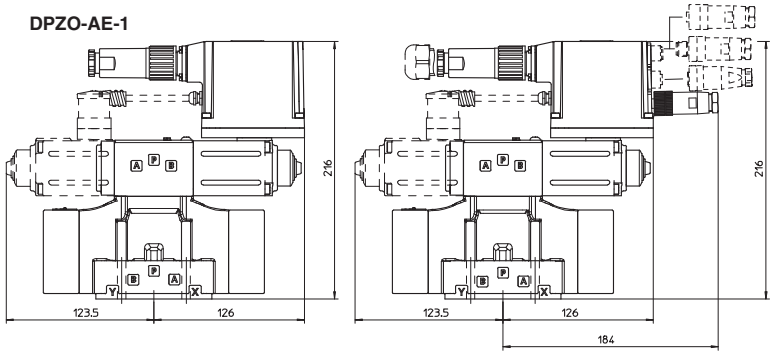
	A	AE, AES, AEG, AEZ	AES-EH
DPZO-*-15*	7,7	8,1	8,2
DPZO-*-17*	8,6	9	9,1

DPZO-A-1

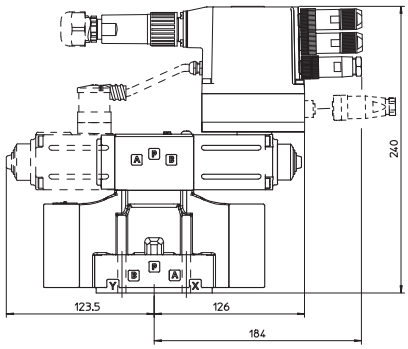


DPZO-AES-1

DPZO-AE-1



DPZO-AES-EH-1



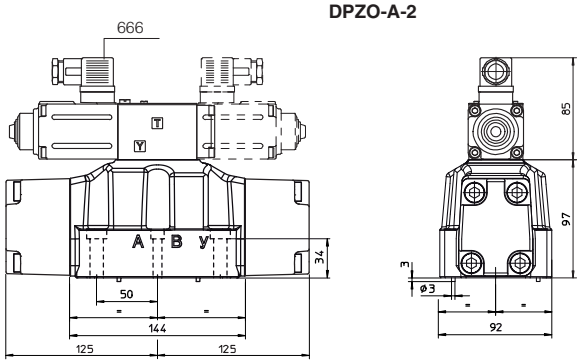
DPZO-A(*)-2 (dotted line = double solenoid version)

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 M6x45 class 12.9
Tightening torque = 15 Nm
Seals: 4 OR 130; 3 OR 109/70
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;

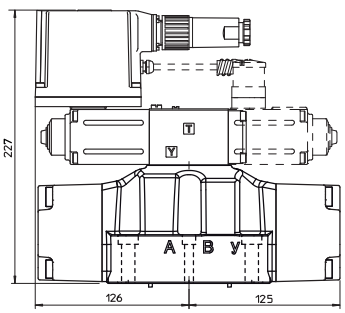
Mass [kg]

	A	AE, AES, AEG, AEZ	AES-EH
DPZO-*-25*	11,9	12,3	12,4
DPZO-*-27*	12,8	13,2	13,3

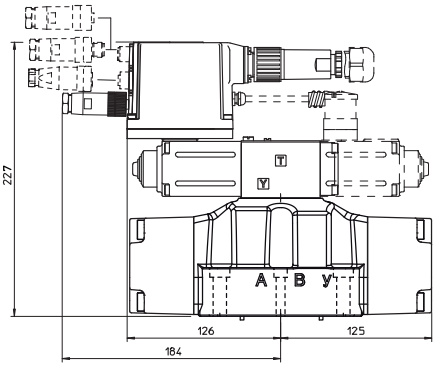
DPZO-A-2



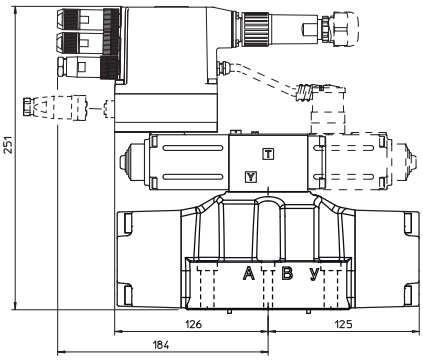
DPZO-AE-2



DPZO-AES-2



DPZO-AES-EH-2



For main and communication connector see section 18 , 19

NOTE: The overall height is increased by 40 mm for /G option (0,9 kg).
For option /B the proportional solenoid and the electronics (in case of execution -AE and -AES) are at side of port B of the main stage.

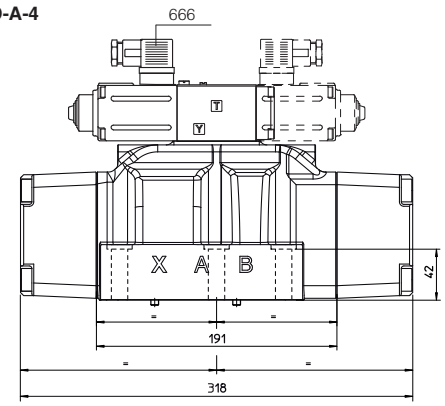
DPZO-A(*)-4 (dotted line = double solenoid version)

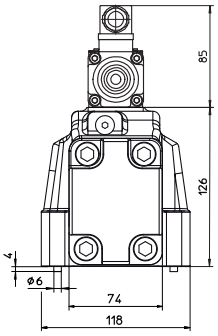
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Seals: 4 OR 4112; 2 OR 3056
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;

Mass [kg]

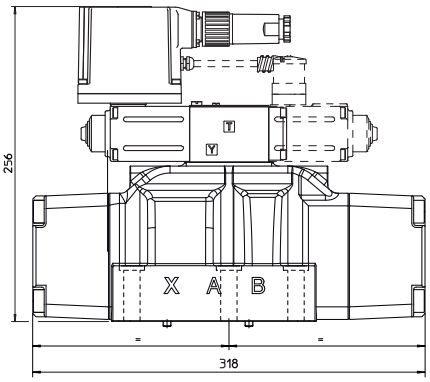
	A	AE, AES, AEG, AEZ	AES-EH
DPZO-*-45*	17,1	18	18,1
DPZO-*-47*	18	18,9	19

DPZO-A-4

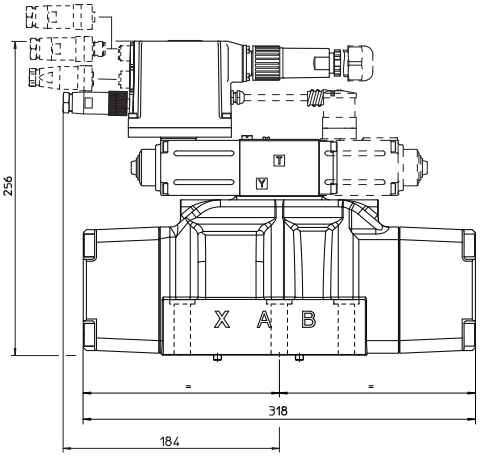




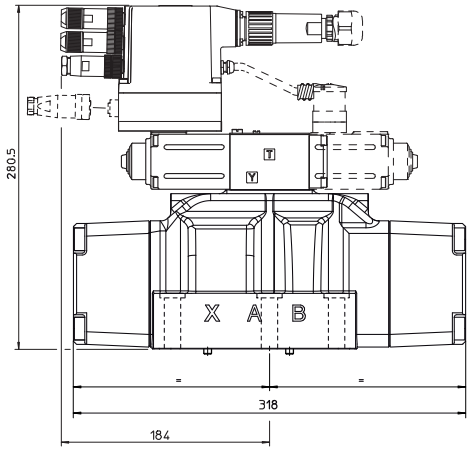
DPZO-AE-4



DPZO-AES-4



DPZO-AES-EH-4



For main and communication connector see section 18 , 19

NOTE: The overall height is increased by 30 mm for /G option (0,9 kg).
For option /B the proportional solenoid and the electronics (in case of execution -AE and -AES) are at side of port B of the main stage.

16 INSTALLATION DIMENSIONS FOR DPZO-6 [mm]

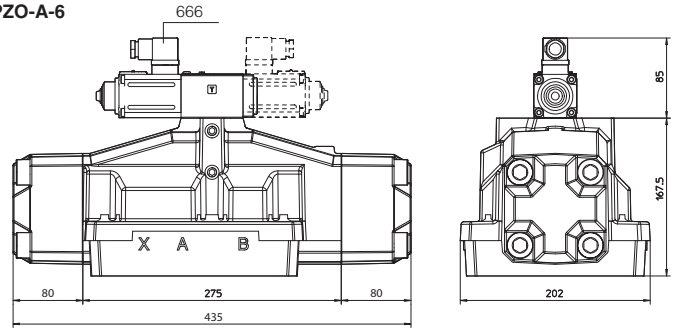
DPZO-A(*)-6 (dotted line = double solenoid version)

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
Fastening bolts:
6 socket head screws M20x90 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, 3 OR 3056

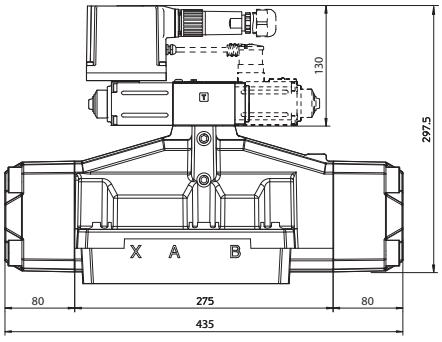
Mass [kg]

	A	AE, AES, AEG, AEZ	AES-EH
DPZO-*-65*	42,1	42,5	42,6
DPZO-*-67*	42,7	43,1	43,2

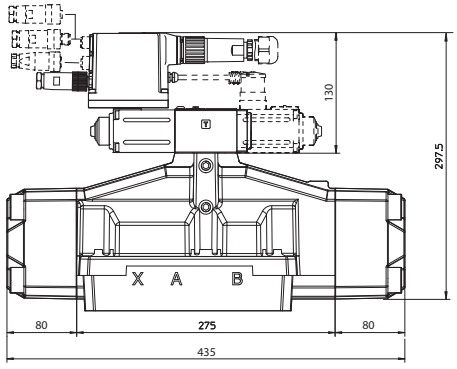
DPZO-A-6



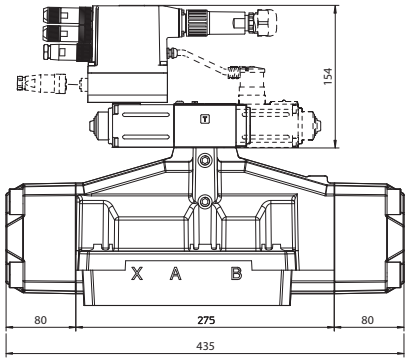
DPZO-AE-6



DPZO-AES-6



DPZO-AES-EH-6



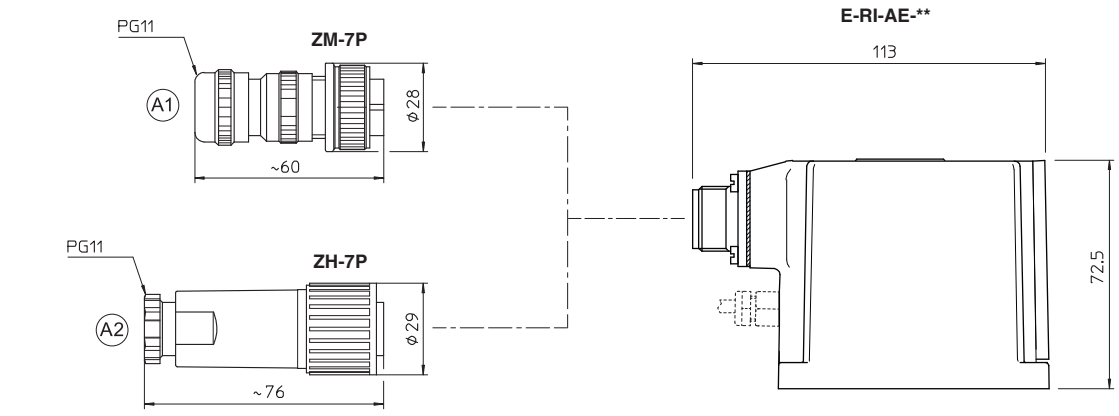
For main and communication connector see section 18 , 19

NOTE: The overall height is increased by 40 mm for /G option (0,9 kg).
For option /B the proportional solenoid and the electronics (in case of execution -AE and -AES) are at side of port B of the main stage.

17 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 to the digital driver. E-SW software is available in different versions according to the driver's communication interface: PS (Serial) E-SW-PS, BC (CANopen) E-SW-BC, BP (PROFIBUS DP) and EH (EtherCAT). Proportional valves with fieldbus communication interface can be directly managed by the machine control unit; it is required to implement in the machine control the standard communication as described in the user manuals supplied with the relevant programming software.

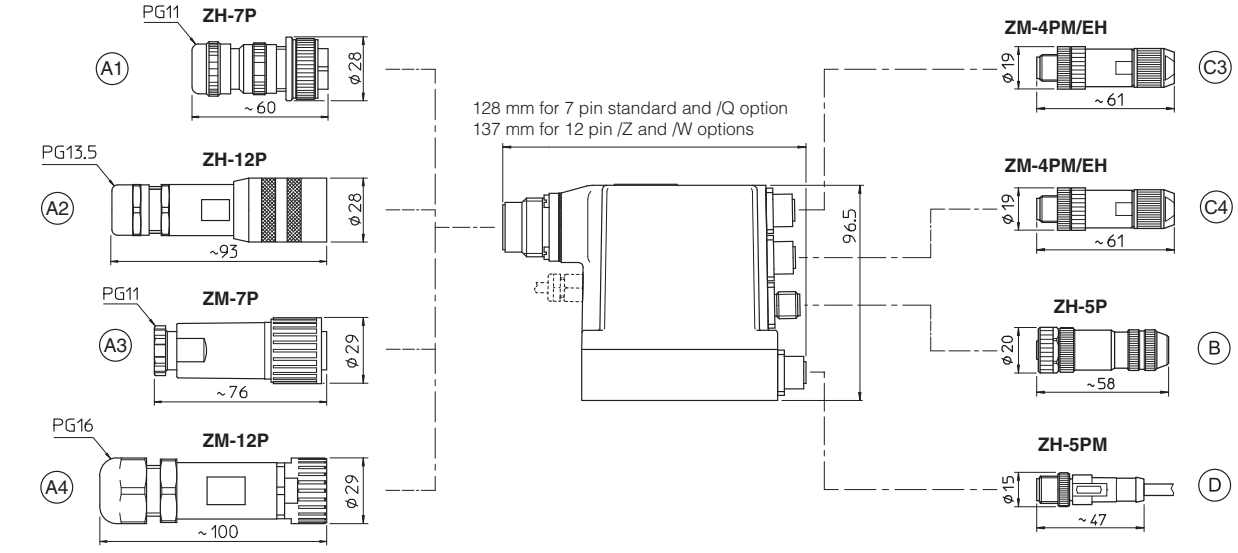
18 CONNECTORS



A1 Main connector (Plastic)

A2 Main connector (Metallic)

EtherCAT -EH execution



B Serial communication connector

C3 Input EtherCAT communication connector (-EH)

C4 Output EtherCAT communication connector (-EH)

D Pressure transducer connector (/W option)

A1 Main connector - 7 pin (Plastic)

A2 Main connector - 12 pin (Plastic)

A3 Main connector - 7 pin (Metallic)

A4 Main connector - 12 pin (Metallic)

19 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

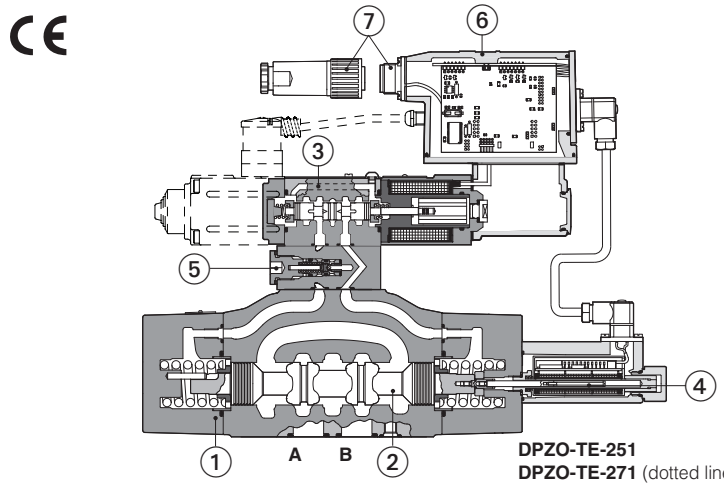
VALVE VERSION	-A	-AE, -AES		-AES/Z	-AES/W -AEZ	CANopen (-BC)	PROFIBUS DP (-BP)	EtherCAT (-EH)
CONNECTOR CODE	666	ZH-7P	ZM-7P	ZH-12P	ZH-5PM	ZH-5P	ZH-5P/BP	ZM-4PM/EH
PROTECTION DEGREE	IP65	IP67	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500	G110, G115, K500			G115, K500	G115, K500		

connectors supplyed with the valve

Proportional directional valves type DPZO-TE

two stage, with position transducer, ISO 4401 sizes 10, 16, 25 and 32

TE and TES executions included in this table are available only for running supplies or spare parts
For new applications it is suggested new TEB and TES executions, see table FS172



DPZO-TE-251
DPZO-TE-271 (dotted line)

① Valve body
② Main stage Spool
③ Pilot valve
④ Main stage position transducer
⑤ Pressure reducing valve
⑥ Integral electronics
⑦ Main connector

DPZO-T* are two stage proportional valves with position transducer on the main spool which provide both directional and non compensated flow control according to electronic reference signal.

They operate in association with electronic drivers, see section 2, which supply the proportional valves with proper current to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -T, with position transducers ④;
- -TE, -TES as -T plus analog (TE) or digital (TES) integral electronics ⑥.

The 4-way spool ②, sliding into a 5-chambers body ①, is piloted by a proportional directional valve ③ type DHZO (see tab. F160) and it is controlled in closed loop position by means of the LVDT transducer ④.
The pressure reducing valve ⑤ with fixed setting ensures a costant piloting pressure.
The integral electronics ⑥ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.
The electronic main connector ⑧ is fully interchangeable for –TE and –TES executions.
Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.
12 pin connector is used for options /Z and /S*.
The special /S* options add a closed loop control of pressure (/SP) or force (/SF and /SL) to the basic closed loop spool position one.

Following communication interfaces ⑦ are available for the digital -TES execution:
- -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software
- -BC, CANopen interface
- -BP, PROFIBUS DP interface

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

The coils are fully plastic encapsulated (insulation class H) and the valves have antivibration, antishock and weather-proof features.
Mounting surface: ISO 4401 sizes 10, 16, 25 and 32.

Max flow respectively up to 160 l/min, 430 l/min, 830 l/min and 1100 l/min with valve differential pressure Δp = 30 bar, see table 2.

Max pressure: 350 bar.

1 MODEL CODE

DPZO – TES – PS – 2 7 1 – L 5 / * / ** / *

Piloted proportional directional valve

T = with position transducer
TE = as T with integral analog electronics
TES = with digital electronics

Communication interfaces (only for TES)
PS = RS232 serial
BC = CANbus
BP = PROFIBUS-DP

Valve size:
1 = 10; **2** = 16;
4 = 25; **6** = 32;

Configuration, see section 3
5 = external plus central position, spring centered
7 = 3 position, spring centered

Spool overlapping in central position, see section 3
1 = P, A, B, T with positive overlapping **(1)**
3 = P positive overlapping (1); A, B, T, negative overlapping

Spool type (regulating characteristics):
L = linear;
S = progressive;
D = differential-progressive (as **S**, but with P-A = Q, P-B = Q/2)
DL = differential-linear (as **L**, but with P-A = Q, P-B = Q/2)

Spool size: **3, 5, 9** see section 3

Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FPM

Hydraulic options, see section 4:
B = solenoid, integral electronics and position transducer at side of port A of the main stage (side B of pilot valve)
E = external pilot (through port X)
D = internal drain

Electronic options for -TE execution see section 7:
F = fault signal
I = current reference input and monitor (4÷20 mA)
Q = enable signal
Z = enable, fault and monitor signal (12 pin connector)

Electronic options for -TES execution see section 9:
I = current reference input and monitor (4÷20 mA)
Z = double power supply, enable, fault and monitor signals (12 pin connector)

Special options for -TES execution see section 9:
SF = additional closed loop force control, with two remote pressure transducers
SL = additional closed loop force control with one remote load cell
SP = additional closed loop pressure control with one remote pressure transducer
C = current feedback interface for transducer(s) **only for options /SF, /SL, /SP**

Notes:
(1) Overlapping = 20% of spool stroke for type **S, D** and **Q**; 10% of spool stroke for type **L** and **DL**

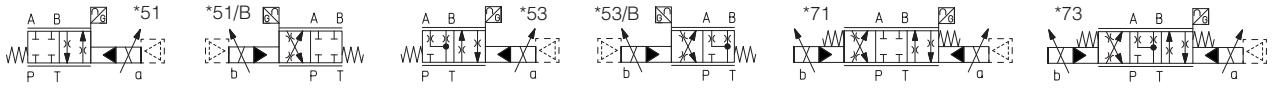
2 ELECTRONIC DRIVERS

Valve model	-T	-TE	-TES	-TES / SF, SL, SP
Drivers model	E-ME-T	E-RI-TE	E-RI-TES	E-RI-TES/SF, /SL, /SP
Data sheet	G140	G200	G210	G212

Note: For power supply and communication connector see section 17

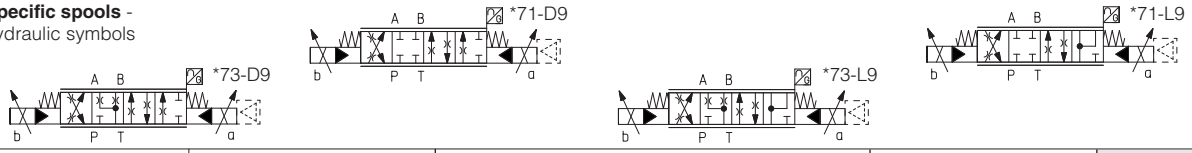
3 HYDRAULIC CHARACTERISTICS OF STANDARD SPOOL (based on mineral oil ISO VG 46 at 50 °C) (3)

Standard spools - hydraulic symbols



Valve model	DPZO-T*-1				DPZO-T*-2							DPZO-T*-4				DPZO-T*-6		
Spool overlapping	1, 3				1, 3							1, 3				1, 3		
Spool type and size	L5	S5	D5	DL5	L3	S3	D3	L5	S5	D5	DL5	L5	S5	DL5	D5	L5	S5	D5
Max flow (1): [l/min]																		
at Δp = 10 bar	100				160			250				480				640		
at Δp = 30 bar	160				270			430				830				1100		
max permissible flow	180				400			550				1000				1600		

Specific spools - hydraulic symbols



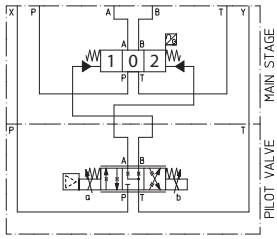
Valve model	DPZO-T*-1	DPZO-T*-2		DPZO-T*-4	
Spool overlapping	1, 3	1, 3		1, 3	
Spool type and size	D9	D9	L9	D9	
Max flow (1): [l/min]					
at Δp = 10 bar	100:60	250		480	
at Δp = 30 bar	160:100	430		830	
max permissible flow	180:110	550		1000	

Pressure limits (2) [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10			
Response time (3) [ms]	< 60	< 75	< 80	< 120
Hysteresis [%]	≤ 0,1%			
Repeatability	± 0,5%			
Thermal drift	zero point displacement < 1% at ΔT = 40°C			

Notes:
- Above performance data refer to valves coupled with Atos electronic drivers, see section 2.
- In case of long time shutdown of the hydraulic supply to the pilot valve, the driver has to be switched off to avoid its overheating.

(1) For different Δp, the max flow is in accordance to the diagrams in section 13.2
(2) Minimum piloting pressure = 25 bar
(3) 0-100% step signal

FUNCTIONAL SCHEME
example of configuration 7
(3 positions, spring centered)



4 HYDRAULIC OPTIONS

4.1 Option /B DPZO-*-*5 = solenoid, integral and position transducer at side of port A of the main stage.
DPZO-*-*7 = integral electronics and position transducer at side of port A of the main stage.
For hydraulic configuration vs. reference signal, see section 13.1

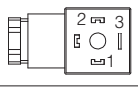
4.2 Pilot and drain configuration -The pilot/drain configuration can be modified as shown in the table E085 section 10.
The valve's standard configuration provides internal pilot and external drain. For different pilot / drain configuration select: **Option /E** External pilot (through port X). **Option /D** Internal drain.

5 GENERAL NOTES

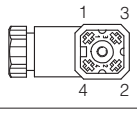
DPZO-T* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.
The electrical signals of the valve (e.g. 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).

6 CONNECTIONS FOR -T EXECUTION

SOLENOID POWER SUPPLY CONNECTOR	
PIN	Signal description
1	SUPPLY
2	SUPPLY
3	GND



POSITION TRANSDUCER CONNECTOR	
PIN	Signal description
1	OUTPUT SIGNAL
2	SUPPLY -15 VDC
3	SUPPLY +15 VDC
4	GND



7 ANALOG INTEGRAL DRIVERS -TE - OPTIONS

Standard driver execution provides on the 7 pin main connector:
Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply
Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers
Reference input signal - analog differential input with ±10 VDC nominal range (pin D,E), proportional to desired valve spool position
Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10 VDC nominal range

Following options are available to adapt standard execution to special application requirements:

7.1 Option /F It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

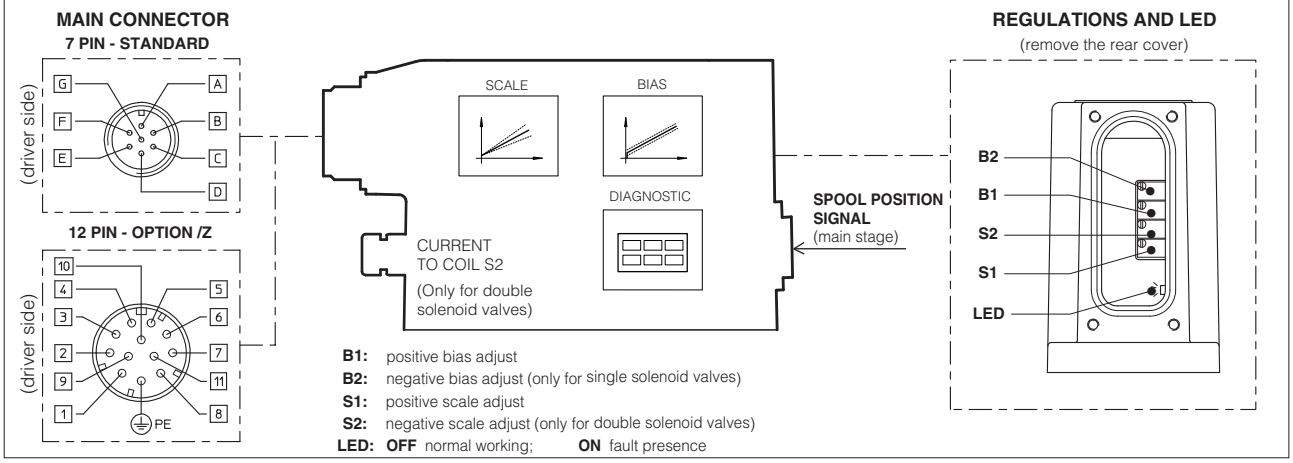
7.2 Option /I It provides the 4÷20 mA current reference and monitor signals instead of the standard ±10 VDC
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

7.3 Option /Q It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

7.4 Option /Z This option includes **/F** and **/Q** features, plus the Monitor output signal.
When the driver is disabled (0 VDC on Enable signal) Fault output is forced to 0 VDC.

7.5 Possible combined options: /FI and /IZ

8 ANALOG INTEGRAL DRIVERS -TE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



8.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS		NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage and driver logic		Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage and driver logic		Gnd - power supply
C (1)	7	AGND	Ground - signal zero for MONITOR signal	(for standard, /Z option)	Input - analog signal
	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	(for /Q and /Z options)	Input - on/off signal
D	4	INPUT+	Reference analog differential input: ±10 VDC maximum range For single solenoid valves the reference input is 0÷+10 VDC For double solenoid valves the reference input is ±10 VDC	(4 ÷ 20 mA for /I option) (4 ÷ 20 mA for /I option) (4 ÷ 20 mA for /I option)	Input - analog signal
E	5	INPUT -			
F (2)	6	MONITOR	Monitor analog output: ±10 VDC maximum range;	(4 ÷ 20 mA for /I option)	Output - analog signal
	11	FAULT	Fault (0V) or normal working (24V)	(for /F and /Z option)	Output - on/off signal
-	8	R_ENABLE	Repeat Enable - output repetition of Enable input		Output - on/off signal
-	9	NC	do not connect		Output - on/off signal
-	10	NC	do not connect		Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing		

Notes:

(1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B

(2) with /F option FAULT signal replaces MONITOR on pin F.

- A minimum time of 50ms to 100ms 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 DIGITAL INTEGRAL DRIVERS -TES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10VDC nominal range

Following options are available to adapt standard execution to application requirements:

9.1 Option /I

It provides 4÷20 mA current reference and monitor signals instead of the standard ±10 V.

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.

9.2 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Logic power supply

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).
Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal

To enable the driver, supply 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

9.3 Options /SP, /SF and /SL

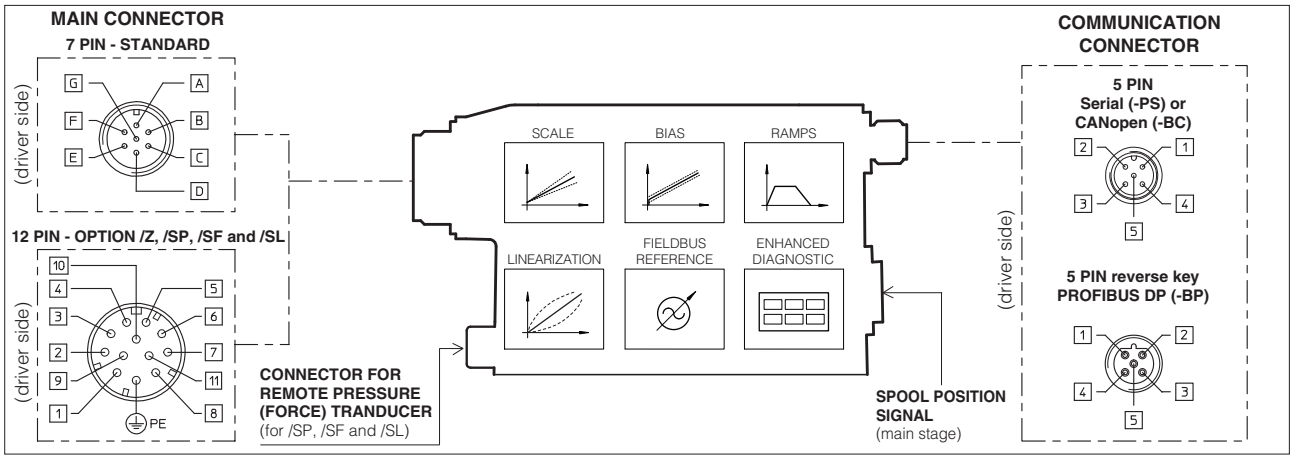
These options add the closed loop control of pressure (/SP) or force (/SF and /SL) to the basic functions of proportional directional valves: a dedicated software alternates pressure (force) and valve's spool position controls depending on the actual hydraulic system conditions.
A dedicated connector is available for the additional transducers that are required to be interfaced to the valve's driver (1 pressure transducer for /SP, 2 pressure transducers for /SF or 1 load cell for /SL).
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control: one for reference (pin 7) and one for monitor (pin 8).
For futher details please refer to the driver technical table **G212.**

9.4 Options /C

Options /CSP, /CSF and /CSL are available to connect pressure (force) transducers with 4 ÷ 20mA current output signal.

9.5 Possible combined options: /ISF, /ISL, /ISP, /CSP, /CSF, /CSL, /CISP, /CISF, /CISL and /IZ

10 DIGITAL INTEGRAL DRIVERS -TES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



10.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
-	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) For single solenoid valves the reference input is 0÷+10 VDC (4 ÷ 20 mA for /I option) For double solenoid valves the reference input is ±10 VDC (4 ÷ 20 mA for /I option) standard: differential input; /Z option: common mode INPUT+ referred to AGND	Input - analog signal
E	-	INPUT -		
C	5	AGND	Ground - signal zero for MONITOR signal signal zero for INPUT+ signal (only for /Z option)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: ±10 VDC maximum range; (4 ÷ 20 mA for /I option)	Output - analog signal
-	7	NC	do not connect (pressure/force input for /SP, /SF and /SL options, see 9.3)	
-	8	NC	do not connect (pressure/force monitor for /SP, /SF and /SL options, see 9.3)	
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0V) or normal working (24V)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 300 to 500 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.

10.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION CONNECTORS

	-PS Serial		-BC CANopen		-BP PROFIBUS DP	
PIN	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	

11 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the Atos E-SW programming software, available in three different versions according to the driver's communication execution: **E-SW-PS** (Serial), **E-SW-BC** (CANopen) and **E-SW-BP** (PROFIBUS DP).

For a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table **G500**.

Programming software, must be ordered separately:

E-SW-* (mandatory - first supply) = Dvd including E-SW-* software installer and operator manuals; it allows the registration to Atos digital service

E-SW-*-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com.
Once the registration is completed, the password will be sent by email.

The software remains active for 10 days from the installation date and then it stops until the user inputs his password.

With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

12 MAIN CHARACTERISTICS OF PROPORTIONAL DIRECTIONAL VALVES

Assembly position	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
Ambient temperature	-20°C ÷ +70°C for -T execution; -20°C ÷ +60°C for -TE and -TES executions
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 μm ($\beta_{10} \geq 75$ recommended)
Fluid temperature	-20°C +60°C (standard seals) -20°C +80°C (/PE seals)
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Max. solenoid current	2,6 A
Max. power	35 Watt
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 (CEI EN-60529)	IP65 for -T execution; IP67 for -TE and -TES executions
Duty factor	Continuous rating (ED=100%)

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

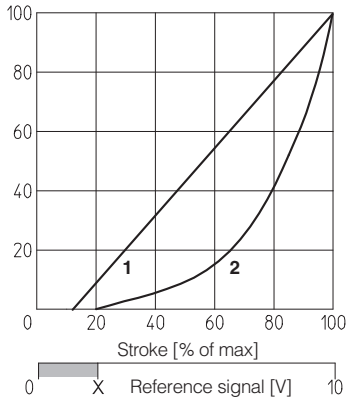
13.1 Regulation diagrams

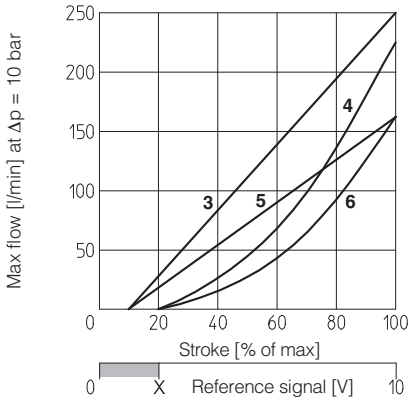
DPZO-1:
1 = 1L5, 1DL5, 3L5, 3DL5
2 = 1S5, 1D5, 3S5, 3D5

DPZO-2:
3 = 1L5, 1DL5, 3L5, 3DL5
4 = 1S5, 1D5, 3S5, 3D5
5 = 1L3, 3L3
6 = 1S3, 1D3, 3S3, 3D3

DPZO-4:
7 = 1L5, 1DL5, 3L5, 3DL5
8 = 1S5, 1D5, 3S5, 3D5

DPZO-6:
9 = 1L5, 3L5
10 = 1S5, 1D5, 3S5, 3D5





X = Threshold for bias activation depending to the valve type and amplifier type

Notes:

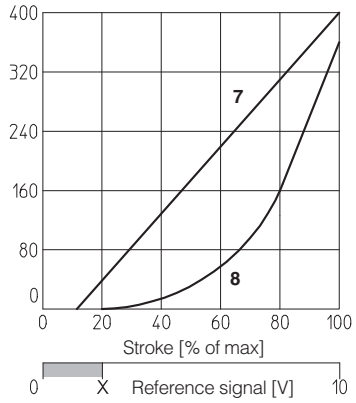
Hydraulic configuration vs. reference signal
for double solenoid valves (standard and option /B):

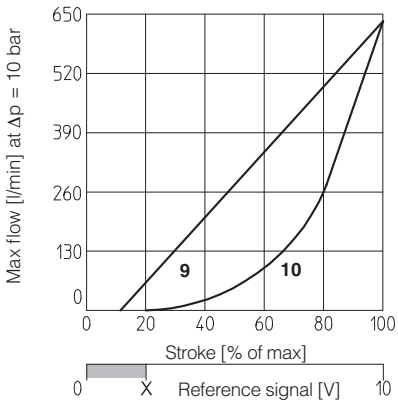
Reference signal 0 ÷+10 V / 12÷20 mA } P → A / B → T

Reference signal 0 ÷-10 V / 4÷12 mA } P → B / A → T

Hydraulic configuration vs. reference signal
for single solenoid valves:

Reference signal 0 ÷+10 V / 12÷20 mA } P → A / B → T (standard) / P → B / A → T (option /B)

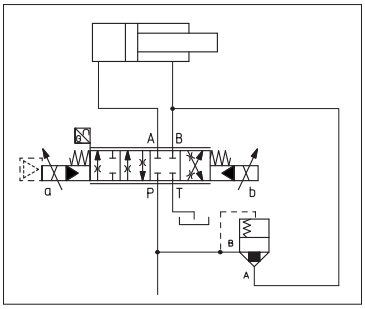




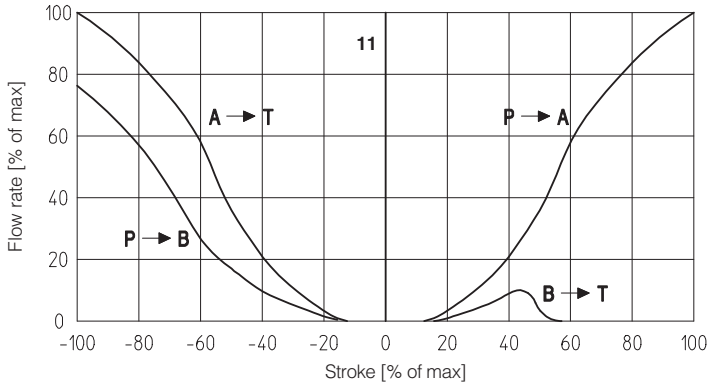
X = Threshold for bias activation depending to the valve type and amplifier type

11 = differential - regenerative spool D9

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



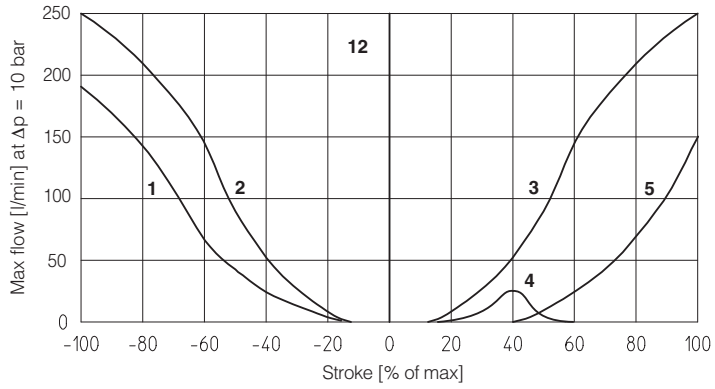
Application example



12 = linear - internal regenerative spool L9

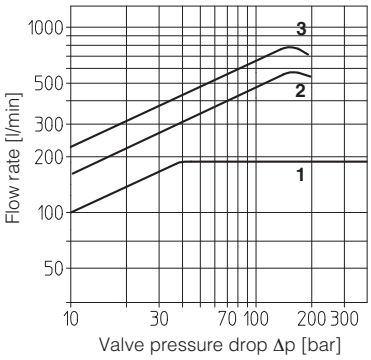
L9 spool type with a fourth position specific to regenerative circuit internal to the valve.

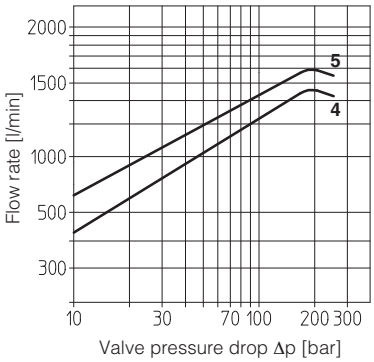
1 = P - B
2 = A - T
3 = P - A
4 = B - T
5 = P - B (regenerative)



13.2 Operating diagrams

Flow /Δp diagram
stated at 100% of spool stroke
DPZO-1:
1 = spools L5, S5, D5, DL5, D9
DPZO-2:
2 = spool L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9
DPZO-4:
4 = spools L5, S5, D5, DL5, D9
DPZO-6:
5 = spools L5, S5, D5



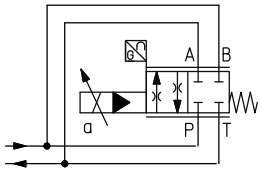


13.3 Dynamic response

The response times in section 3 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.

13.4 Operation as throttle valve

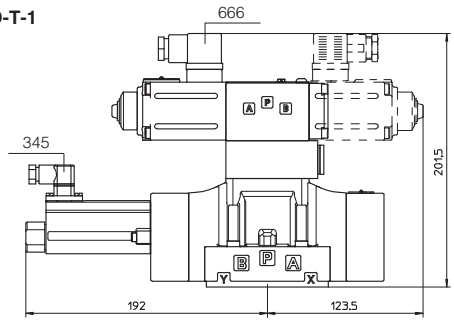
Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar

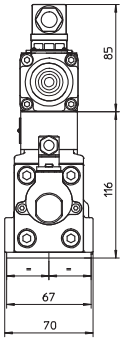


DPZO-*-		151-L5	251-L5	451-L5	651-L5
Max flow	[l/min]	160	430	830	1100
Δp	[bar]	30	30	30	30

DPZO-T(*)-1 (dotted line = double solenoid version)

DPZO-T-1



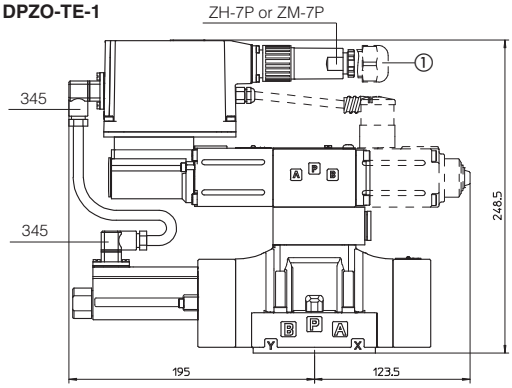


ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 2 OR 108
Diameter of ports A, B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;

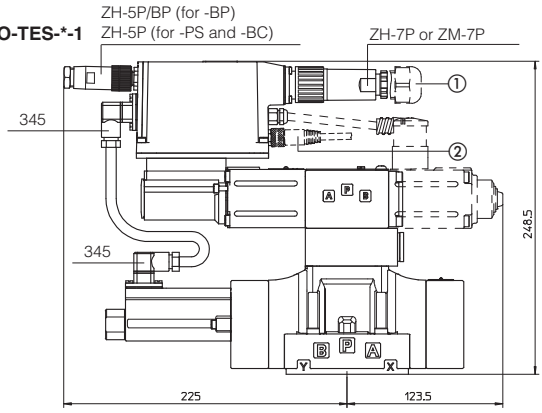
Mass [kg]

	T	TE, TES
DPZO-*-15*	8,5	8,9
DPZO-*-17*	9,4	9,8

DPZO-TE-1

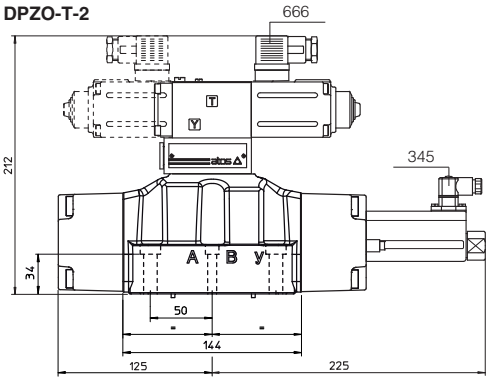


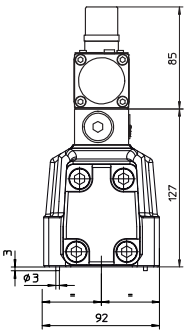
DPZO-TES-*-1



DPZO-T(*)-2 (dotted line = double solenoid version)

DPZO-T-2



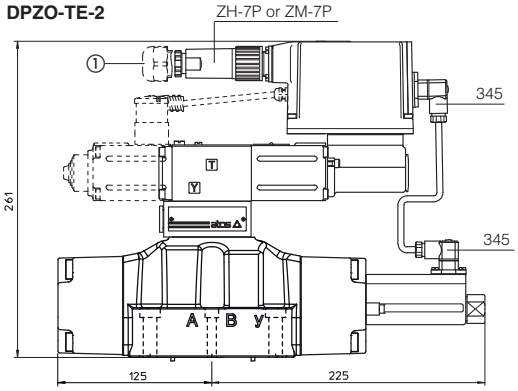


ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Seals: 4 OR 130; 3 OR 109/70
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;

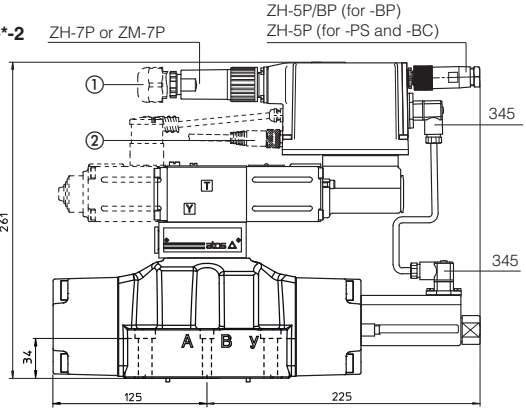
Mass [kg]

	T	TE, TES
DPZO-*-25*	13,5	13,9
DPZO-*-27*	14,4	14,8

DPZO-TE-2



DPZO-TES-*-2

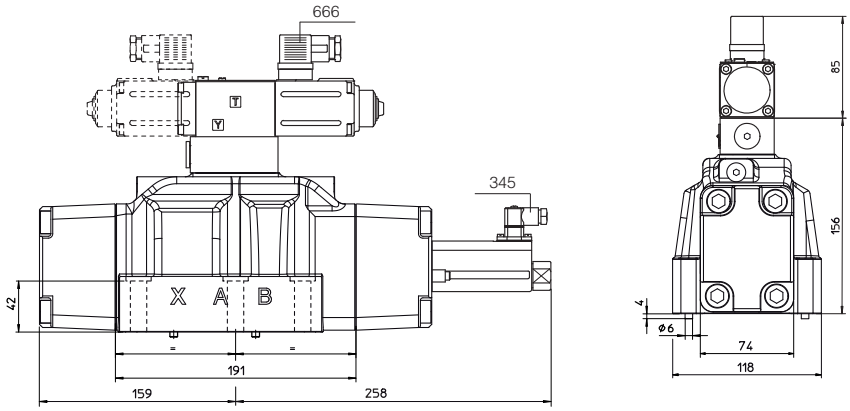


① Dotted line =12 pin connector ZH-12P for options /SF, /SL, /SP, /Z
② = M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

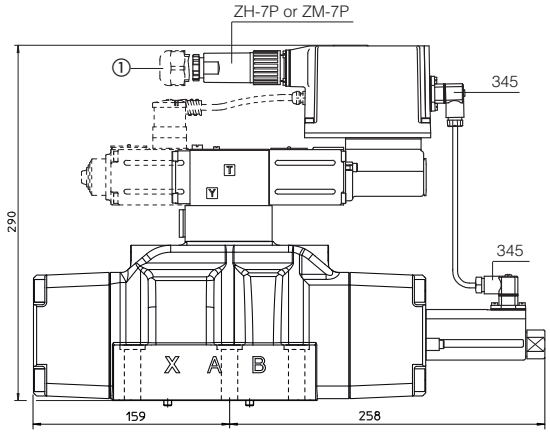
NOTE:
For option /B the proportional solenoid, the position transducer and the electronics (in case of execution -TE and -TES) are at side of port A of the main stage.

DPZO-T(*)-4 (dotted line = double solenoid version)

DPZO-T-4

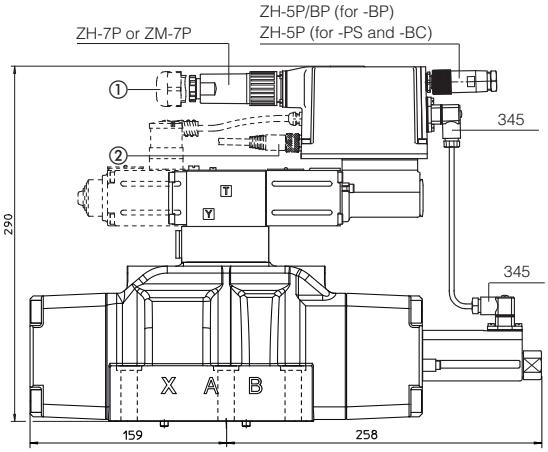


DPZO-TE-4



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;

DPZO-TES-*-4



Mass [kg]

	T	TE, TES
DPZO-*-45*	17,6	18
DPZO-*-47*	18,5	18,9

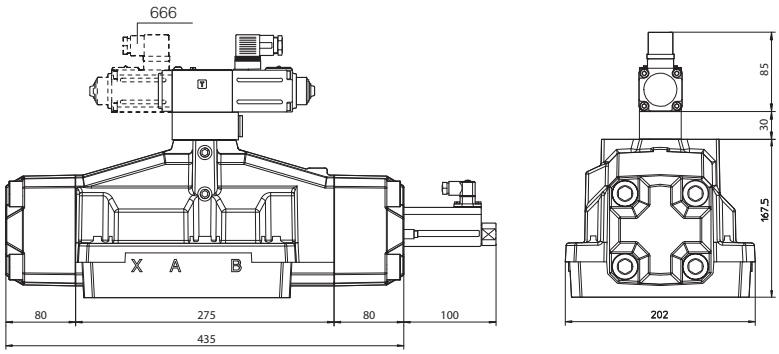
① Dotted line =12 pin connector ZH-12P for options /SF, /SL, /SP, /Z
② = M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

NOTE:
For option /B the proportional solenoid, the position transducer and the electronics (in case of execution -TE and -TES) are at side of port A of the main stage.

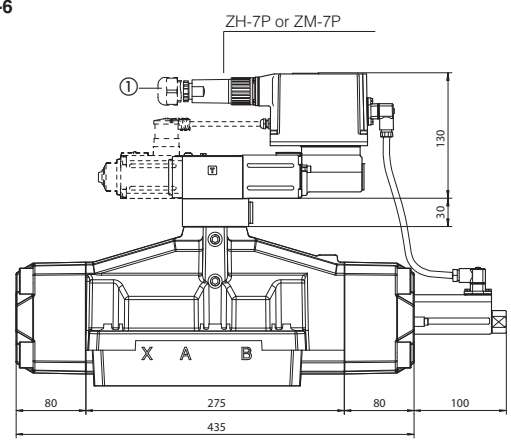
16 INSTALLATION DIMENSIONS FOR DPZO-6 [mm]

DPZO-T(*)-6 (dotted line = double solenoid version)

DPZO-T-6

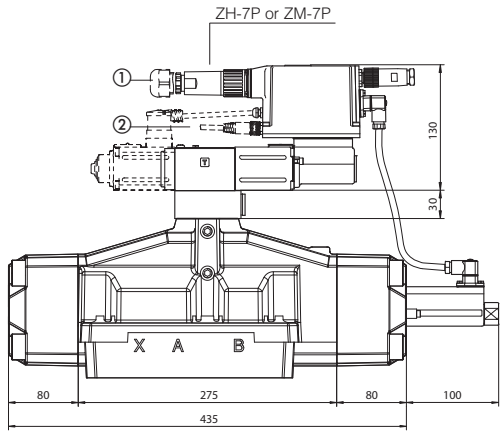


DPZO-TE-6



ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
Fastening bolts:
6 socket head screws M20x90 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, 3 OR 3056

DPZO-TES-6



Mass [kg]

	T	TE, TES
DPZO-*-65*	41,7	42,3
DPZO-*-67*	42,5	43,1

-TES EXECUTION

① Dotted line =12 pin connector ZH-12P for options /SF, /SL, /SP, /Z
② = M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

NOTE:
For option /B the proportional solenoid, the position transducer and the electronics (in case of execution -TE and -TES) are at side of port A of the main stage.

17 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

VALVE VERSION	-T		-TE, -TES		-TE/Z -TES /Z, /SF, /SL, /SP	serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)	TES /SF, /SL, /SP (transducer)
	Power supply	Transducer						
CONNECTOR CODE	666	345	ZH-7P	ZM-7P	ZH-12P	ZH-5P	ZH-5P/BP	ZH-4P-M8/* (1)
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500		G200, G210, K500			G210, K500		G212, K500

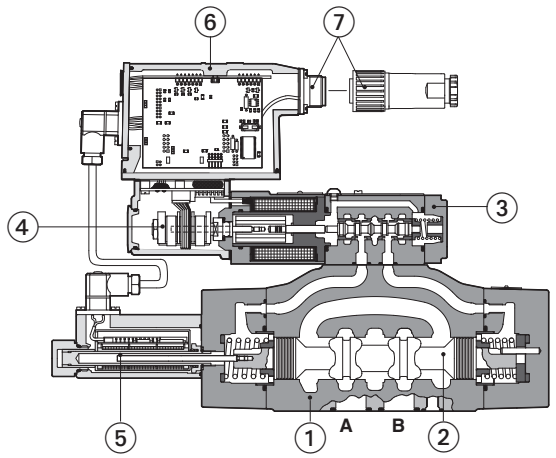
(1) M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

connectors supplied with the valve

Proportional directional valves type DPZO-LES

high performance, two stage, with two position transducers, ISO 4401 sizes 10, 16, 25, 27 and 32

LE and LES executions included in this table are available only for running supplies or spare parts
For new applications it is suggested new LEB and LES executions, see table FS175



DPZO-LE-271

① Valve body
② Main stage Spool
③ Pilot valve
④ Pilot valve position transducer
⑤ Main stage position transducer
⑥ Integral electronics
⑦ Main connector

DPZO-L* are two stage proportional valves with double position transducer which provide both directional and non compensated flow control according to electronic reference signal.

They operate in association with electronic drivers, see section 2, which supply the proportional valves with proper current to align valve regulation to the reference signal supplied to the electronic driver.

They are high performance valves particularly used in closed loop positioning or speed controls with high dynamic requirements.

They are available in different executions:
- -L, with two position transducers ④, ⑤;
- -LE, -LES as -L plus analog (LE) or digital (LES) integral electronics ⑥.

The 4-way spool ②, sliding into a 5-chambers body ①, is piloted by the high performance proportional directional valve ③ type DLHZO (see tab. F180) provided of high precision sleeve and LVDT position transducer ④ for maximum regulating accuracy and dynamic response. It is controlled in double closed loop position by means of the LVDT position transducers ④ and ⑤.
The integral electronics ⑥ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.
The electronic main connector ⑧ is fully interchangeable for –LE and –LES executions.
Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.
12 pin connector is used for options /Z and /S*.
The special /S* options add a closed loop control of pressure (/SP) or force (/SF and /SL) to the basic closed loop spool position one.

Following communication interfaces ⑦ are available for the digital -LES execution:
- -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software
- -BC, CANopen interface
- -BP, PROFIBUS DP interface

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

The coils are fully plastic encapsulated (insulation class H) and the valves have antivibration, antishock and weather-proof features.
Mounting surface: ISO 4401 sizes 10, 16, 25, 27 and 32.

Max flow respectively up to 160 l/min, 430 l/min, 830 l/min, 950 l/min and 1100 l/min with valve differential pressure Δp = 30 bar, see table 3.

Max pressure: 350 bar.

1 MODEL CODE

**DPZO –LES – PS – 2 7 1 – L 5 / * / ** / *

Piloted proportional directional valve

L = with two integral position transducers
LE = as L plus integral analog electronics
LES = with digital electronics

Communication interfaces (only for LES)
PS = Serial
BC = CANopen
BP = PROFIBUS DP

Valve size:
1 = 10; **2** = 16; **4** = 25; **4M** = 27; **6** = 32;

Configuration, see section 2
6 = 2 external position, spring offset (only for spool overlapping **0** and type **L**)
7 = 3 position, spring centered

Spool overlapping in central position, see section 3
0 = zero overlapping (only for spool type L, DL and T) **(1)**
1 = P, A, B, T with positive overlapping **(2)**
3 = P positive overlapping **(2)**;A, B, T, negative overlapping

Spool type (regulating characteristics):
L = linear;
S = progressive;
D = differential-progressive (as **S**, but with P-A = Q, P-B = Q/2)
DL = differential-linear (as **L**, but with P-A = Q, P-B = Q/2)
Q = linear spool, for alternate P/Q controls **(3)**
T = non linear
V = differential-progressive, for alternate P/Q controls **(3)**

Spool size: **3, 5, 9** see section 3

Seals material: omit for NBR (mineral oil & water glycol)
PE = FPM

Series number

Hydraulic options, see section 4:
B = solenoid, integral electronics and position transducer at side of port B of the main stage (side A of pilot valve);
G = pressure reducing valve for piloting - standard for DPZO-L*-1
E = external pilot (through port X)
D = internal drain

Electronic options for -LE execution see section 7:
F = fault signal
I = current reference input and monitor (4÷20 mA)
Q = enable signal
Z = enable, fault and monitor signal (12 pin connector)

Electronic options for -LES execution see section 9:
I = current reference input and monitor (4÷20 mA)
Z = double power supply, enable, fault and monitor signals (12 pin connector)

Special options for -LES execution see section 9:
SF = additional closed loop force control, with two remote pressure transducers
SL = additional closed loop force control with one remote load cell
SP = additional closed loop pressure control with one remote pressure transducer
C = current feedback interface for transducer(s) **only for options /SF, /SL, /SP**

Notes: **(1)** For zero overlapping spool **0L3**, **0L5**, **0DL5**, **0T5**,the valve offset position (with switch-off power supply) is 1 ÷ 6% P-B/A-T
(2) Overlapping = 20% of spool stroke for type **S, D** and **Q**; 10% of spool stroke for type **L** and **DL**
(3) The spool type **Q** and **V** are specific for alternate P/Q controls and they can be used in combination with option /S* of digital integral drivers (see section 13.1 and G212), or digital position controllers type Z-RI-LEZ (see tab. F230) or Z-ME-KZ (see tab. G340)

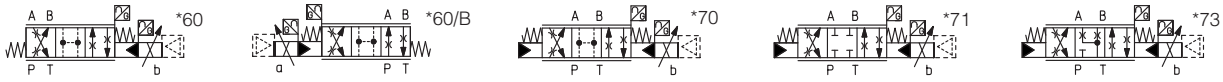
2 ELECTRONIC DRIVERS

Valve model	-L	-LE	-LES	-LES / SF, SL, SP
Drivers model	E-ME-L	E-RI-LE	E-RI-LES	E-RI-LES /SF, /SL, /SP
Data sheet	G150	G200	G210	G212

Note: For power supply and communication connector see section 16

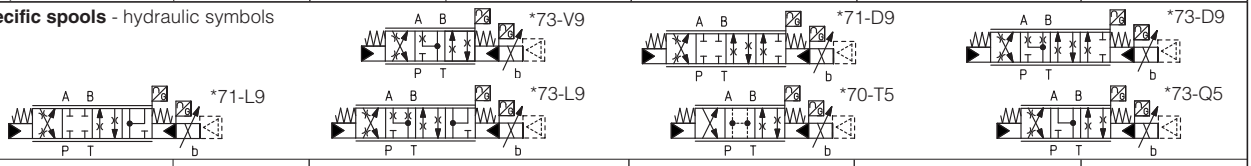
3 HYDRAULIC CHARACTERISTICS OF STANDARD SPOOL (based on mineral oil ISO VG 46 at 50 °C) (3)

Standard spools - hydraulic symbols



Valve model	DPZO-L*-1				DPZO-L*-2							DPZO-L*-4				DPZO-L*-4M				DPZO-L*-6		
Spool overlapping	0,1,3	1, 3		0,1,3	0,1,3	1, 3		0,1,3	1, 3		0,1,3	0, 1, 3	1, 3		0, 1, 3	0, 1, 3	1, 3		0, 1, 3	0,1,3	1, 3	1, 3
Spool type and size	L5	S5	D5	DL5	L3	S3	D3	L5	S5	D5	DL5	L5	S5	D5	DL5	L5	S5	D5	DL5	L5	S5	D5
Max flow (1): [l/min]																						
at Δp = 10 bar	100				160			250				480				550				640		
at Δp = 30 bar	160				270			430				830				950				1100		
max permissible flow	180				400			550				1000				1100				1600		

Specific spools - hydraulic symbols

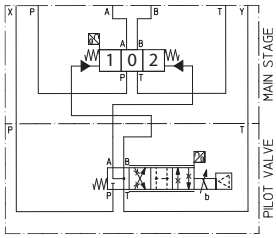


Valve model	DPZO-L*-1			DPZO-L*-2					DPZO-L*-4			DPZO-L*-4M			DPZO-L*-6
Spool overlapping	1, 3	3		1, 3		3		0	1, 3	3		1, 3	3		1, 3
Spool type and size	D9	Q5	V9	D9	L9	Q5	V9	T5	D9	Q5	V9	D9	Q5	V9	S5
Max flow (1): [l/min]															
at Δp = 10 bar	100			250				188	480			550			640
at Δp = 30 bar	160			430				232	830			950			1100
max permissible flow	180			880				660	1000			1100			1600

Pressure limits (2) [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10			
Response time [ms] (3) spool overlapping 0	< 25	< 25	< 30	< 30	< 80
Response time [ms] (3) spool overlapping 1-3	< 50	< 70	< 75	< 75	< 100
Hysteresis [%]	≤ 0,1%				
Repeatability	± 0,1%				
Thermal drift	zero point displacement < 1% at ΔT = 40°C				

Notes: • Above performance data refer to valves coupled with Atos electronic drivers, see section 2.
• In case of long interruption of the hydraulic supply to the pilot valve, the driver has to be switched off to avoid its overheating.
(1) For different Dp, the max flow is in accordance to the diagrams in section 13.2
(2) Minimum piloting pressure = 25 bar
(3) 0-100% step signal

FUNCTIONAL SCHEME
example of configuration 7
(3 positions, spring centered)



4 HYDRAULIC OPTIONS

4.1 Option /B Solenoid, integral electronics and position transducer at side of port B of the main stage.
For hydraulic configuration vs reference signal, see section 13.1

4.2 Option /G Pressure reducing valve with fixed setting (= 40 bar for DPZO-1 and -2; 100 bar for DPZO-4) installed between pilot valve and main body. It is advisable for valves with internal pilot in case of system pressure higher than 200 bar. This option is standard for DPZO-L*-1.

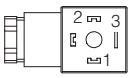
4.3 Pilot and drain configuration -The pilot / drain configuration can be modified as shown in the table E080 section 12. The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select: **Option /E** External pilot (through port X). **Option /D** Internal drain.

5 GENERAL NOTES

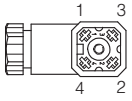
DPZO-L* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.
The electrical signals of the valve (e.g. 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).

6 CONNECTIONS FOR -L EXECUTION

SOLENOID POWER SUPPLY CONNECTOR	
PIN	Signal description
1	SUPPLY
2	SUPPLY
3	GND



POSITION TRANSDUCER CONNECTOR (pilot and main stage)	
PIN	Signal description
1	OUTPUT SIGNAL
2	SUPPLY -15 VDC
3	SUPPLY +15 VDC
4	GND



7 ANALOG INTEGRAL DRIVERS -LE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply
Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10 VDC nominal range (pin D, E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10 VDC nominal range

Following options are available to adapt standard execution to special application requirements:

7.1 Option /F It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

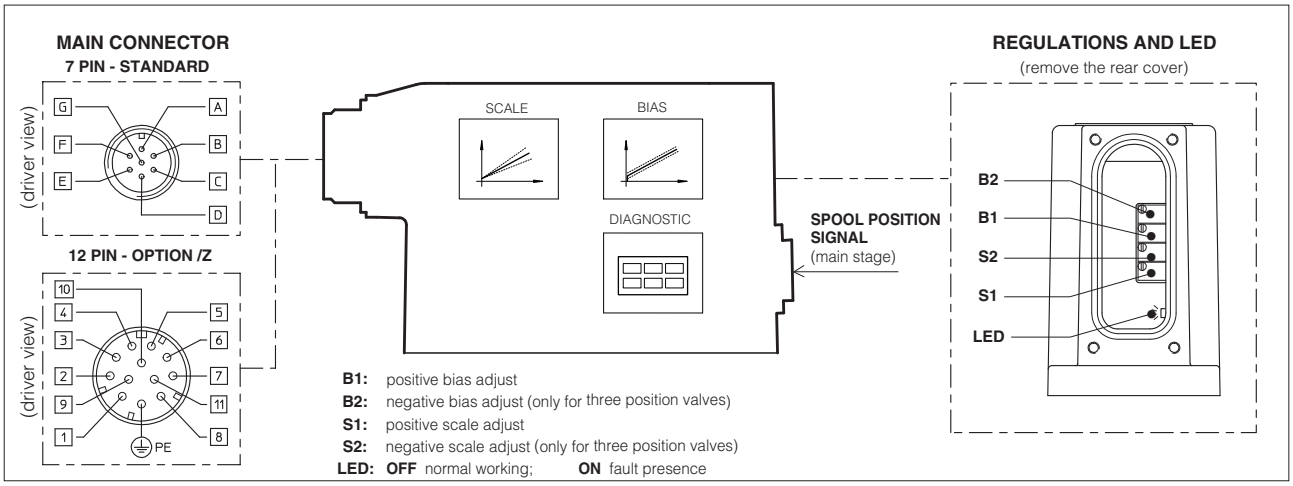
7.2 Option /I It provides the 4÷20 mA current reference and monitor signals instead of the standard ±10 VDC
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

7.3 Option /Q It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

7.4 Option /Z This option includes **/F** and **/Q** features, plus the Monitor output signal.
When the driver is disabled (0 VDC on Enable signal) Fault output is forced to 0.

7.5 Possible combined options: /FI and /IZ

8 ANALOG INTEGRAL DRIVERS -LE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



8.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage and driver logic	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage and driver logic	Gnd - power supply
C (1)	7	AGND	Ground - signal zero for MONITOR signal (for standard, /Z option)	Gnd - analog signal
	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q and /Z options)	Input - on/off signal
D	4	INPUT+	Reference analog differential input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) For two position valves the reference input is 0÷+10 VDC (4 ÷ 20 mA for /I option) For three position valves the reference input is ±10 VDC (4 ÷ 20 mA for /I option)	Input - analog signal
E	5	INPUT -		
F (2)	6	MONITOR	Monitor analog output: ±10 VDC maximum range; (4 ÷ 20 mA for /I option)	Output - analog signal
	11	FAULT	Fault (0V) or normal working (24V) (for /F and /Z option)	Output - on/off signal
-	8	R_ENABLE	Repeat Enable - output repetition of Enable input	Output - on/off signal
-	9	NC	do not connect	Output - on/off signal
-	10	NC	do not connect	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Notes:

(1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B

(2) with /F option FAULT signal replaces MONITOR on pin F.

- A minimum time of 50ms to 100ms 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 DIGITAL INTEGRAL DRIVERS -LES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10VDC nominal range

Following options are available to adapt standard execution special to application requirements:

9.1 Option /I

It provides 4÷20 mA current reference and monitor signals instead of the standard ±10 V.

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.

9.2 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Logic power supply

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).

Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal

To enable the driver, supply 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

9.3 Options /SP, /SF and /SL

These options add the closed loop control of pressure (/SP) or force (/SF and /SL) to the basic functions of proportional directional valves: a dedicated software alternates pressure (force) and valve's spool position controls depending on the actual hydraulic system conditions.

A dedicated connector is available for the additional transducers that are required to be interfaced to the valve's driver (1 pressure transducer for /SP, 2 pressure transducers for /SF or 1 load cell for /SL).

Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control: one for reference (pin 7) and one for monitor (pin 8).

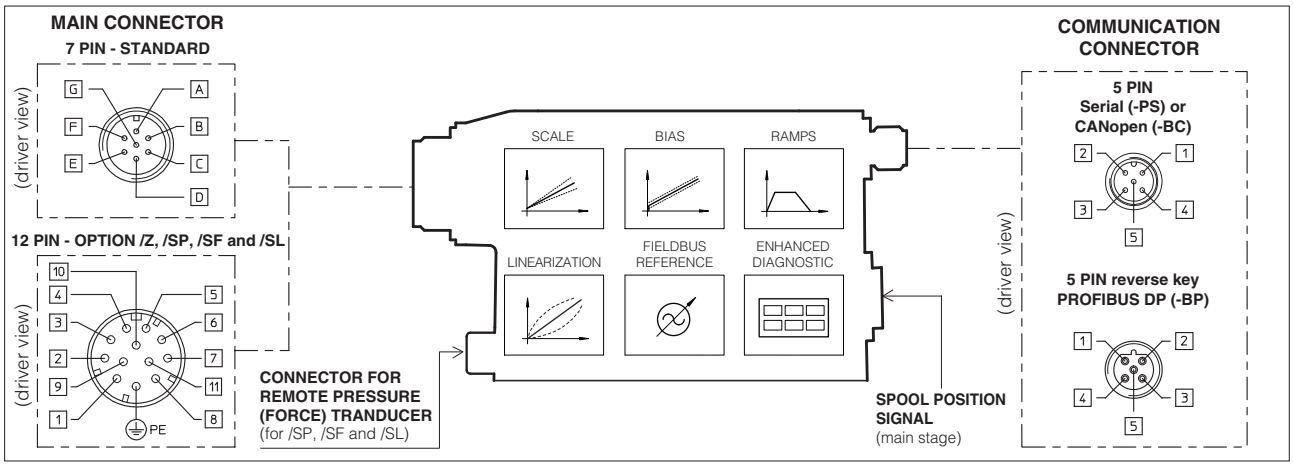
For futher details please refer to the driver technical table **G212.**

9.4 Options /C

Options /CSP, /CSF and /CSL are available to connect pressure (force) transducers with 4 ÷ 20mA current output signal.

9.5 Possible combined options: /ISP, /ISF, /ISL, /CSP, /CSF, /CSL, /CISP, /CISF, /CISL and /IZ

10 DIGITAL INTEGRAL DRIVERS -LES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



10.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
-	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) For two position valves the reference input is 0÷+10 VDC (4 ÷ 20 mA for /I option) For three position valves the reference input is ±10 VDC (4 ÷ 20 mA for /I option) standard: differential input; /Z option: common mode INPUT+ referred to AGND	Input - analog signal
E	-	INPUT -		
C	5	AGND	Ground - signal zero for MONITOR signal signal zero for INPUT+ signal (only for /Z option)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: ±10 VDC maximum range; (4 ÷ 20 mA for /I option)	Output - analog signal
-	7	NC	do not connect (pressure/force input for /SP, /SF and /SL options, see 9.3)	
-	8	NC	do not connect (pressure/force monitor for /SP, /SF and /SL options, see 9.3)	
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0V) or normal working (24V)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 300 to 500 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.

10.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION CONNECTORS

	-PS Serial		-BC CANopen		-BP PROFIBUS DP	
PIN	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	

11 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the Atos E-SW programming software, available in three different versions according to the driver's communication execution: **E-SW-PS** (Serial), **E-SW-BC** (CANopen) and **E-SW-BP** (PROFIBUS DP).

For a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table **G500**.

Programming software, must be ordered separately:

E-SW-* (mandatory - first supply) = Dvd including E-SW-* software installer and operator manuals; it allows the registration to Atos digital service

E-SW-*-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com.
Once the registration is completed, the password will be sent by email.

The software remains active for 10 days from the installation date and then it stops until the user inputs his password.

With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

12 MAIN CHARACTERISTICS OF PROPORTIONAL DIRECTIONAL VALVES

Assembly position	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
Ambient temperature	-20°C ÷ +70°C for -L execution; -20°C ÷ +60°C for -LE and LES executions
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 μm ($\beta_{10} \geq 75$ recommended)
Fluid temperature	-20°C +60°C (standard seals and water glycol) -20°C +80°C (/PE seals)
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Max. solenoid current	2,6 A
Max. power	35 Watt
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 (CEI EN-60529)	IP65 for -L execution; IP67 for -LE and -LES executions
Duty factor	Continuous rating (ED=100%)

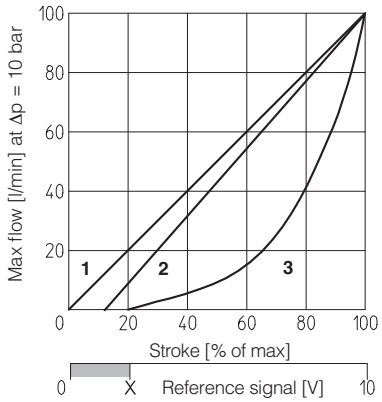
13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

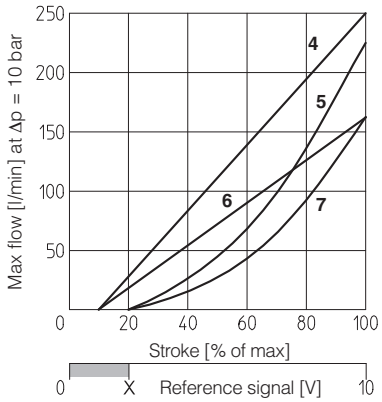
13.1 Regulation diagrams

DPZO-1:
1 = 0L5, 0DL5
2 = 1L5, 3L5, 1DL5, 3DL5
3 = 1S5, 1D5, 3S5, 3D5

DPZO-2:
4 = 1L5, 3L5, 1DL5, 3DL5
5 = 1S5, 1D5, 3S5, 3D5
6 = 1L3, 3L3
7 = 1S3, 1D3, 3S3, 3D3
8 = 0L5, 0DL5
9 = 0L3
10 = 0T5 not linear spool (only for DPZO-2)

The spool type T5 is specific for closed loop position controls and fine low flow metering in the range from 0 to 40% of max spool stroke.





X = Threshold for bias activation depending to the valve type and amplifier type

DPZO-4:
11 = 0L5, 0DL5
12 = 1L5, 1DL5, 3L5, 3DL5
13 = 1S5, 1D5, 3S5, 3D5

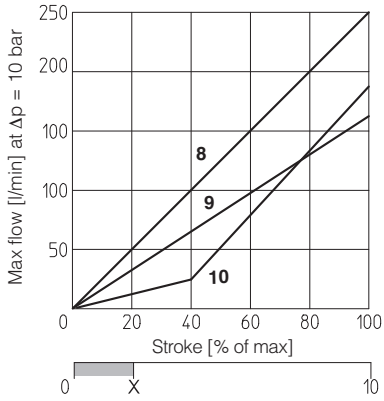
DPZO-4M:
14 = 0L5, 0DL5
15 = 1L5, 1DL5, 3L5, 3DL5
16 = 1S5, 1D5, 3S5, 3D5

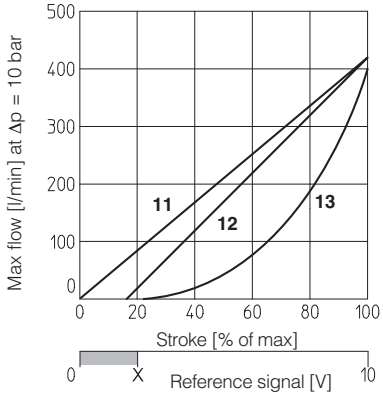
DPZO-6:
17 = 0L5, 0DL5
18 = 1L5, 3L5
19 = 1S5, 1D5, 3S5, 3D5

Note:
Hydraulic configuration vs. reference signal for configurations 60, 70, 71 and 73 (standard and option /B)

Reference signal 0 ÷+10 V / 12÷20 mA } P → A / B → T

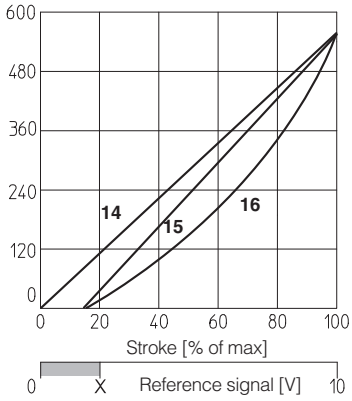
Reference signal 0 ÷-10 V / 4÷12 mA } P → B / A → T

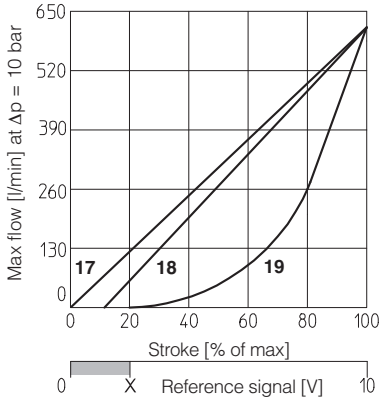




Hydraulic configuration vs. reference signal for configurations 51 and 53 (standard and option /B)

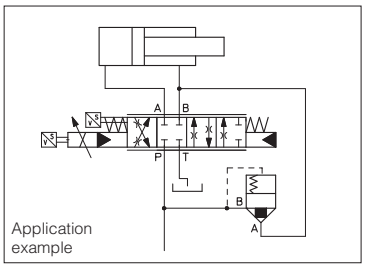
Reference signal 0 ÷+10 V / 12÷20 mA } P → A / B → T (standard) P → B / A → T (option /B)

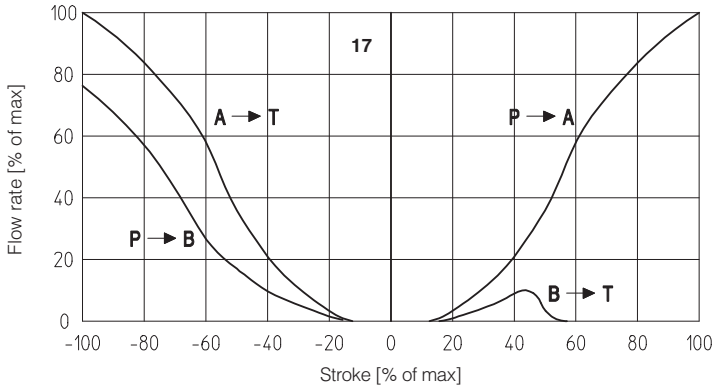




17 = differential - regenerative spool D9

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.

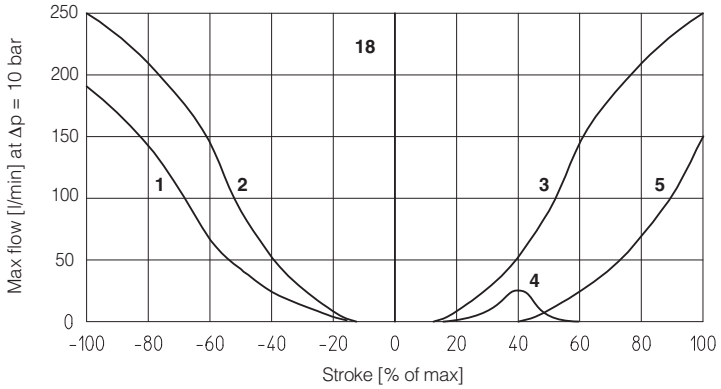




18 = linear - internal regenerative spool L9 (only for DPZO-2)

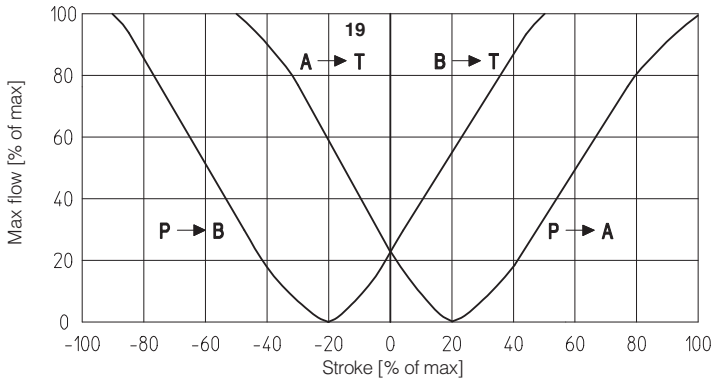
L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.

1 = P - B
2 = A - T
3 = P - A
4 = B - T
5 = P - B (regenerative)



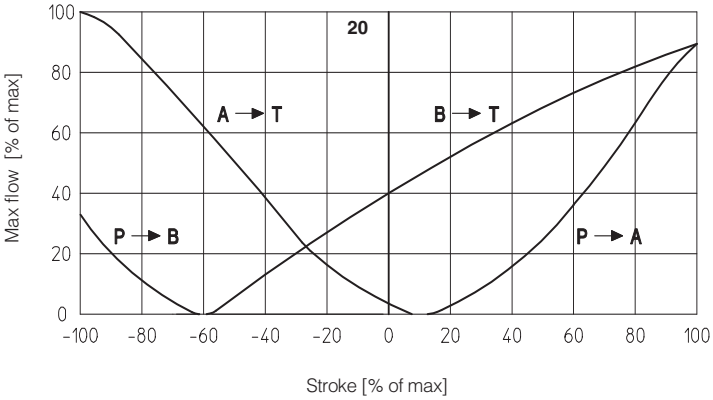
19 = linear spool Q5 (not available for size 32)

Q5 spool type is specific for alternate P/Q controls and it can be used in combination with /S* option of digital integral drivers, see tab. GS212.
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.



20 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls and it can be used in combination with /S* option of digital integral drivers, see tab. G212, or Z-ME-KZ/GI (see tab. GS345).
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



13.2 Operating diagrams

Flow /Δp diagram
stated at 100% of spool stroke

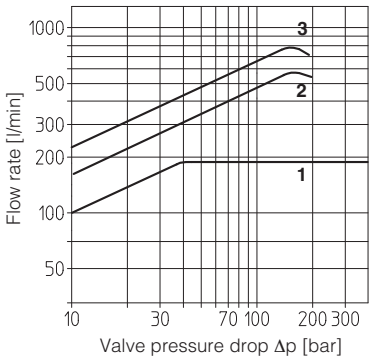
DPZO-1:
1 = spools L5, S5, D5, DL5, D9, V9

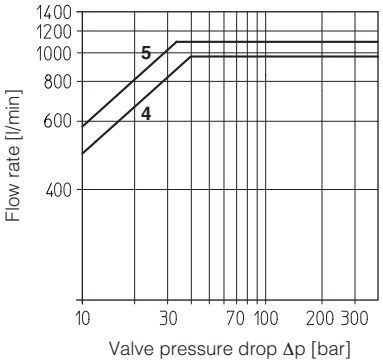
DPZO-2:
2 = spool L3, S3, D3, T5
3 = spools L5, S5, D5, DL5, D9, L9, V9

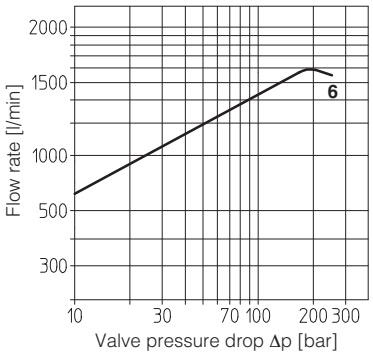
DPZO-4:
4 = spools L5, S5, D5, DL5, D9, V9

DPZO-4M:
5 = spools L5, S5, D5, DL5, D9, V9

DPZO-6:
6 = all spools







Spool stroke [%]

13.3 Bode diagrams

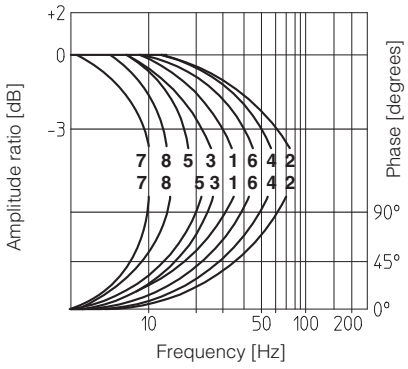
Stated at nominal hydraulic conditions.

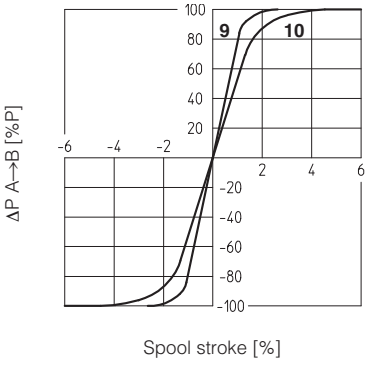
DPZO-1:
1 = 160 and 170 ± 100%
2 = 160 and 170 ± 5%

DPZO-2:
3 = 260 and 270 ± 100%
4 = 260 and 270 ± 5%

DPZO-4 and DPZO-4M:
5 = 460 and 470 ± 100%
6 = 460 and 470 ± 5%

DPZO-6:
7 = 660 and 670 ± 100%
8 = 660 and 670 ± 5%





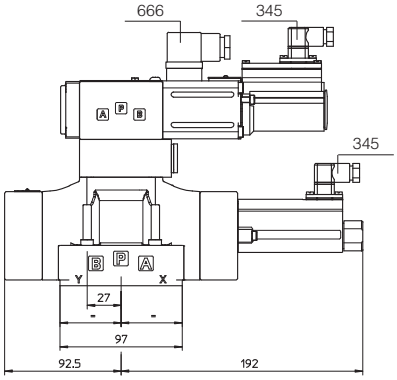
13.4 Pressure gain

9 = DPZO-L(*)-1 *60 and *70
10 = DPZO-L(*)-260, -270
DPZO-L(*)-460, -470
DPZO-L(*)-660, -670

13.5 Dynamic response

The response times in section 2 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.

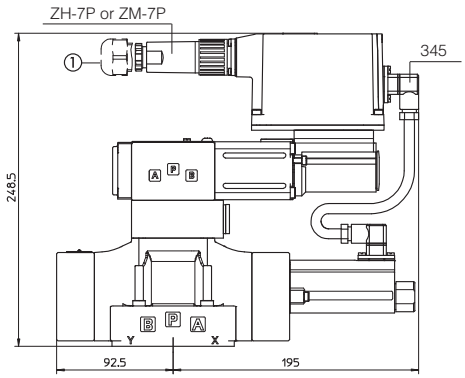
DPZO-L(*)-1



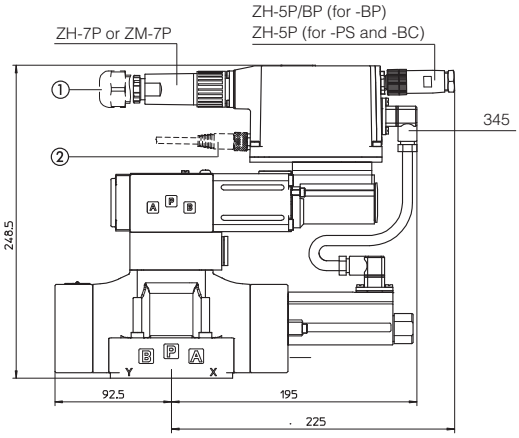
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 2 OR 108
Diameter of ports A, B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;

Mass [kg]

DPZO-L-1	9
DPZO-LE-1	9,4
DPZO-LES-1	

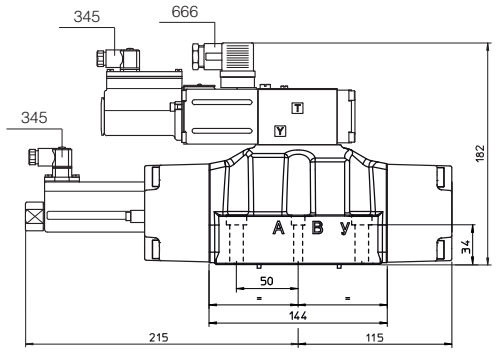


DPZO-LE-1

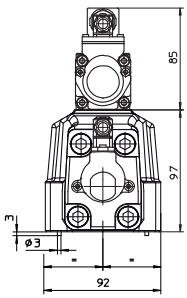


DPZO-LES-*-1

DPZO-L(*)-2



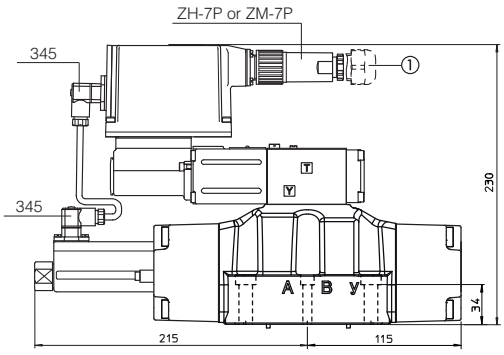
DPZO-L-2



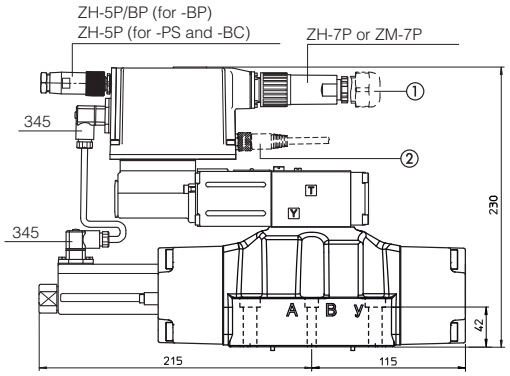
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Seals: 4 OR 130; 3 OR 109/70
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;

Mass [kg]

DPZO-L-2	13,5
DPZO-LE-2	13,9
DPZO-LES-2	



DPZO-LE-2

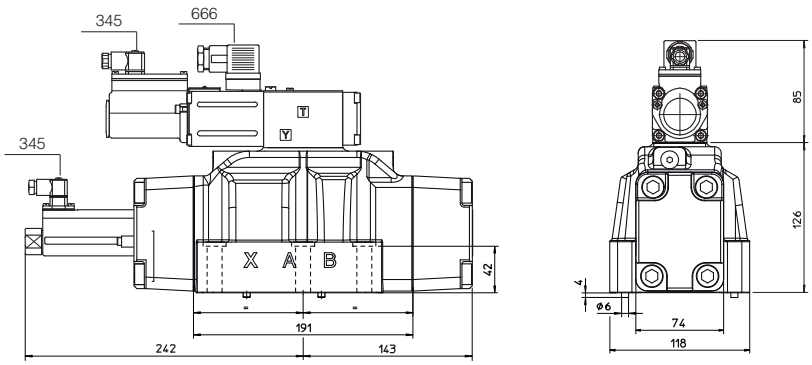


DPZO-LES-*-2

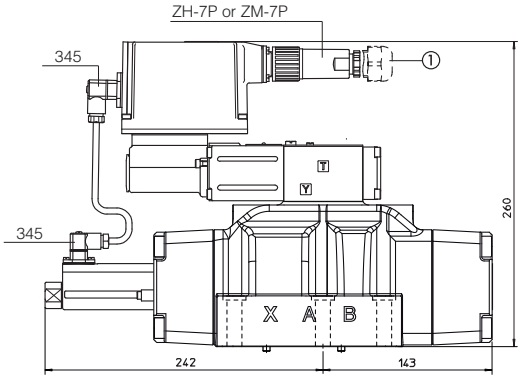
① Dotted line =12 pin connector ZH-12P for options /SF, /SL, /SP, /Z
② = M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

NOTE: The overall height is increased by 30 mm for /G option (0,9 kg).
For option /B the proportional solenoid, the position transducer and the electronics (in case of execution -LE and -LES) are at side of port B of the main stage.

DPZO-L(*)-4
DPZO-L(*)-4M



DPZO-L-4
DPZO-L-4M

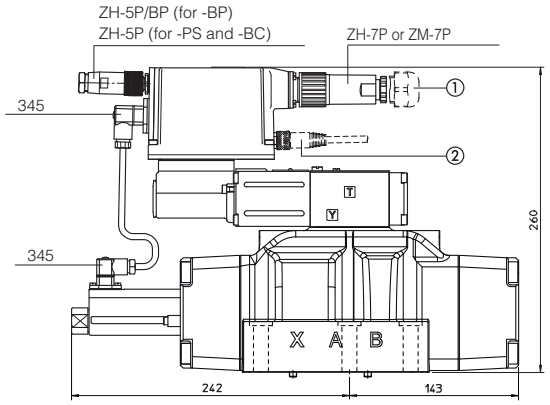


DPZO-LE-4
DPZO-LE-4M

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

DPZO-4
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;

DPZO-4M
Seals: 4 OR 4131; 2 OR 3056
Diameter of ports A, B, P, T: **Ø = 32 mm;**
Diameter of ports X, Y: Ø = 7 mm;



DPZO-LES- *-4
DPZO-LES- *-4M

Mass [kg]

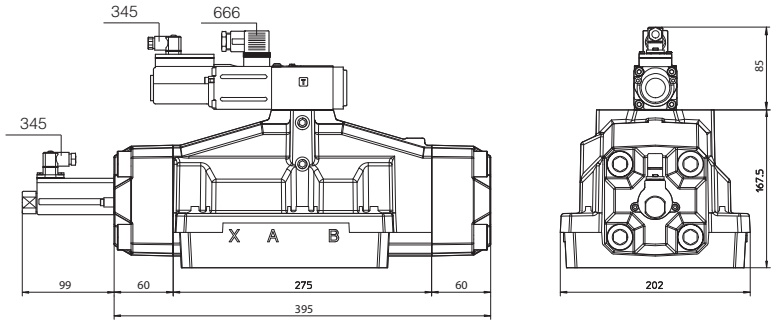
DPZO-L-4	18
DPZO-LE-4	18,9
DPZO-LES-4	

① Dotted line =12 pin connector ZH-12P for options /SF, /SL, /SP, /Z
② = M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

NOTE: The overall height is increased by 40 mm for /G option (0,9 kg).
For option /B the proportional solenoid, the position transducer and the electronics (in case of execution -LE and -LES) are at side of port B of the main stage.

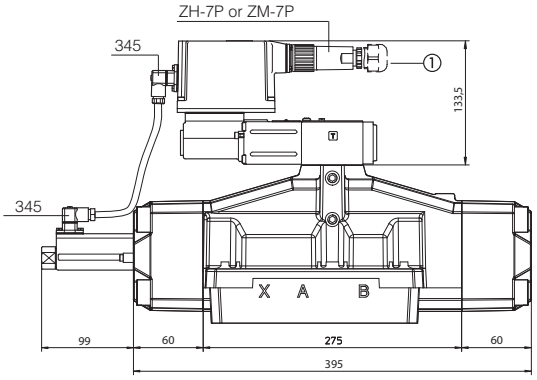
16 INSTALLATION DIMENSIONS FOR DPZO-6 [mm]

DPZO-L(*)-6

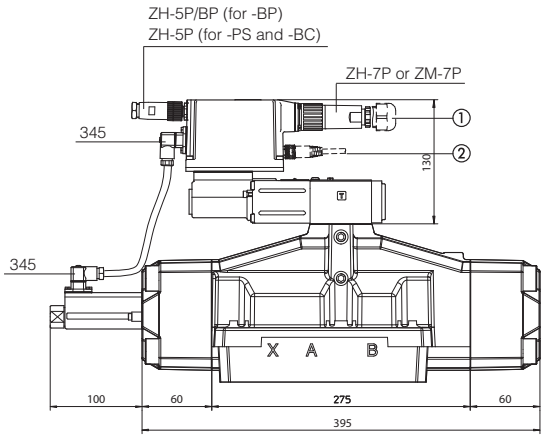


DPZO-L-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
Fastening bolts:
6 socket head screws M20x90 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, 3 OR 3056



DPZO-LE-6



DPZO-LES- *-6

Mass [kg]

DPZO-L-6	42,5
DPZO-LE-6	43,1
DPZO-LES-6	

① Dotted line =12 pin connector ZH-12P for options /SF, /SL, /SP, /Z
② = M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

NOTE: The overall height is increased by 40 mm for /G option (0,9 kg).
For option /B the proportional solenoid, the position transducer and the electronics (in case of execution -LE and -LES) are at side of port B of the main stage.

17 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

VALVE VERSION	-L		-LE, -LES		-LE/Z -LES /Z, /SF, /SL, /SP	serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)	TES /SF, /SL, /SP (transducer)
	Power supply	Transducer						
CONNECTOR CODE	666	345	ZH-7P	ZM-7P	ZH-12P	ZH-5P	ZH-5P/BP	ZH-4P-M8/* (1)
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500		G200, G210, K500			G210, K500		G212, K500

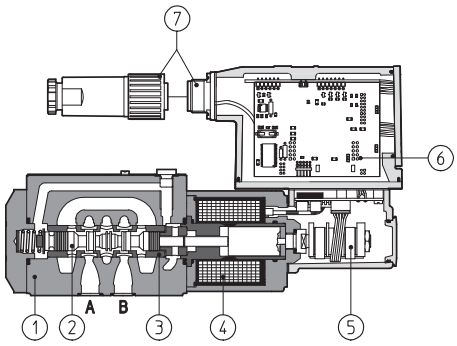
(1) M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

connectors supplied with the valve

Servoproportional valves type DLHZO-TE and DLKZOR-TE

sleeve execution, direct operated, with position transducer, ISO 4401 size 06 and 10

TE and TES executions included in this table are available only for running supplies or spare parts
For new applications it is suggested new TEB and TES executions, see table FS180



DLKZOR-TE-160

① Valve body
② Spool
③ Sleeve
④ Proportional solenoid
⑤ Position transdducer
⑥ Integral electronics
⑦ Main connector

DLHZO and DLKZOR are high performance servoproportional valves, direct operated, with sleeve execution and LVDT position transducer, which provide both directional and non compensated flow control according to the electronic reference signal.
They operate in association with electronic drivers, see section 2, which supply the proportional valves with proper current to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -T, with integral position transducer ⑤;
- -TE, -TES as -T plus analog (TE) or digital (TES) integral electronics ⑥.

The 4-way spool ② is sliding into a precision - machined and hardened sleeve ③ for maximum overlapping accuracy. The sleeve ③ is mechanically forced into a 5-chambers body ①. The spool is directly operated by a proportional solenoids ④ and it is controlled in closed loop position by means of the LVDT position transducer ⑤.

The integral electronics ⑥ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.

The electronic main connector ⑧ is fully interchangable for -TE and -TES executions.

Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.

12 pin connector is used for options /Z and /S*.

The special /S* options add a closed loop control of pressure (/SP) or force (/SF and /SL) to the basic closed loop spool position one.

Following communication interfaces ⑦ are available for the digital -TES execution:
- -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software
- -BC, CANopen interface
- -BP, PROFIBUS DP interface

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

The coils are fully plastic encapsulated (insulation class H) and the valves have antivibration, antishock and weather-proof features.

Mounting surface: ISO 4401 sizes 06 and 10.

Max flow respectively up to 40 l/min and 100 l/min with valve differential pressure Δp = 70 bar, see table 3.

Max pressure = 350 bar

1 MODEL CODE

DLHZO - TES - PS - 0 4 0 - L 7 3 / * / ** / * *

DLHZO = size 06
DLKZOR = size 10

T = with position transducer
TE = as T with integral analog electronics
TES = with digital electronics

Communication interfaces (only for TES)
PS = Serial
BC = CANopen
BP = PROFIBUS DP

Valve size , see section 2
0 = ISO 4401 size 06 **1** = ISO 4401 size 10

Valve configuration, see section 2
4 = spring offset with fail safe
6 = spring offset

0 = zero overlapping

Spool type (regulating characteristics)
L = linear;
D = differential-linear (as **L**, but with P-A = Q, P-B = Q/2) (2)
DT = as **D**, but with non linear regulation (1)
T = not linear regulation **(1)**
V = progressive

0, 1, 3, 5, 7 = spool size, see section 3

Fail safe configuration (de-energized solenoid):
1 = A, B, P, T with positive overlapping (20% of spool stroke)
3 = P positive overlapping (20% of spool stroke); A, B, T negative

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FPM

Series number

Hydraulic options, see section 4**:**
B = solenoid, integral electronics and position transducer at side of port A
Y = external drain

Electronics options, for -TE execution see section 7**:**
F = fault signal
I = current reference input and monitor (4÷20 mA)
Q = enable signal
Z = enable, fault and monitor signals (12 pin connector)

Electronics options, for -TES execution see section 9**:**
I = current reference input and monitor (4÷20mA)
Z = double power supply, enable fault and monitor signals (12 pin connector)

Special options for -TES execution see section 9:
SF = additional closed loop force control, with two remote pressure transducers
SL = additional closed loop force control with one remote load cell
SP = additional closed loop pressure control with one remote pressure transducer
C = current feedback interface for transducer(s) **only for options /SF, /SL, /SP**

Notes:
(1) Spool type **D, DT** and **T** are available only for valve configuration with fail safe position DLHZO-*-040 and DLKZOR-*-140

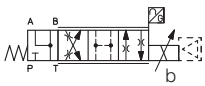
2 ELECTRONIC DRIVERS

Valve model	-T	-TE	-TES	-TES / SF, SL, SP
Drivers model	E-ME-T	E-RI-TE	E-RI-TES	E-RI-TES / SF, SL, SP
Data sheet	G140	G200	G210	G212

Note: For power supply and communication connector see section 15 and 17

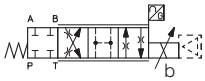
3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols

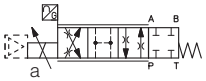


*40-L*3
*40-D*3
*40-DT*3
*40-T*3
*40-V*3

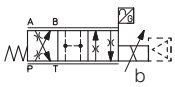
*40-L*3/B
*40-D*3/B
*40-DT*3/B
*40-T*3/B
*40-V*3/B



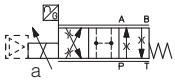
*40-L*1
*40-D*1
*40-DT*1
*40-T*1
*40-V*1



*40-L*1/B
*40-D*1/B
*40-DT*1/B
*40-T*1/B
*40-V*1/B



*60-L*1
*60-V*1



*60-L*1/B
*60-V*1/B

Valve model		DLHZO-T*											DLKZOR-T*					
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		**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Max flow (1) [l/min]		2,5	4,5	5	9	13	18		26			26÷13		40	60			60÷33	
at Δp = 30 bar		4	7	8	14	20	28		40			40÷20		60	100			100÷50	
at Δp = 70 bar		8	14	16	30	40	50		70			70÷40		90	160			160÷80	
max permissible flow																			
Leakage [cm³/min] at P = 100 bar (2)		<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<1500	<400	<400	<1200	<400
Fail safe connections		P → A					P → B					A → T		B → T					
Leakage [cm³/min] at P = 100 bar (3)	Fail safe 1	50					70					70		50					
	Fail safe 3	50					70					-		-					
Flow [l/min] (4) DLHZO	Fail safe 3	-					-					15÷30		10÷20					
Flow [l/min] (4) DLKZOR	Fail safe 3	-					-					40÷60		25÷40					
Response time (5) [ms]		≤ 10												≤ 15					
Hysteresis [%]		≤ 0,1%												≤ 0,1%					
Thermal drift		zero point displacement < 1% at ΔT = 40°C																	

Notes:
- Above performance data refer to valves coupled with Atos electronic drivers, see sections [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 tab. D150).

(1) For different Δp, the max flow is in accordance to the diagrams in section 13.2
(2) Referred to spool in neutral position and 50°C oil temperature.
(3) Referred to spool in fail safe position and 50°C oil temperature.
(4) Referred to spool in fail safe position at Δp = 35 bar per edge and 50°C oil temperature.
(5) 0-100% step signal

4 HYDRAULIC OPTIONS

4.1 Option /B Solenoid, integral electronics and position transducer at side of port A.
4.2 Option /Y External drain is mandatary if the pressure in port T exceeds 160 bar.

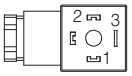
5 GENERAL NOTES

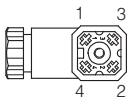
DLHZO and DLKZOR servoproportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

The electrical signals of the valve (e.g. 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).

6 CONNECTIONS FOR -T EXECUTION

SOLENOID POWER SUPPLY CONNECTOR		
PIN	Signal description	
1	SUPPLY	
2	SUPPLY	
3	GND	

POSITION TRANSDUCER CONNECTOR		
PIN	Signal description	
1	OUTPUT SIGNAL	
2	SUPPLY -15 VDC	
3	SUPPLY +15 VDC	
4	GND	

7 ANALOG INTEGRAL DRIVERS -TE - OPTIONS

Standard driver execution provides on the 7 pin main connector:
Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply
Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers
Reference input signal - analog differential input with ±10 VDC nominal range (pin D, E), proportional to desired valve spool position
Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10 VDC nominal range
Following options are available to adapt standard execution to special application requirements:

7.1 Option /F
It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

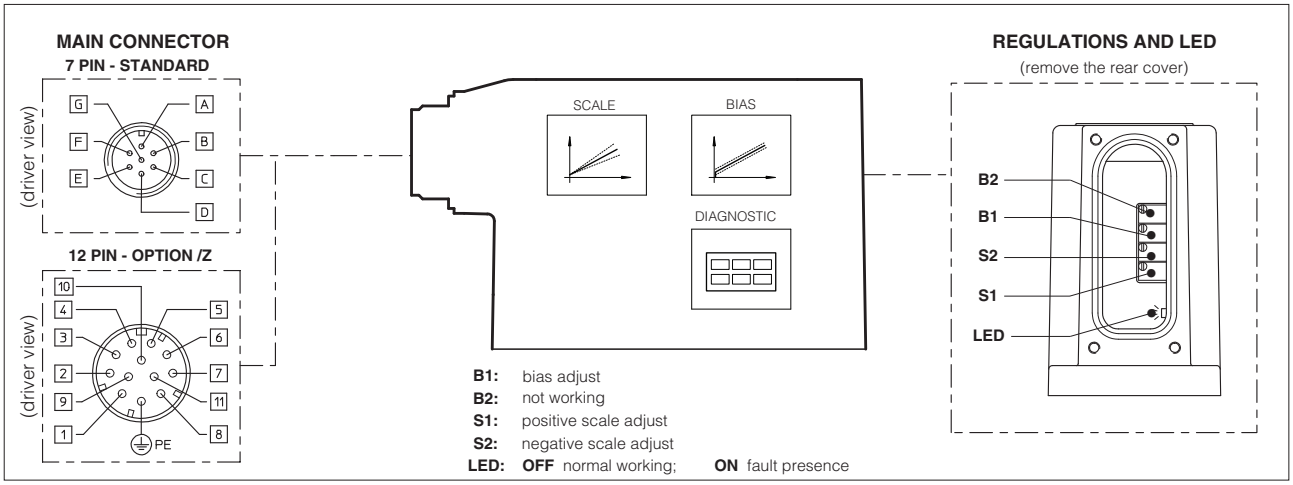
7.2 Option /I
It provides the 4÷20 mA current reference and monitor signals instead of the standard ±10 VDC
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

7.3 Option /Q
It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

7.4 Option /Z
This option includes **/F** and **/Q** features, plus the Monitor output signal.
When the driver is disabled (0 VDC on Enable signal) Fault output is forced to 0 VDC.

7.5 Possible combined options: /FI and /IZ

8 ANALOG INTEGRAL DRIVERS -TE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



8.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage and driver logic	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage and driver logic	Gnd - power supply
C (1)	7	AGND	Ground - signal zero for MONITOR signal (for standard and /Z options)	Gnd - analog signal
	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q and /Z options)	Input - on/off signal
D	4	INPUT+	Reference analog differential input: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Input - analog signal
E	5	INPUT -		
F (2)	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
	11	FAULT	Fault (0V) or normal working (24V) (for F and /Z options)	Output - on/off signal
-	8	R_ENABLE	Repeat Enable - output repetition of Enable input	Output - on/off signal
-	9	NC	do not connect	Output - on/off signal
-	10	NC	do not connect	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Notes (1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B

(2) with /F option FAULT signal replaces MONITOR on pin F.

A minimum time of 50ms to 100ms 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 DIGITAL INTEGRAL DRIVERS -TES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10VDC nominal range

Following options are available to adapt standard execution to special application requirements:

9.1 Option /I

It provides 4÷20 mA current reference and monitor signals instead of the standard ±10 V.

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.

9.2 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Logic power supply

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).

Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal

To enable the driver, supply 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

9.3 Options /SP, /SF and /SL

These options add the closed loop control of pressure (/SP) or force (/SF and /SL) to the basic functions of proportional directional valves: a dedicated software alternates pressure (force) and valve's spool position controls depending on the actual hydraulic system conditions.

A dedicated connector is available for the additional transducers that are required to be interfaced to the valve's driver (1 pressure transducer for /SP, 2 pressure transducers for /SF or 1 load cell for /SL).

Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control: one for reference (pin 7) and one for monitor (pin 8).

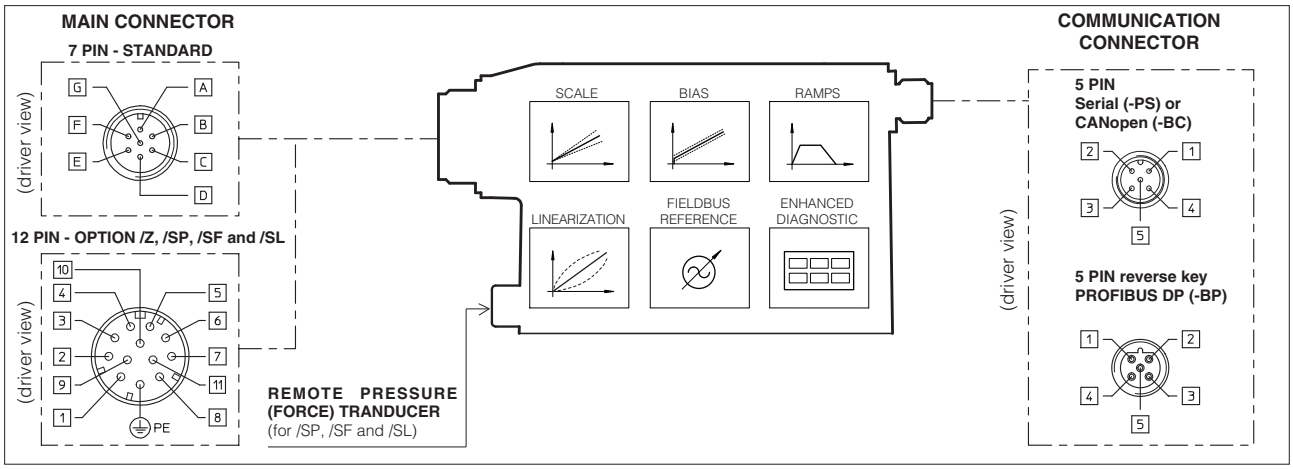
For futher details please refer to the driver technical table **G212.**

9.4 Options /C

Options /CSP, /CSF and /CSL are available to connect pressure (force) transducers with 4 ÷ 20mA current output signal.

9.5 Possible combined options: /ISP, /ISF, /ISL, /CSP, /CSF, /CSL, /CISP, /CISF, /CISL and /IZ

10 DIGITAL INTEGRAL DRIVERS -TES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



10.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
-	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) standard: differential input; /Z option: common mode INPUT+ referred to AGND	Input - analog signal
E	-	INPUT -		
C	5	AGND	Ground - signal zero for MONITOR signal signal zero for INPUT+ signal (only for /Z option)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
-	7	NC	do not connect (pressure/force input for /SP, /SF and /SL options, see 9.3)	
-	8	NC	do not connect (pressure/force monitor for /SP, /SF and /SL options, see 9.3)	
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0V) or normal working (24V)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 300 to 500 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.

10.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION CONNECTORS

	-PS Serial		-BC CANopen		-BP PROFIBUS DP	
PIN	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	

11 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the Atos E-SW programming software, available in three different versions according to the driver's communication execution: **E-SW-PS** (Serial), **E-SW-BC** (CANopen) and **E-SW-BP** (PROFIBUS DP).

For a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table **G500**.

Programming software, must be ordered separately:

E-SW-* (mandatory - first supply) = Dvd including E-SW-* software installer and operator manuals; it allows the registration to Atos digital service

E-SW-*-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com.
Once the registration is completed, the password will be sent by email.

The software remains active for 10 days from the installation date and then it stops until the user inputs his password.

With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

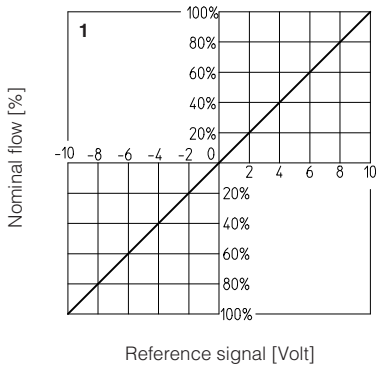
12 MAIN CHARACTERISTICS OF PROPORTIONAL DIRECTIONAL VALVES

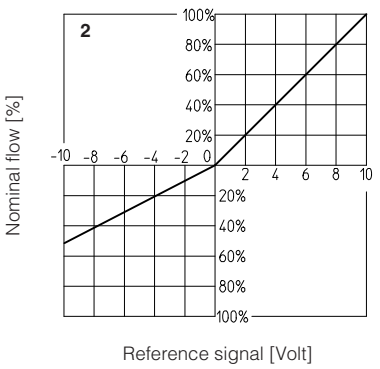
Assembly position	Any position	
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)	
Ambient temperature	-20°C ÷ +70°C for -T execution; -20°C ÷ +60°C for -TE and TES executions	
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1	
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)	
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 μm ($\beta_{10} \geq 75$ recommended)	
Fluid temperature	-20°C +60°C (standard seals and water glycol) -20°C +80°C (/PE seals)	
Valve model	**DLHZO-T***	**DLKZOR-T***
Coil resistance R at 20°C	3 ÷ 3,3 Ω	3,8 ÷ 4,1 Ω
Max. solenoid current	2,6 A	3 A
Max. power	35 Watt	40 Watt
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 (CEI EN-60529)	IP65 for -T execution; IP67 for -TE and -TES executions	
Duty factor	Continuous rating (ED=100%)	

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

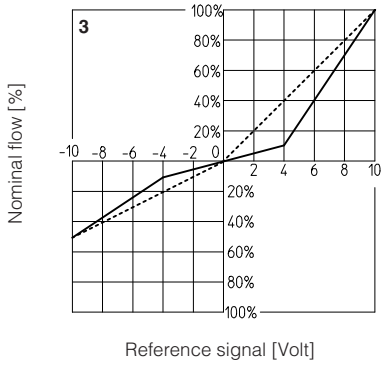


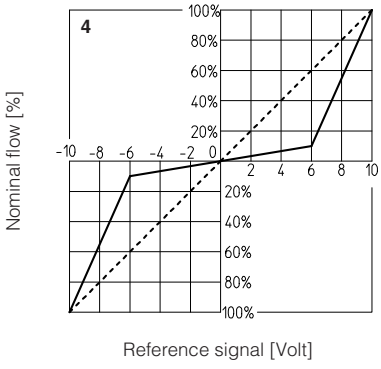


3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZO)

T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (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





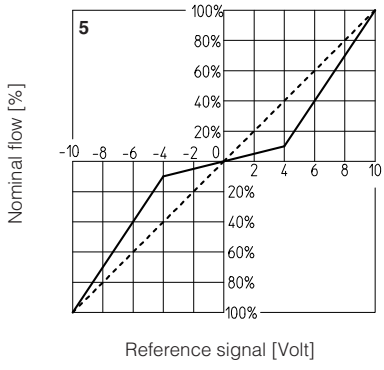
5 = Non linear spool T7
6 = Progressive spool V

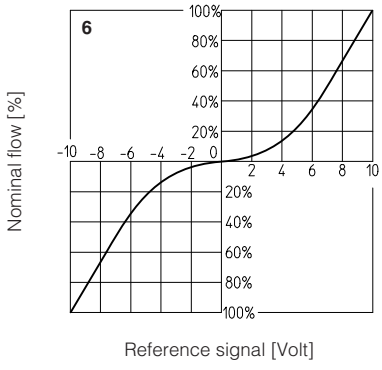
Note:
Hydraulic configuration vs. reference signal:
Standard:
Reference signal 0 ÷+10 V / 12÷20 mA } P → A / B → T

Reference signal 0 ÷-10 V / 4÷12 mA } P → B / A → T

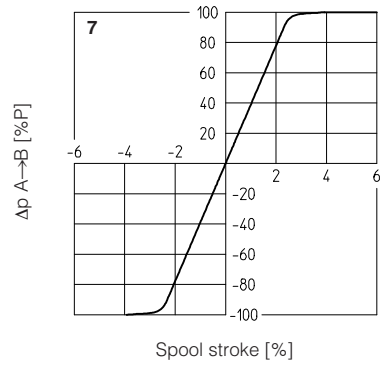
option /B:
Reference signal 0 ÷+10 V / 12÷20 mA } P → B / A → T

Reference signal 0 ÷-10 V / 4÷12 mA } P → A / B → T





7 = Pressure gain

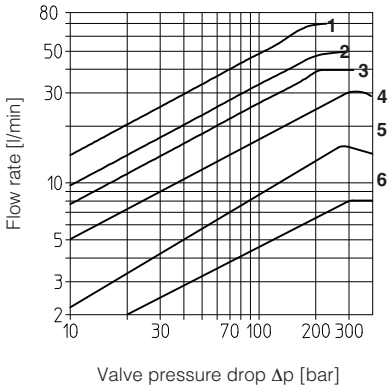


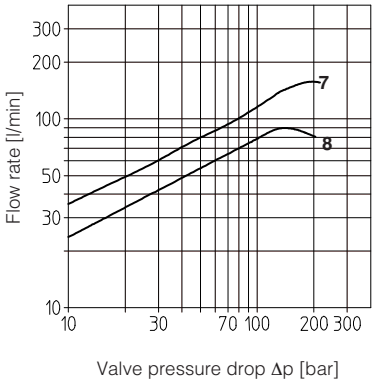
13.2 Flow /Δp diagrams

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



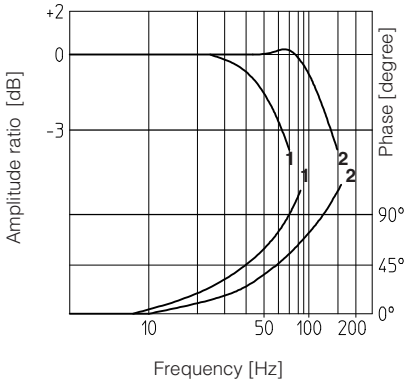


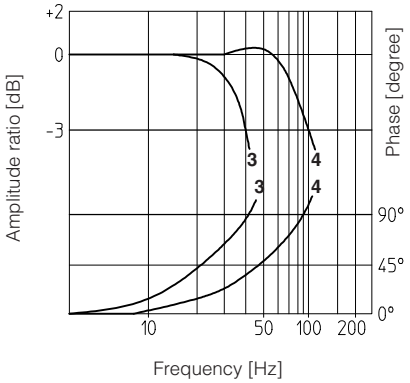
13.3 Bode diagrams

Stated at nominal hydraulic conditions

DLHZO:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZOR:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke





13.4 Dynamic response

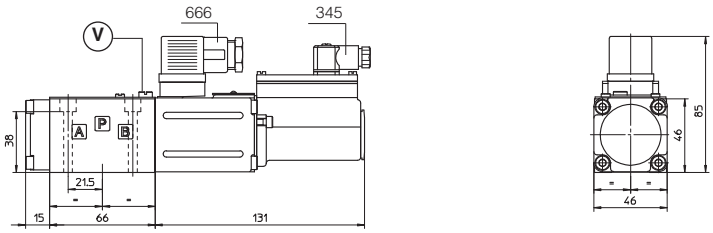
The response times in section 3 have to be considered as average values.
For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

14 INSTALLATION DIMENSIONS [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)

Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108; 1 OR 2025/70
Diameter of ports A, B, P, T: Ø 7,5 mm (max)
Diameter of port Y: Ø 3,2 mm (only for /Y option)

DLHZO-T



Mass: 2,3 kg

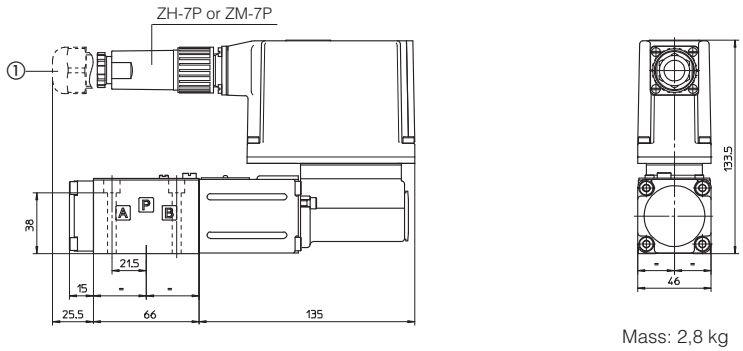
Note: for option /B the solenoid and the position transducer are at side of port A

(V) = Air bleed off

-TE EXECUTION

① Dotted line =12 poles connector ZH-12P for option /Z

DLHZO-TE

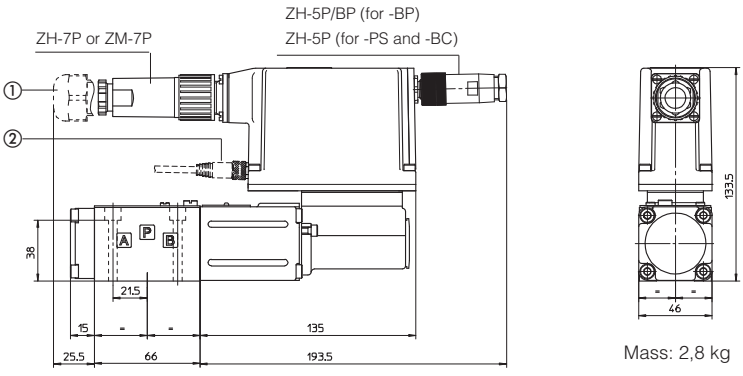


Mass: 2,8 kg

-TES EXECUTION

① Dotted line =12 pin connector ZH-12P for options /SF, /SL, /SP, /Z
② Dotted line = M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

DLHZO-TES



Mass: 2,8 kg

Note: for option /B the solenoid, the position transducer and the integral electronics are at side of port A

15 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

VALVE VERSION	-T		-TE, -TES		-TE/Z -TES /Z, /SF, /SL, /SP	serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)	TES /SF, /SL, /SP (transducer)
	Power supply	Transducer						
CONNECTOR CODE	666	345	ZH-7P	ZM-7P	ZH-12P	ZH-5P	ZH-5P/BP	ZH-4P-M8/* (1)
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500		G200, G210, K500			G210, K500		G212, K500

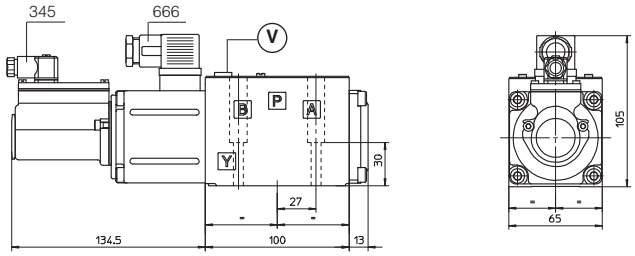
(1) M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

connectors supplied with the valve

16 INSTALLATION DIMENSIONS [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)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 1 OR 108
Diameter of ports A, B, P, T: Ø 11,2 mm (max)
Diameter of port Y: Ø 5 mm (only for /Y option)

DLKZOR-T



Mass: 4,2 kg

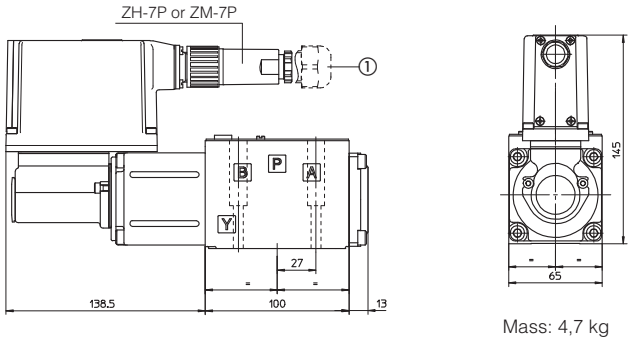
Note: for option /B the solenoid and the position transducer are at side of port A

(V) = Air bleed off

-TE EXECUTION

① Dotted line =12 poles connector ZH-12P for option /Z

DLKZOR-TE

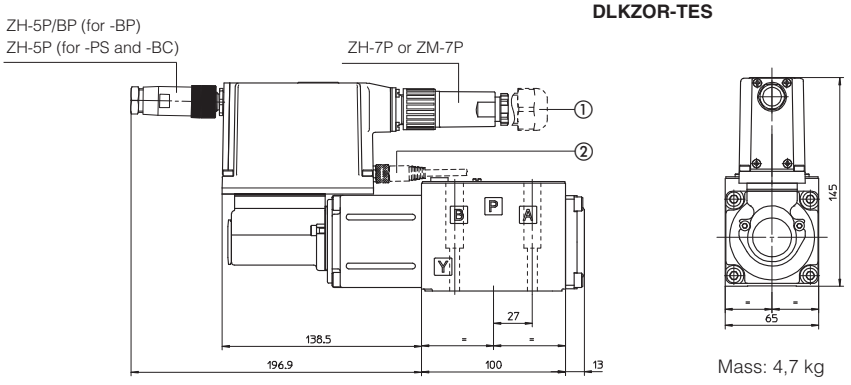


Mass: 4,7 kg

-TES EXECUTION

① Dotted line =12 pin connector ZH-12P for options /SF, /SL, /SP, /Z
② Dotted line = M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

DLKZOR-TES



Mass: 4,7 kg

Note: for option /B the solenoid, the position transducer and the integral electronics are at side of port A

17 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

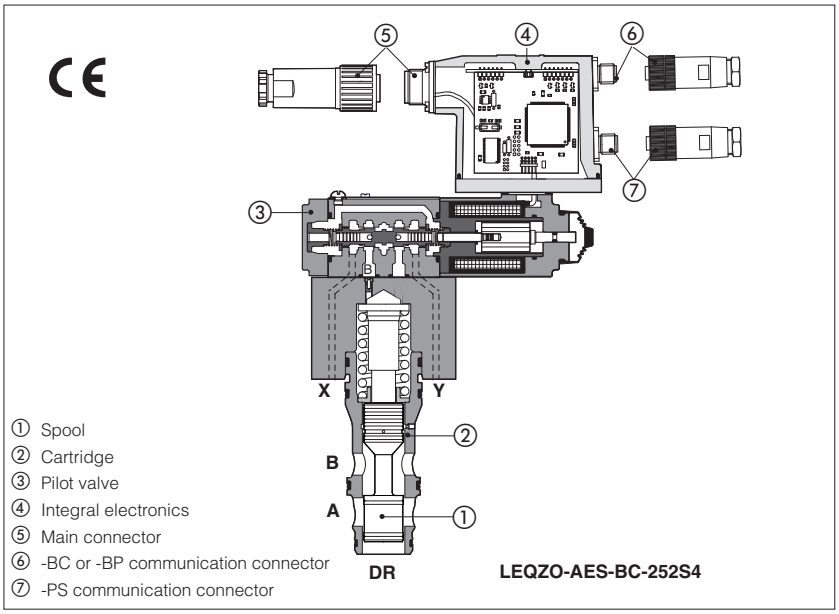
VALVE VERSION	-T		-TE, -TES		-TE/Z -TES /Z, /SF, /SL, /SP	serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)	TES /SF, /SL, /SP (transducer)
	Power supply	Transducer						
CONNECTOR CODE	666	345	ZH-7P	ZM-7P	ZH-12P	ZH-5P	ZH-5P/BP	ZH-4P-M8/* (1)
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500		G200, G210, K500			G210, K500		G212, K500

(1) M8 connector ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
M8 connector ZH-4P-M8/2-2 moulded with 2 cables, 2 mt lenght for 2 pressure transducers (options /SF)

connectors supplied with the valve

Proportional throttle cartridges type LEQZO-A*, 2-way

without position transducer, nominal sizes 16, 25 and 32



① Spool
② Cartridge
③ Pilot valve
④ Integral electronics
⑤ Main connector
⑥ -BC or -BP communication connector
⑦ -PS communication connector

1 MODEL CODE

LEQZO - AES - PS - 25 2 S 4 / * ** /*

Flow control valve

A = without position transducer
AE = as A plus integral electronics
AES = as A plus integral digital electronics

Communication interfaces (only for AES)
PS = Serial (1)
BC = CANopen
BP = PROFIBUS DP

Size:
16 **25** **32**

2 = 2 way

Spool type
L = linear
S = progressive

Spool size: **4** = see section 3

Options for -A execution, see section 5:
6 = with 6 V_{DC} coil instead of standard 12V_{DC} coil
18 = with 18 V_{DC} coil instead of standard 12V_{DC} coil

Electronics options for -AE execution, see section 7:
I = current reference input (4÷20 mA)
Q = enable signal

Electronics options for -AES execution, see section 9:
Q = enable signal
Z = double power supply, enable fault and monitor (12 pin connector)

Series number

Syntethic fluids
WG = water-glycol
PE = phosphate ester

Notes
(1) Serial interface always present, also for -BC and -BP options

LEQZO-A* are 2-way proportional cartridge valves, designed for mounting in manifold blocks and provide not compensated flow control according to the electronic reference signal.
They operate in association with electronic drivers, see table 2 which supply the proportional valve with proper current to align valve regulation to the reference signal supplied to the electronic driver.
They are available in different executions:

- -A, without position transducer;
- -AE, -AES as -A plus analogue (AE) or digital (AES) integral electronics.

The regulation is operated by means of a spool ① sliding into a cartridge ② piloted by the proportional pressure reducing valve type DHRZO ③.
The integral electronics ④ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.
The electronic main connector ⑤ is fully interchangeable for -AE and -AES executions.
Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.
12 pin connector is used for AEG version and for option /Z (AES).
Following communication interfaces ⑥, ⑦ are available for the digital -AES execution:

- standard -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software - always present.
- optional -BC, CANopen interface (only for -AES)
- optional -BP, PROFIBUS-DP interface (only for -AES)

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

The coils are fully plastic encapsulated (insulation class H), and the valves have antivibration, antishock and weather-proof features.

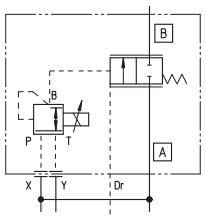
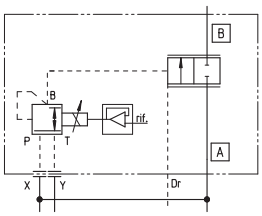
- Reduced response times
- Accurate flow regulation with good repeatibility
- Sizes: 16, 25 and 32.
- Max flow up to 350 l/min with differential pressure Δp = 5 bar, see section 3.
- Max pressure: 250 bar.

2 ELECTRONIC DRIVERS FOR LEQZO

Valve model	-A						-AE	-AES
Drivers model	E-MI-AC-01F	E-MI-AS-IR	E-BM-AC-01F	E-BM-AS-PS	E-ME-AC-01F	E-RP-AC-01F	E-RI-AE	E-RI-AES
Data sheet	G010	G020	G025	G030	G035	G100	G110	G115

Note: For power supply and communication connector see section 16

3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols	LEQZO-A	LEQZO-AE, LEQZO-AES
		

Valve model		LEQZO-A, LEQZO-AE, LEQZO-AES					
Valve size		16		25		32	
Spool type and size		S4	L4	S4	L4	S4	L4
Max regulated flow at Δp = 5 bar at Δp = 10 bar	[l/min]	 140 200		 230 320		 350 490	
Max pressure (1)	[bar]	Ports A, B, X = 250		Y = 5		Dr = 5	
Response time 0 ÷ 100% step signal	[ms]	75					
Hysteresis	[% of max flow]	≤ 5%					
Repeatability	[% of max flow]	± 1%					

Notes:
• Above performance data refer to valves coupled with Atos electronic drivers, see section 2.
1) Minimum piloting pressure X port = 25 bar.

4 GENERAL NOTES

LEQZO proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

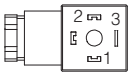
The electrical signals of the valve (e.g. monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

5 OPTIONS FOR -A EXECUTION

5.1 Option /6 6 VDC coil instead of standard 12 VDC, to be used in case of power supply 12 VDC

5.2 Option /18 18 VDC coil instead of standard 12 VDC, to be used with electronic drivers not supplied by Atos

6 CONNECTIONS FOR -A EXECUTION

SOLENOID POWER SUPPLY CONNECTOR		
PIN	Signal description	
1	SUPPLY	
2	SUPPLY	
3	GND	

7 ANALOG INTEGRAL DRIVERS -AE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with 0÷+10VDC nominal range (pin D,E), proportional to desired coil current

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

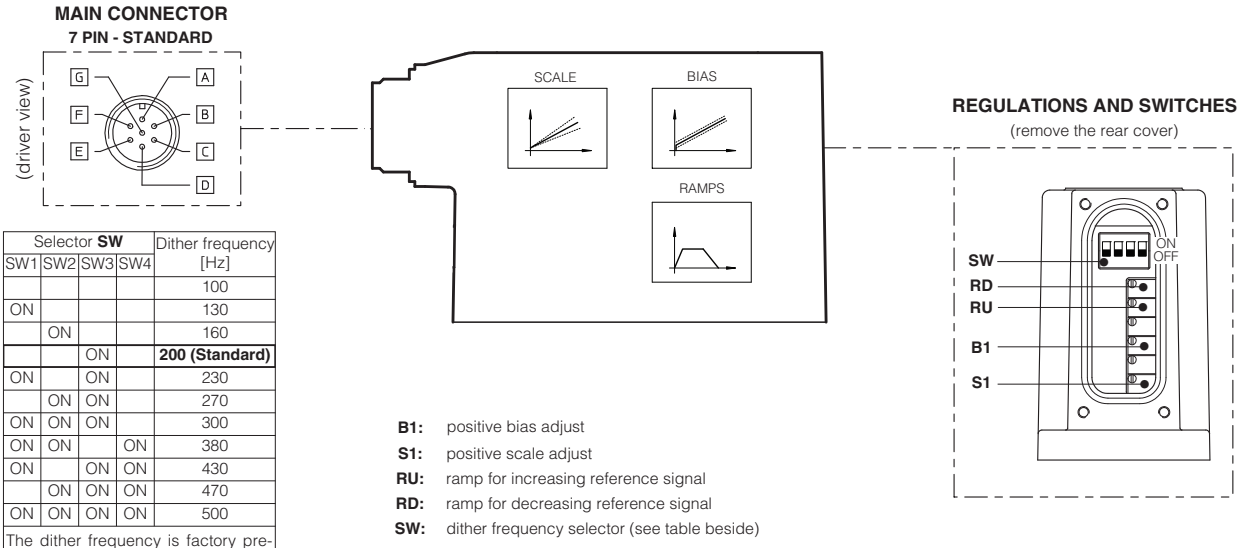
Following options are available to adapt standard execution to special application requirements:

7.1 Option /I
It provides the 4÷20 mA current reference signal instead of the standard 0÷+10 VDC. Monitor output signal is still the standard 0÷+10VDC.
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.

7.2 Option /Q
It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

7.3 Possible combined option: /IQ

8 ANALOG INTEGRAL DRIVERS -AE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



Selector **SW**				Dither frequency
SW1	SW2	SW3	SW4	[Hz]
				100
ON				130
	ON			160
		ON		**200 (Standard)**
ON		ON		230
	ON	ON		270
ON	ON	ON		300
ON	ON		ON	380
ON		ON	ON	430
	ON	ON	ON	470
ON	ON	ON	ON	500

The dither frequency is factory preset at 200 Hz and its regulation may be adjusted after contact with Atos technical department

B1: positive bias adjust
S1: positive scale adjust
RU: ramp for increasing reference signal
RD: ramp for decreasing reference signal
SW: dither frequency selector (see table beside)

8.1 ELECTRONIC CONNECTIONS - 7 PIN MAIN CONNECTORS

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	V+	Power supply 24 VDC for solenoid power stage and driver logic	Input - power supply
B	V0	Power supply 0 VDC for solenoid power stage and driver logic	Gnd - power supply
C (1)	AGND	Ground - signal zero for MONITOR signal	Gnd - analog signal
	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q option)	Input - on/off signal
D	INPUT+	Reference analog differential input: 0÷10 VDC maximum range (4 ÷ 20 mA for /I option) Default setting: 0÷+10 VDC (4 ÷ 20 mA for /I option)	Input - analog signal
E	INPUT -		
F	MONITOR	Monitor analog output: 0÷+5 VDC maximum range; 1 V = 1 A	Output - analog signal
G	EARTH	Internally connected to the driver housing	

Note: (1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B.

A minimum time of 60ms to 160ms 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 DIGITAL INTEGRAL DRIVERS -AES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

Reference input signal - analog differential input with 0÷+10 VDC nominal range (pin D,E), proportional to desired coil current (4÷20 mA with cable break detection, ±10 mA, ±20 mA or 0÷20 mA software selectable)

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monior = 1A coil current)

Following options are available to adapt standard execution to special application requirements:

9.1 Option /Q

To enable the driver, supply 24Vdc on pin C referred to pin B: when the enable signal is set to zero the valve status is software selectable, by factory default the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active. For the complete list of selectable status, see tab. G115.

9.2 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Logic power supply

Option /Z provides separate power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).

Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

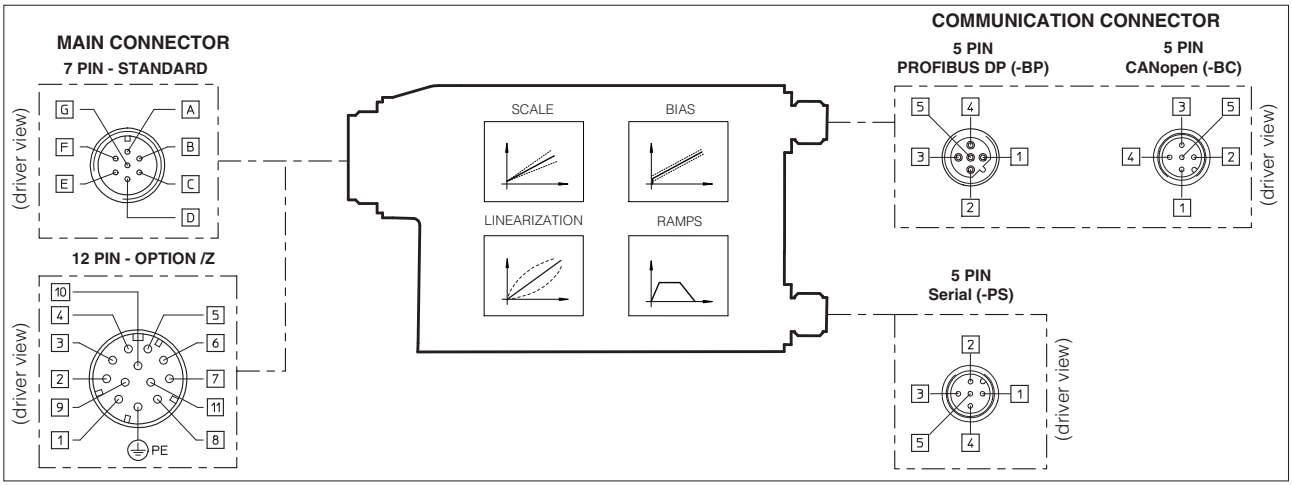
Enable Input Signal

To enable the driver, supply 24Vdc on pin C referred to pin B: when the enable signal is set to zero the valve status is software selectable, by factory default the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active. For the complete list of selectable status, see tab. G115.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal.

10 DIGITAL INTEGRAL DRIVERS -AES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



10.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
-	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: ±10 VDC, ±20 mA maximum range software selectable Default setting: 0÷+10 VDC, differential input /Z option common mode INPUT+ referred to AGND	Input - analog signal
E	-	INPUT -		
C	5	AGND	Ground - signal zero for MONITOR signal (INPUT+ signal only for /Z option)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: 0÷+10 VDC maximum range	Output - analog signal
-	7	NC	do not connect	
-	8	NC	do not connect	
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 270 to 340 ms have be considered between the driver energizing with the 24VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION AND PRESSURE TRANSDUCER CONNECTORS

	-PS Serial		-BC CANopen		-BP PROFIBUS DP		/W pressure connector	
PIN	SIGNAL	TECHNICAL SPECIF.	SIGNAL	TECHNICAL SPECIF.	SIGNAL	TECHNICAL SPECIF.	SIGNAL	TECHNICAL SPECIF.
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination	VT	transducer power supply 24 VDC
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)	TR	transducer signal 0÷10 VDC
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	Data line and termination Signal zero	AGND	Signal zero for power supply and signal
4	RS_RX	Receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)	NC	do not connect
5	RS_TX	Transmitting data line	CAN_L	Bus line (low)	SHIELD	do not connect	NC	do not connect

11 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the Atos E-SW programming software, available in three different versions according to the driver's communication execution: **E-SW-PS** (Serial), **E-SW-BC** (CANopen) and **E-SW-BP** (PROFIBUS DP). Programming software E-SW-BC and E-SW-BP, for BC and BP drivers, can be also used to modify the valve's parameterization through the serial communication interface, without disconnecting the valve from the machine's bus line.

For a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table **G500**.

Programming software, must be ordered separately:

E-SW-* (mandatory - first supply) = Dvd including E-SW-* software installer and operator manuals; it allows the registration to Atos digital service

E-SW-*-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com.
Once the registration is completed, the password will be sent by email.

The software remains active for 10 days from the installation date and then it stops until the user inputs his password.

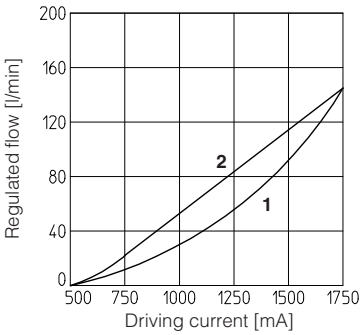
With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

12 MAIN CHARACTERISTICS OF PROPORTIONAL THROTTLE CARTRIDGE

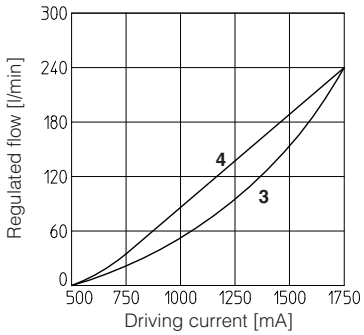
Assembly position	Any position
Subplate surface finishing	Roughness index, $\sqrt{}^{0.4}$ flatness ratio 0,01/100 (ISO 1101)
Ambient temperature	-20°C ÷ +70°C for -A execution; -20°C ÷ +60°C for -AE and -AES executions
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)
Fluid contamination class	ISO 18/15 achieved with in line filters of 10 μm and $\beta_{10} \geq 75$ (recommended)
Fluid temperature	-20°C +60°C (standard and /WG seals) -20°C +80°C (/PE seals)
Coil resistance R at 20°C	3 ÷ 3.3 Ω for standard 12 VDC coil; 2 ÷ 2,2 Ω for 6 VDC coil; 13 ÷ 13,4 Ω for 18 VDC coil
Max solenoid current	2,6 A for standard 12 VDC coil; 3,25 A for 6 VDC coil; 1,5 A for 18 VDC coil
Max power	40 Watt
Protection degree (CEI EN-60529)	IP65 for -A execution; IP67 for -AE and AES executions
Duty factor	Continuous rating (ED=100%)

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

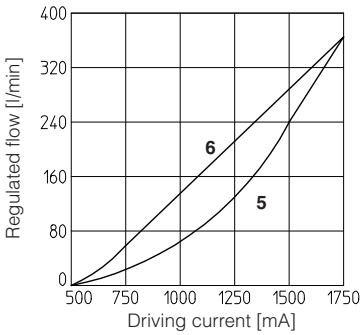
13.1 Regulation diagrams measured at Δp 5 bar



1 = LEQZO-A*-162S4
2 = LEQZO-A*- 162L4



3 = LEQZO-A*- 252S4
4 = LEQZO-A*- 252L4

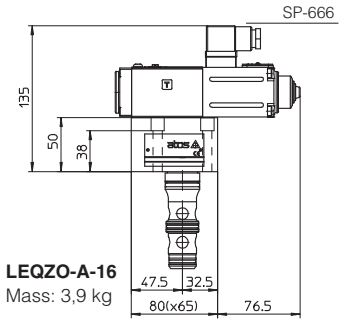


5 = LEQZO-A*- 322S4
6 = LEQZO-A*- 322L4

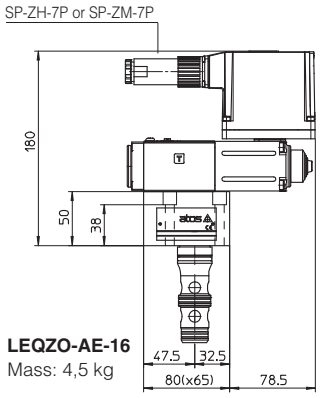
Notes: with 18 VDC coil the driving current is half of standard 12 VDC coil
For the valves with digital electronics, the regulation characteristic can be modified by setting the internal software parameters, see tab. G500.

14 DIMENSIONS [mm]

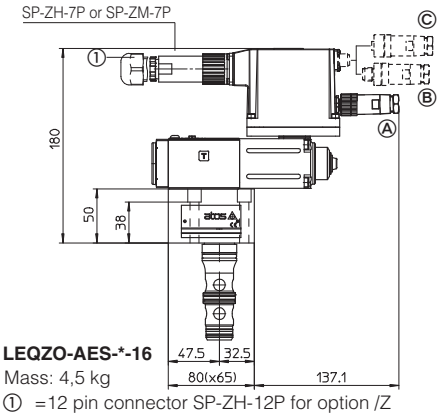
Fastening bolts:
N°4 M8x50 class 12.9
Tightening torque = 35 Nm



LEQZO-A-16
Mass: 3,9 kg

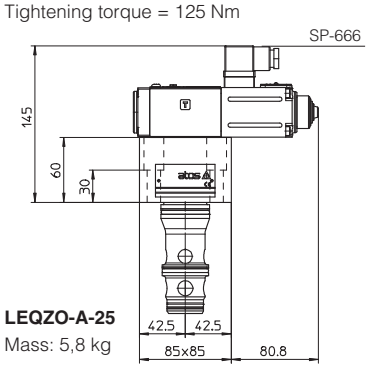


LEQZO-AE-16
Mass: 4,5 kg

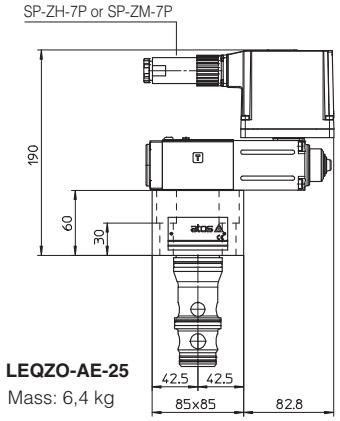


LEQZO-AES-*-16
Mass: 4,5 kg
① =12 pin connector SP-ZH-12P for option /Z

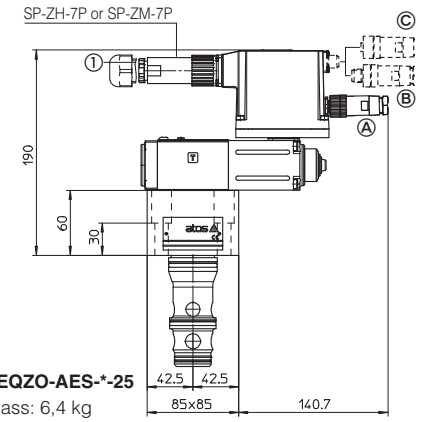
Fastening bolts:
N°4 M12x50 class 12.9
Tightening torque = 125 Nm



LEQZO-A-25
Mass: 5,8 kg

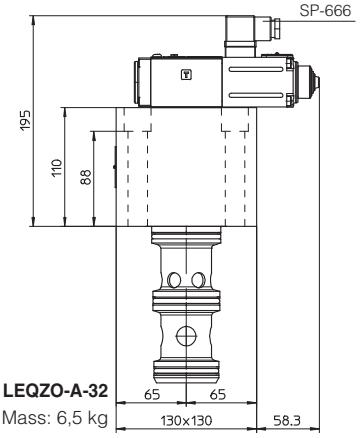


LEQZO-AE-25
Mass: 6,4 kg

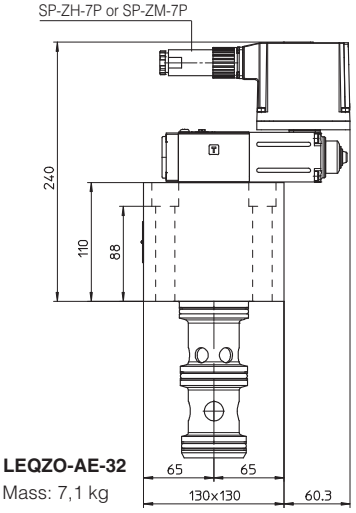


LEQZO-AES-*-25
Mass: 6,4 kg
① =12 pin connector SP-ZH-12P for option /Z

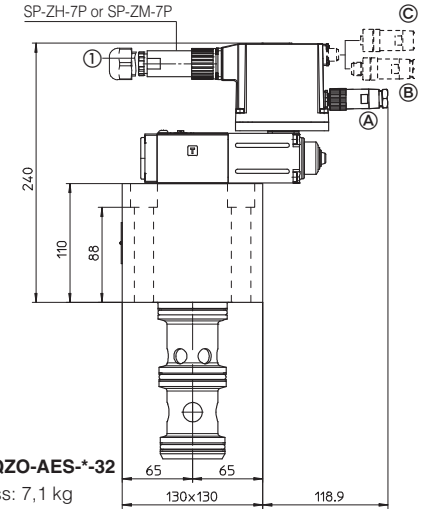
Fastening bolts:
N°4 M16x120 class 12.9
Tightening torque = 300 Nm



LEQZO-A-32
Mass: 6,5 kg



LEQZO-AE-32
Mass: 7,1 kg

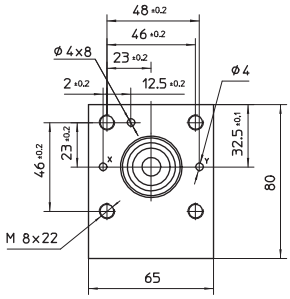


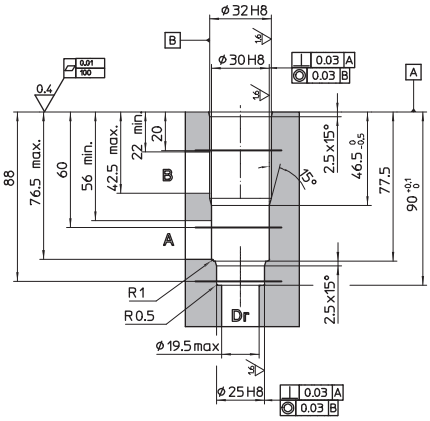
LEQZO-AES-*-32
Mass: 7,1 kg

Ⓐ -PS communication interface, SP-ZH-5P connector
Ⓑ -BP communication interface, SP-ZH-5P/BP connector
① Dotted line =12 pin connector SP-ZH-12P for option /Z
Ⓒ -BC communication interface, SP-ZH-5P connector

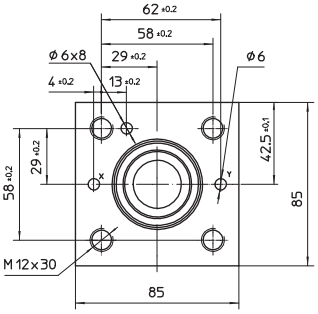
15 COVER INTERFACE AND CAVITY DIMENSIONS FOR LEQZO [mm]

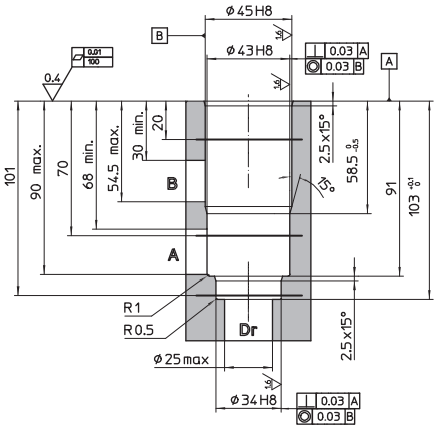
Size 16



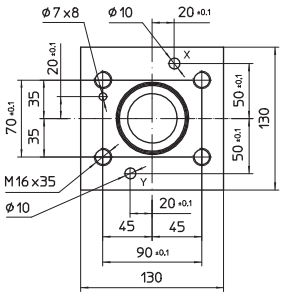


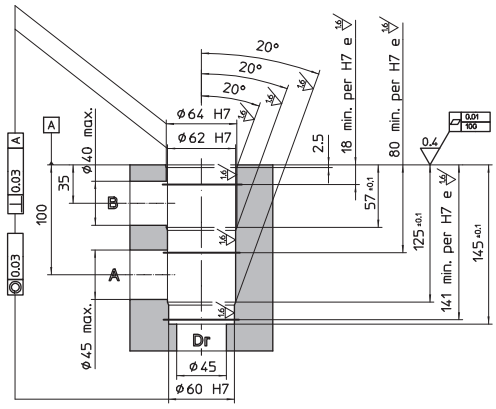
Size 25





Size 32





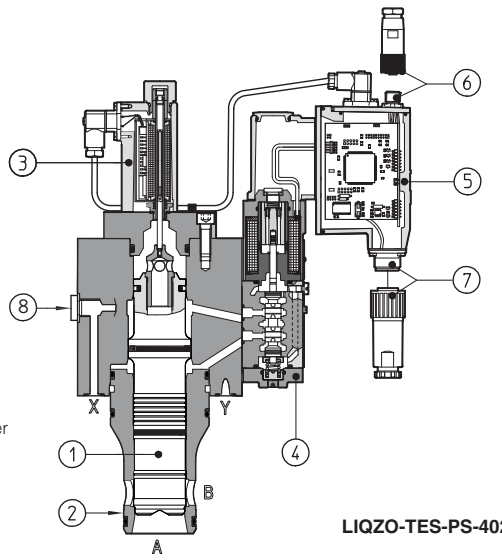
16 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

VALVE VERSION	-A	-AE, -AES		-AES/Z	-Serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)
CONNECTOR CODE	SP-666	SP-ZH-7P	SP-ZM-7P	SP-ZH-12P	SP-ZH-5P	SP-ZH-5P/BP
PROTECTION DEGREE	IP65	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500	G110, G115, K500			G115, K500	

connectors supplyed with the valve

Proportional throttle cartridges type LIQZO-T*, 2-way

with position transducer, ISO 7368 sizes from 16 to 50



① Poppet
② Sleeve
③ Main stage position transducer
④ Pilot valve
⑤ Integral electronics
⑥ Communication connector
⑦ Main connector
⑧ External pilot port

LIQZO-TES-PS-402L4

1 MODEL CODE

LIQZO - TES - PS - 25 2 L4 / * ** /*

Flow control valve

T = with position transducer
TE = as T plus integral analog electronics
TES = as T plus integral digital electronics

Communication interfaces (only for TES)
PS = Serial
BC = CANopen
BP = PROFIBUS DP

Valve size , see section 3
16 25 32 40 50

Valve configuration, see section 3
2 = 2 way

Spool type (regulating characteristics):
L4 = linear

Electronics options, for -TE execution
see section 6:
I = current reference input and monitor (4÷20 mA)
F = fault signal
Q = enable signal
Z = enable, fault and monitor signals (12 pin connector)

Electronics options, for -TES execution
see section 8:
I = current reference input and monitor (4÷20 mA)
Z = double power supply, enable fault and monitor signals (12 pin connector)

Series number

Synthetic fluids:
WG = water-glycol
PE = phosphate ester

Versions with reduced flow are available on request *2L2.

LIQZO-TE are 2-way proportional cartridge valves, designed for mounting in manifold blocks which provide proportional not compensated flow control according to the electronic reference signal.
They operate in association with electronic drivers, see section 2, which supply the proportional valves with proper current to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -T, with position transducer ③;
- -TE, -TES as -T plus analogue (TE) or digital (TES) integral electronics ⑤.

The regulation is operated by means of a poppet ① with double piloting area, sliding into a sleeve ② and provided of integral LVDT position transducer ③.
The poppet is controlled in closed loop by means of a proportional directional valve ④ type DHZO, see table F160.

The integral electronics ⑤ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.

The electronic main connector ⑦ is fully interchangeable for -TE and -TES executions.

Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.

12 pin connector is used for option /Z.

Following communication interfaces ⑥ are available for the digital -TES execution:
- -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software
- -BC, CANopen interface
- -BP, PROFIBUS-DP interface

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

Typical applications: plastic injection and blow moulding, foundry and steel plants.
Mounting surface: ISO 7368
Sizes from 16 to 50
Max flow up to 2000 l/min with differential pressure Δp = 5 bar, see section 3.

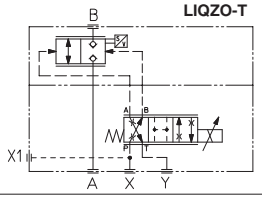
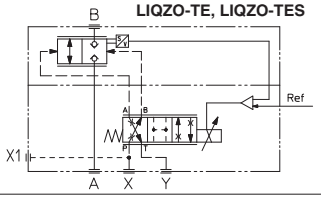
Max pressure = 350 bar.

2 ELECTRONIC DRIVERS

Valve model	-T	-TE	-TES
Drivers model	E-ME-T	E-RI-TE	E-RI-TES
Data sheet	G140	G200	G210

Note: For power supply and communication connector see section 15

3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols		LIQZO-T			LIQZO-TE, LIQZO-TES	
						
Model		LIQZO-T*				
Size		16	25	32	40	50
Max regulated flow	[l/min]					
at Δp = 5 bar		250	500	800	1200	2000
at Δp =10 bar		350	700	1100	1700	2800
Max permissible flow		600	1200	1800	2500	4000
Max pressure	[bar]	350				
Nominal flow of pilot valve at Δp = 70 bar	[l/min]	15				
Leakage of pilot valve at P = 100 bar	[l/min]	1				
Response time 0 ÷ 100% step signal	[ms]	22	25	30	32	40
Piloting volume	[cm³]	1,58	2,16	7,0	9,4	17,7
Hysteresis	[% of the max flow]	≤ 0,5%				
Repeatability	[% of the max flow]	± 0,5%				
Thermal drift		zero point displacement < 1% at ΔT = 40°C				

Notes:
- Above performance data refer to valves coupled with Atos electronic drivers, see section 2.
- Recommended piloting pressure is 140 ÷ 160 bar.
- In case of long time shutdown of the hydraulic supply to the pilot valve, the driver has to be switched off to avoid its overheating.

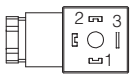
4 GENERAL NOTES

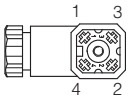
LIQZO-T* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

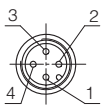
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

The electrical signals of the valve (e.g. 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 CONNECTIONS FOR -T EXECUTION

SOLENOID POWER SUPPLY CONNECTOR SP-666		
PIN	Signal description	
1	SUPPLY	
2	SUPPLY	
3	GND	

POSITION TRANSDUCER CONNECTOR SP-345		
SIZES 16 ÷ 40		
PIN	Signal description	
1	OUTPUT SIGNAL	
2	SUPPLY -15 VDC	
3	SUPPLY +15 VDC	
4	GND	

POSITION TRANSDUCER CONNECTOR ZBE 06		
SIZE 50		
PIN	Signal description	
1	OUTPUT SIGNAL	
2	SUPPLY +24 VDC	
3	GND	
4	NC	

6 ANALOG INTEGRAL DRIVERS -TE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10 VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10 VDC nominal range

Following options are available to adapt standard execution to special application requirements:

6.1 Option /F

It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC

6.2 Option /I

It provides the 4÷20 mA current reference and monitor signals instead of the standard ±10 VDC

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.

6.3 Option /Q

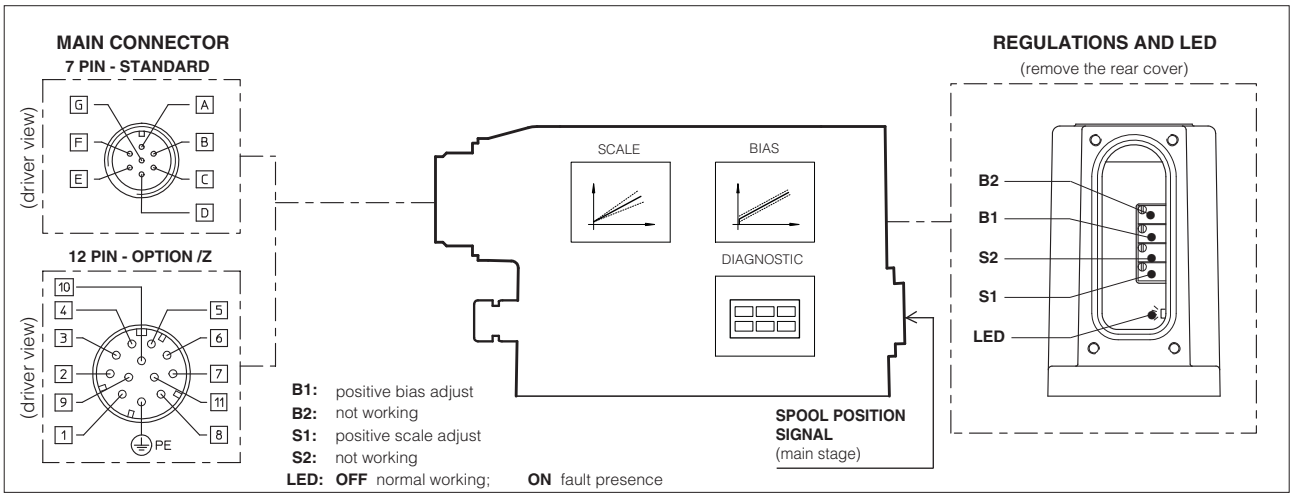
It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

6.4 Option /Z

This option includes **/F** and **/Q** features, plus the Monitor output signal.
When the driver is disabled (0 VDC on Enable signal) Fault output is forced to 0 VDC.

6.5 Possible combined options: /FI and /IZ

7 ANALOG INTEGRAL DRIVERS -TE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



7.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage and driver logic	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage and driver logic	Gnd - power supply
C (1)	7	AGND	Ground - signal zero for MONITOR signal (for standard, /Z option)	Gnd - analog signal
	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q and /Z options)	Input - on/off signal
D	4	INPUT+	Reference analog differential input: 0 ÷ +10 VDC maximum range (4 ÷ 20 mA for /I option)	Input - analog signal
E	5	INPUT -		
F (2)	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
	11	FAULT	Fault (0V) or normal working (24V) (for /F and /Z options)	Output - on/off signal
-	8	R_ENABLE	Repeat Enable - output repetition of Enable input	Output - on/off signal
-	9	NC	do not connect	Output - on/off signal
-	10	NC	do not connect	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Notes:
(1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B

(2) with /F option FAULT signal replaces MONITOR on pin F.

- A minimum time of 50ms to 100ms 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 DIGITAL INTEGRAL DRIVERS -TES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10VDC nominal range

Following options are available to adapt standard execution to special application requirements:

8.1 Option /I

It provides 4÷20 mA current reference and monitor signals instead of the standard ±10 V.
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.

8.2 Option /Z

It provides on the 12 pin main connector the following additional features:

Logic power supply

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).
Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal

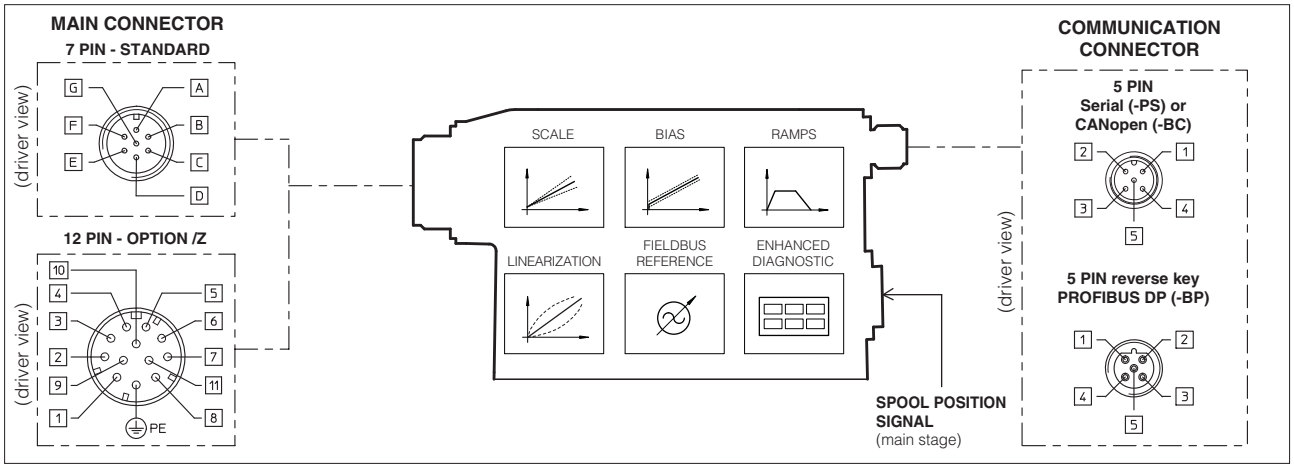
To enable the driver, supply 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

8.3 Possible combined options: /IZ

9 DIGITAL INTEGRAL DRIVERS -TES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



9.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
-	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: 0 ÷ +10 VDC maximum range (4 ÷ 20 mA for /I option)	Input - analog signal
E	-	INPUT -	standard: differential input; /Z option: common mode INPUT+ referred to AGND	
C	5	AGND	Ground - signal zero for MONITOR signal signal zero for INPUT+ signal (only for /Z option)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
-	7	NC	do not connect	
-	8	NC	do not connect	
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0V) or normal working (24V)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 300 to 500 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.

9.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION CONNECTORS

	-PS Serial		-BC CANopen		-BP PROFIBUS DP	
PIN	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	

10 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the Atos E-SW programming software, available in three different versions according to the driver's communication execution: **E-SW-PS** (Serial), **E-SW-BC** (CANopen) and **E-SW-BP** (PROFIBUS DP).

For a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table **G500**.

Programming software, must be ordered separately:

E-SW-* (mandatory - first supply) = Dvd including E-SW-* software installer and operator manuals; it allows the registration to Atos digital service

E-SW-*-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com.
Once the registration is completed, the password will be sent by email.

The software remains active for 10 days from the installation date and then it stops until the user inputs his password.

With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

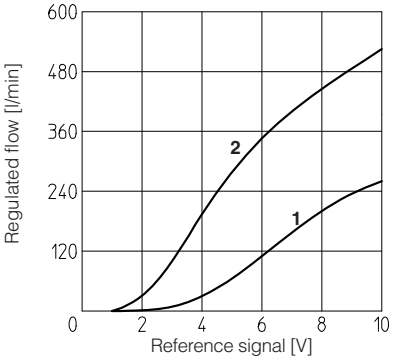
11 MAIN CHARACTERISTICS OF PROPORTIONAL THROTTLE CARTRIDGE VALVES

Assembly position	Any position
Subplate surface finishing	Roughness index, $\sqrt{}^{0.4}$ flatness ratio 0,01/100 (ISO 1101)
Ambient temperature	-20°C ÷ +70°C for -T execution; -20°C ÷ +60°C for -TE and TES executions
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)
Fluid contamination class	ISO 18/15 achieved with in line filters of 10 μm and $\beta_{10} \geq 75$ (recommended)
Fluid temperature	-20°C +60°C (standard and /WG seals) -20°C +80°C (/PE seals)
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Max. solenoid current	2,6 A
Max. power	35 Watt
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 (CEI EN-60529)	IP65 for -T execution; IP67 for -TE and TES executions
Duty factor	Continuous rating (ED=100%)

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

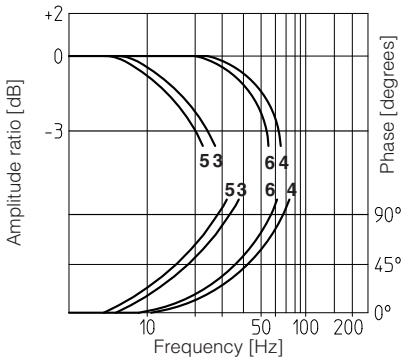
12.1 Regulation diagrams, see note

1 = LIQZO-T*-162L4
2 = LIQZO-T*-252L4



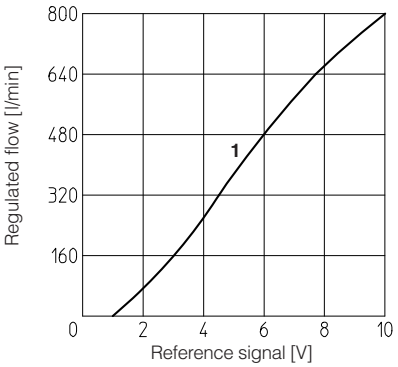
12.2 Bode diagrams
stated at nominal hydraulic conditions

3 = LIQZO-T*-162L4: 10% ÷ 90%
4 = LIQZO-T*-162L4: 50% ± 5%
5 = LIQZO-T*-252L4: 10% ÷ 90%
6 = LIQZO-T*-252L4: 50% ± 5%



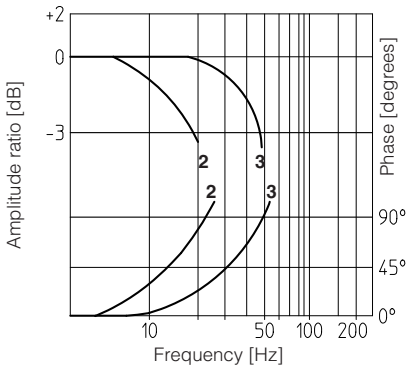
12.3 Regulation diagrams, see note

1 = LIQZO-T*-322L4



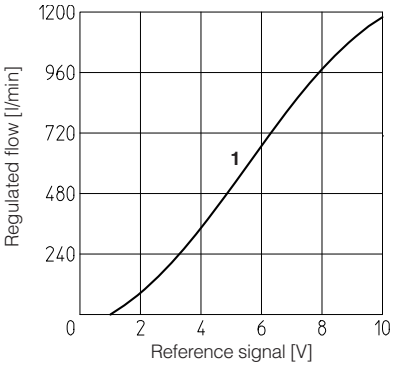
12.4 Bode diagrams
stated at nominal hydraulic conditions

2 = LIQZO-T*-322L4: 10% ÷ 90%
3 = LIQZO-T*-322L4: 50% ± 5%



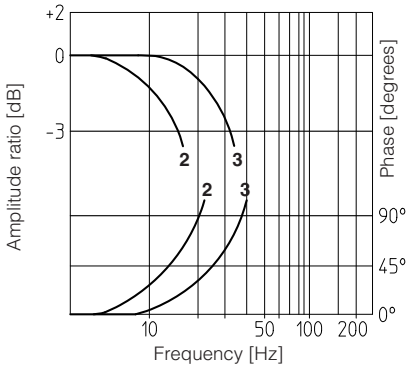
12.5 Regulation diagrams, see note

1 = LIQZO-T*-402L4



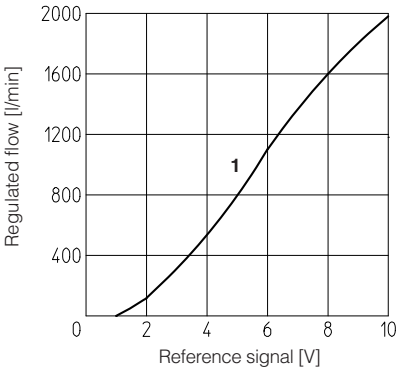
12.6 Bode diagrams
stated at nominal hydraulic conditions

2 = LIQZO-T*-402L4: 10% ÷ 90%
3 = LIQZO-T*-402L4: 50% ± 5%



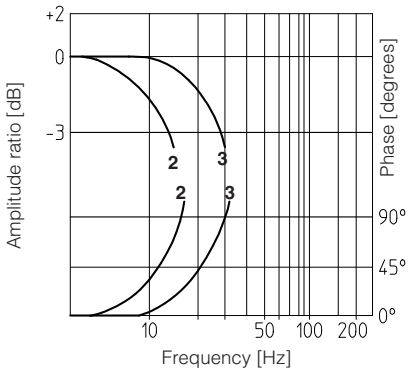
12.7 Regulation diagrams, see note

1 = LIQZO-T*-502L4



12.8 Bode diagrams
stated at nominal hydraulic conditions

2 = LIQZO-T*-502L4: 10% ÷ 90%
3 = LIQZO-T*-502L4: 50% ± 5%



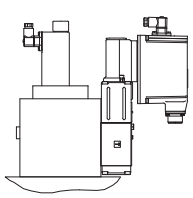
Note:
For the valves with digital electronics, the regulation characteristic can be modified by setting the internal software parameters, see tab. G500.

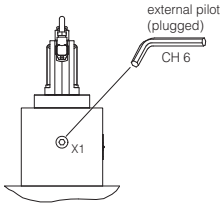
12.9 Dynamic response

The response times in section 3 and the frequency responses of the bode diagrams in sections 12.2, 12.4, 12.6, 12.8, 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 ADDITIONAL EXTERNAL PILOT PORT CONNECTION

Sizes 16 - 50



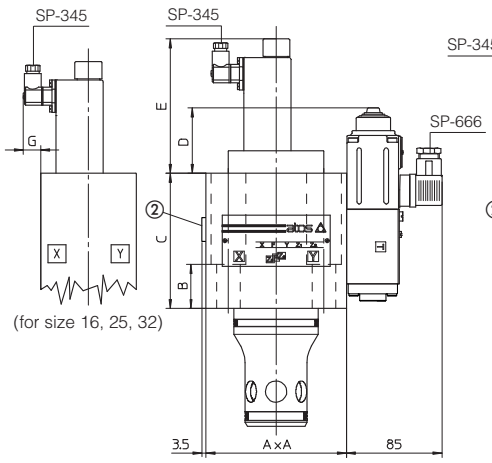


X1 = additional external pilot port connection G1/4"

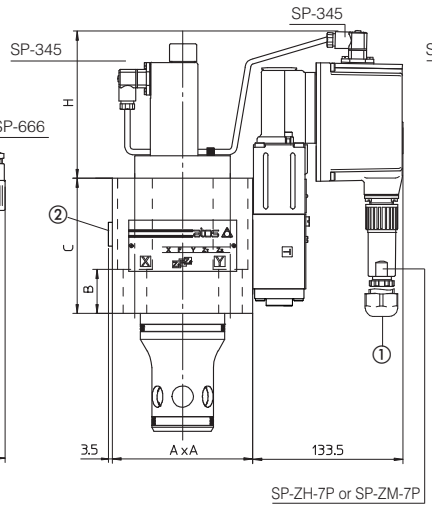
14 INSTALLATION DIMENSIONS [mm]

Size 16, 25, 32, 40

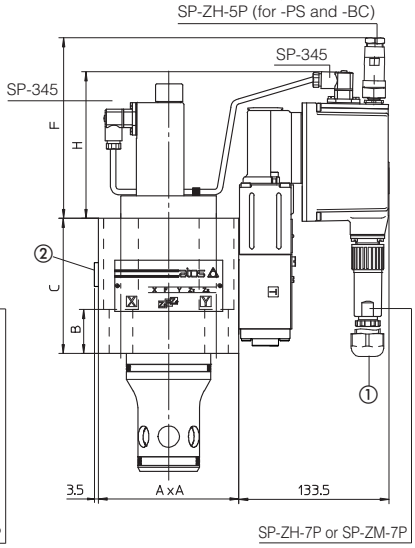
LIQZO-T



LIQZO-TE

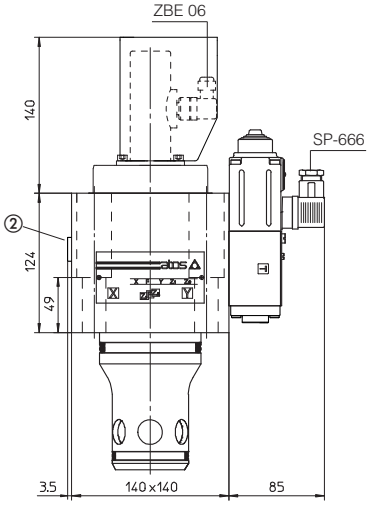


LIQZO-TES

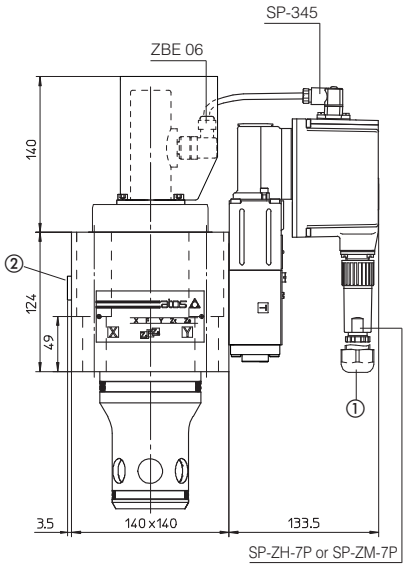


Size 50

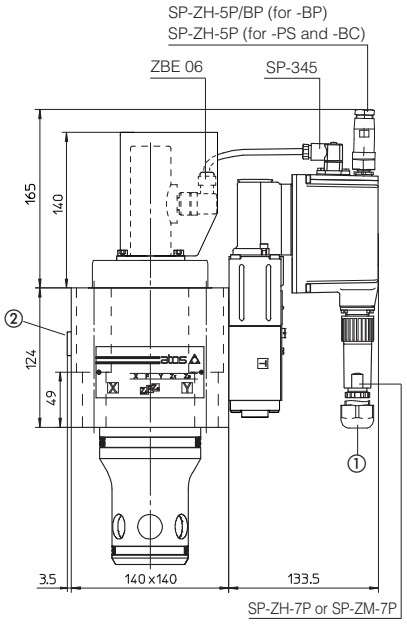
LIQZO-T



LIQZO-TE



LIQZO-TES



Size	A	B	C	D	E	F (TES)	G	H	Fastening bolts class 12.9	Tightening torque	Weight (Kg) T	Weight (Kg) TE-TES
16	65	75	98	80	100	178	25	150	N°4 M8x90	35 Nm	5,2	5,8
25	85	80	95	79	114	182	16	150	N°4 M12x100	125 Nm	7,5	8,1
32	100	30	105	72	121	171	7	145	N°4 M16x60	300 Nm	10,2	10,8
40	125	39	120	58	120	157	-	130	N°4 M20x70	600 Nm	16	16,6
50	see drawing						-	135	N°4 M20x80	600 Nm	23,2	23,8

-TE and -TES EXECUTION

① Dotted line = 12 pin connector SP-ZH-12P for option /Z

-ALL EXECUTIONS

② External piloting X1 = G1/4

Mounting surface and cavity: ISO 7368
(see table P006)

15 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

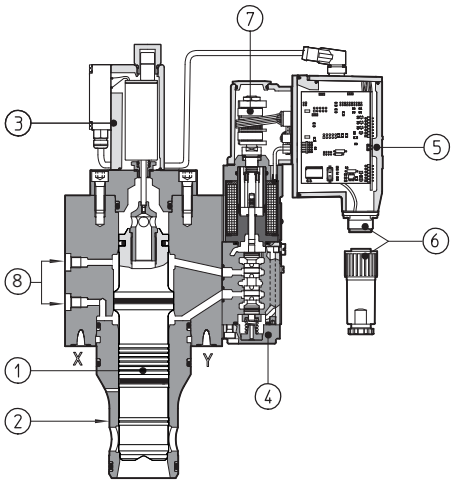
VALVE VERSION	-T			-TE, -TES		-TE/Z -TES /Z	serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)
	Power supply	Transducer						
CONNECTOR CODE	SP-666	SP-345	ZBE 06	SP-ZH-7P	SP-ZM-7P	SP-ZH-12P	SP-ZH-5P	SP-ZH-5P/BP
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500			G200, G210, K500			G210, K500	

connectors supplied with the valve

Proportional 2-way throttle cartridges

high dynamics, with two position transducers, ISO 7368 sizes from 16 to 100

LE and LES executions included in this table are available only for running supplies or spare parts
For new applications it is suggested new LEB and LES executions, see table FS330



① Poppet
② Sleeve
③ Main stage position transducer
④ Pilot valve
⑤ Integral electronics
⑥ Main connector
⑦ Pilot valve position transducer
⑧ Air bleeding

LIQZO-LE-402L4

LIQZO-L* and **LIQZP-L*** are 2-way proportional cartridge valves, with double position transducer designed for mounting in mainfold blocks which provide proportional non compensated flow control according to electronic reference signal.

They operate in association with electronic drivers, see section [2], which supply the proportional valves with proper current to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -L, with two integral position transducers ③, ⑧;
- -LE, -LES as -L plus analogue (LE) or digital (LES) integral electronics ⑤.

The regulation is operated by means of a poppet ① with double piloting area sliding into a sleeve ② and provided of integral LVDT position transducer ③.

The spool is operated by means of a high performances proportional directional valve ④ in "rugged" executions to withstand high vibrations and mechanical stresses (type DLHZO for cartridge dimensions up to size 50 and type DLKZOR for cartridge dimensions up to size 100) - see tab. F180, provided of high precision sleeve and LVDT position transducer ③ for maximum regulating accuracy and dynamic response. It is controlled in double closed loop position by means of the LVDT position transducers ③ and ⑧.

The integral electronics ⑤ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.
Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.
12 pin connector is used for options /Z.

Following communication interfaces ⑥ are available for the digital -LES execution:
- -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software
- -BC, CANopen interface
- -BP, PROFIBUS DP interface

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

Typical applications: plastic injection and blow moulding, ceramics, punching & nibbling machines, die-casting, foundry and sheet machinery;

Sizes from 16 to 100

LIQZO: sizes from **16** to **40**,
Max flow: **500** to **1050 l/min**
Max pressure: **350 bar**

LIQZP: sizes from **50** to **100**,
Max flow: **2000** to **5000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO - LES - PS - 25 2 L4 / * ** /*

Flow control valve
LIQZO
size 16 to 40,
Pmax 350 bar
LIQZP
size 50 to 80,
Pmax 420 bar

L = with two integral position transducers
LE = as L plus integral electronics
LES = as L plus integral digital electronics

Communication interfaces (only for LES)
PS = Serial
BC = CANopen
BP = PROFIBUS DP

Valve size, see section [3]
LIQZO: 16, 25, 32, 40
LIQZP: 50, 63, 80, 100

Valve configuration, see section [3]
2 = 2 way

Spool type (regulating characteristics):
L4 = linear

Electronic options for -LE execution see section [6]:
F = fault signal
I = current reference input and monitor (4÷20 mA)
Q = enable signal
Z = enable, fault and monitor signal (12 pin connector)

Electronic options for -LES execution see section [8]:
I = current reference input and monitor (4÷20 mA)
Z = double power supply, enable, fault and monitor signals (12 pin connector)

Series number

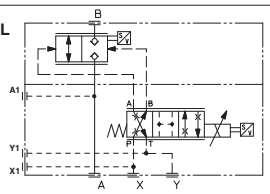
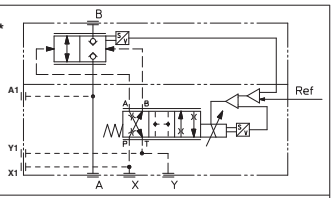
Seals material:
omit for NBR (mineral oil & water glycol)
PE = FPM

2 ELECTRONIC DRIVERS

Valve model	-L	-LE	-LES
Drivers model	E-ME-L	E-RI-LE	E-RI-LES
Data sheet	G150	G200	G210

Note: For power supply and communication connector see section [15]

3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols	LIQZO-L 				LIQZO-LE* 			
Model	LIQZO-L*				LIQZP-L*			
Size	16	25	32	40	50	63	80	100
Max regulated flow [l/min] at Δp = 5 bar at Δp =10 bar Max permissible flow	 250 350 600	 500 700 1200	 800 1100 1800	 1200 1700 2500	 2000 2800 4000	 3000 4250 6000	 4500 6350 10000	 7200 10200 16000
Max pressure [bar]	Ports A, B = **350**		X = 350	Y ≤ 10	Ports A, B = **420**		X = 350	Y ≤ 10
Nominal flow of pilot valve at Δp = 70 bar [l/min]	4	7	14	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
Response time 0 ÷ 100% step signal [ms]	13	14	15	18	20	24	30	50
Pilot volume [cm³]	1,6	2.2	7,0	9,4	17.7	32,5	39,5	59,4
Hysteresis [% of the max flow]	≤ 0,1%							
Repeatability [% of the max flow]	± 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.
- Recommended piloting pressure is 140 ÷ 160 bar.
- In case of long time shutdown of the hydraulic supply to the pilot valve, the driver has to be switched off to avoid its overheating.

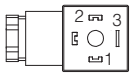
4 GENERAL NOTES

LIQZO-L* proportional cartridges are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.
The electrical signals of the valve (e.g. 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 CONNECTIONS FOR -L EXECUTION

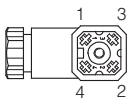
SOLENOID POWER SUPPLY CONNECTOR 666

PIN	Signal description
1	SUPPLY
2	SUPPLY
3	GND



PILOT VALVE POSITION TRANSDUCER CONNECTOR 345

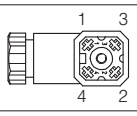
PIN	Signal description
1	OUTPUT SIGNAL
2	SUPPLY -15 VDC
3	SUPPLY +15 VDC
4	GND



MAIN STAGE POSITION TRANSDUCER CONNECTOR 345

SIZES 16 ÷ 40

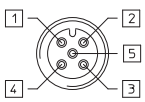
PIN	Signal description
1	OUTPUT SIGNAL
2	SUPPLY -15 VDC
3	SUPPLY +15 VDC
4	GND



MAIN STAGE POSITION TRANSDUCER CONNECTOR ZBE08

SIZES 50 ÷ 100

PIN	Signal description	Technical specification
1	PROG	do not connect
2	VT+	Power supply reference +15 VDC
3	AGND	Common GND for transducer power & signal
4	TR	Transducer output signal
5	VT-	Power supply reference -15 VDC



6 ANALOG INTEGRAL DRIVERS -LE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply
Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10 VDC nominal range (pin D, E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10 VDC nominal range

Following options are available to adapt standard execution to special application requirements:

6.1 Option /F
It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

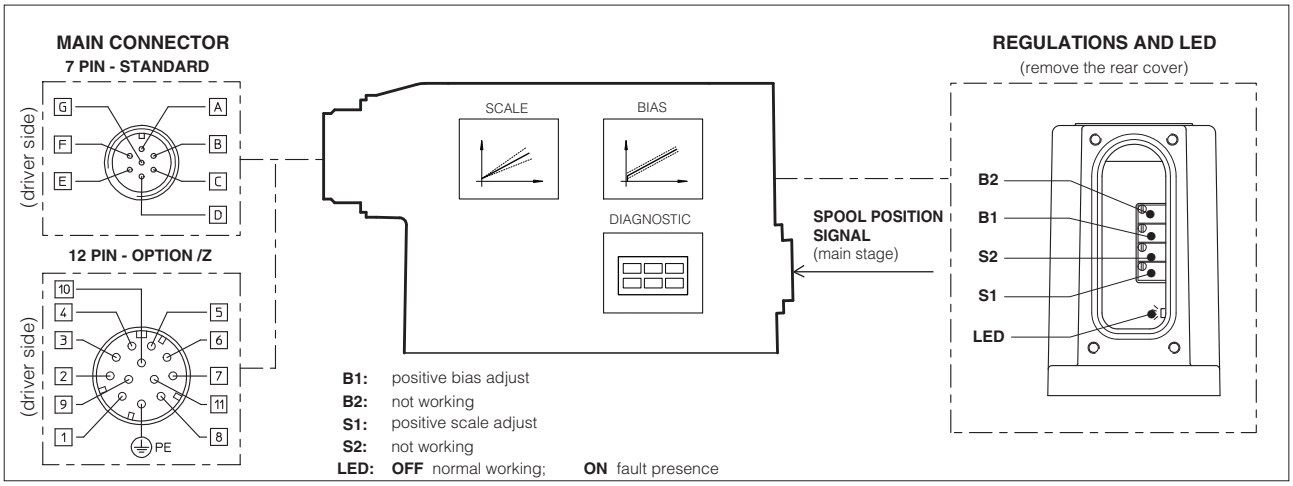
6.2 Option /I
It provides the 4÷20 mA current reference and monitor signals instead of the standard ±10 VDC
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

6.3 Option /Q
It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

6.4 Option /Z
This option includes **/F** and **/Q** features, plus the Monitor output signal.
When the driver is disabled (0 VDC on Enable signal) Fault output is forced to 0 VDC.

6.5 Possible combined options: /FI and /IZ

7 ANALOG INTEGRAL DRIVERS -LE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



7.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage and driver logic	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage and driver logic	Gnd - power supply
C (1)	7	AGND	Ground - signal zero for MONITOR signal (for standard, /Z option)	Gnd - analog signal
	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q and /Z options)	Input - on/off signal
D	4	INPUT+	Reference analog differential input: 0 ÷ +10 VDC maximum range (4 ÷ 20 mA for /I option)	Input - analog signal
E	5	INPUT -		
F (2)	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
	11	FAULT	Fault (0V) or normal working (24V) (for /F and /Z options)	Output - on/off signal
-	8	R_ENABLE	Repeat Enable - output repetition of Enable input	Output - on/off signal
-	9	NC	do not connect	Output - on/off signal
-	10	NC	do not connect	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Notes:

(1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B

(2) with /F option FAULT signal replaces MONITOR on pin F.

- A minimum time of 50ms to 100ms 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 DIGITAL INTEGRAL DRIVERS -LES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10VDC nominal range

Following options are available to adapt standard execution to special application requirements:

8.1 Option /I

It provides 4÷20 mA current reference and monitor signals instead of the standard ±10 V.

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.

8.2 Option /Z

It provides on the 12 pin main connector the following additional features:

Logic power supply

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).
Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal

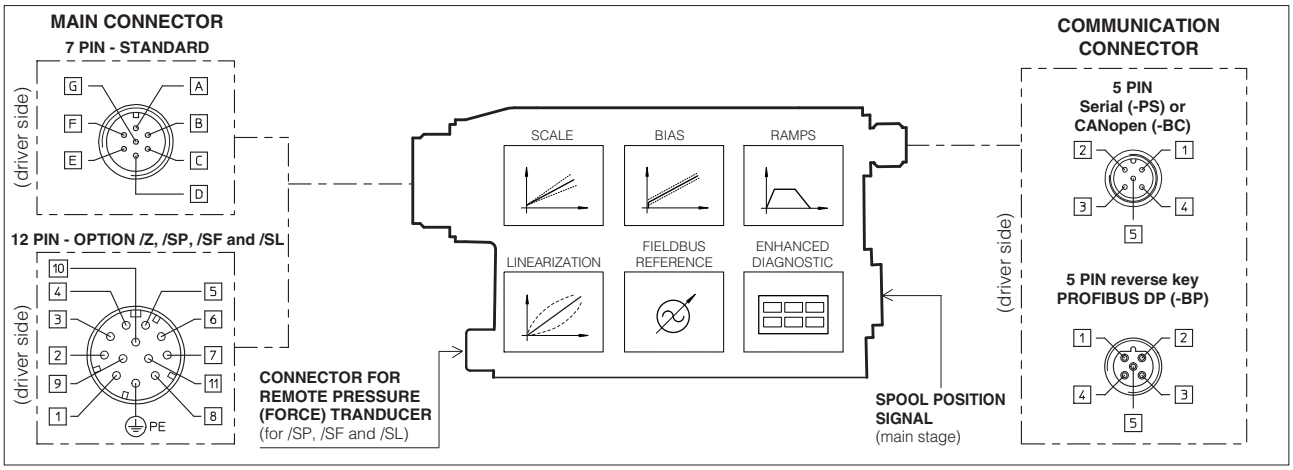
To enable the driver, supply 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

8.3 Possible combined options: /IZ

9 DIGITAL INTEGRAL DRIVERS -LES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



9.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
-	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: 0 ÷ +10 VDC maximum range (4 ÷ 20 mA for /I option)	Input - analog signal
E	-	INPUT -	standard: differential input; /Z option: common mode INPUT+ referred to AGND	
C	5	AGND	Ground - signal zero for MONITOR signal signal zero for INPUT+ signal (only for /Z option)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
-	7	NC	do not connect	
-	8	NC	do not connect	
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0V) or normal working (24V)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 300 to 500 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.

9.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION CONNECTORS

	-PS Serial		-BC CANopen		-BP PROFIBUS DP	
PIN	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	

10 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the Atos E-SW programming software, available in three different versions according to the driver's communication execution: **E-SW-PS** (Serial), **E-SW-BC** (CANopen) and **E-SW-BP** (PROFIBUS DP).

For a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table G500.

Programming software, must be ordered separately:

E-SW-* (mandatory - first supply) = Dvd including E-SW-* software installer and operator manuals; it allows the registration to Atos digital service

E-SW-*-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com.
Once the registration is completed, the password will be sent by email.

The software remains active for 10 days from the installation date and then it stops until the user inputs his password.

With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

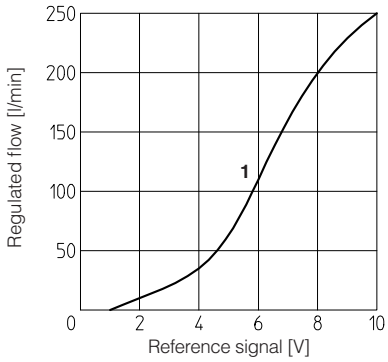
11 MAIN CHARACTERISTICS OF PROPORTIONAL THROTTLE CARTRIDGE VALVES

Assembly position	Any position
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)
Ambient temperature	-20°C ÷ +70°C for -L execution; -20°C ÷ +60°C for -LE and LES executions
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 μm ($\beta_{10} \geq 75$ recommended)
Fluid temperature	-20°C +60°C (standard seals and water glycol) -20°C +80°C (/PE seals)
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Max. solenoid current	2,6 A
Max. power	35 Watt
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 (CEI EN-60529)	IP65 for -L execution; IP67 for -LE and -LES executions
Duty factor	Continuous rating (ED=100%)

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

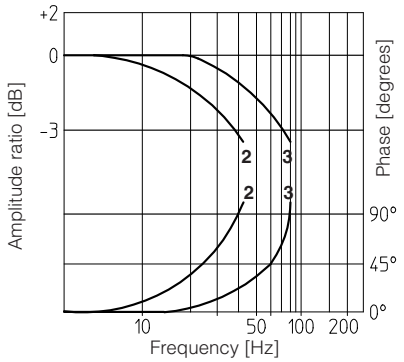
12.1 Regulation diagrams

1 = LIQZO-L*-16*



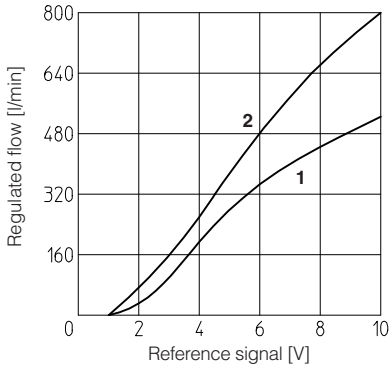
12.2 Bode diagrams
stated at nominal hydraulic conditions

2 = LIQZO-L*-16*: 10% ↔ 90%
3 = LIQZO-L*-16*: 50% ± 5%



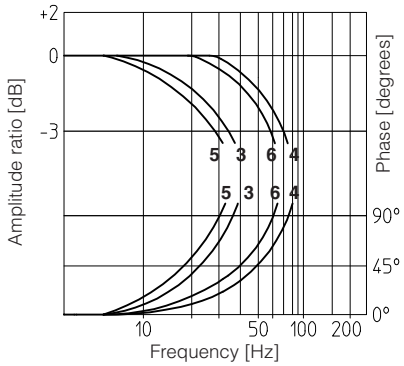
12.3 Regulation diagrams

1 = LIQZO-L*-25*
2 = LIQZO-L*-32*



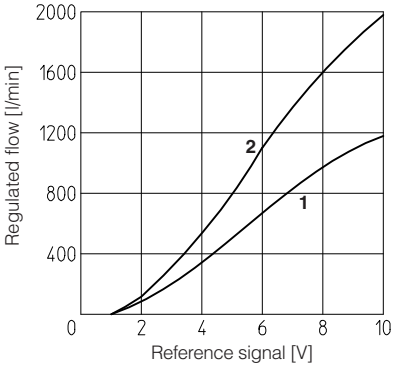
12.4 Bode diagrams
stated at nominal hydraulic conditions

3 = LIQZO-L*-25*: 10% ↔ 90%
4 = LIQZO-L*-25*: 50% ± 5%
5 = LIQZO-L*-32*: 10% ↔ 90%
6 = LIQZO-L*-32*: 50% ± 5%



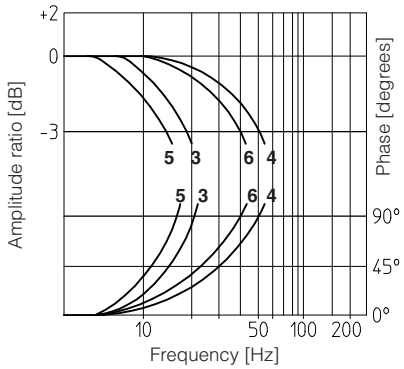
12.5 Regulation diagrams

1 = LIQZO-L*-40*
2 = LIQZO-L*-50*



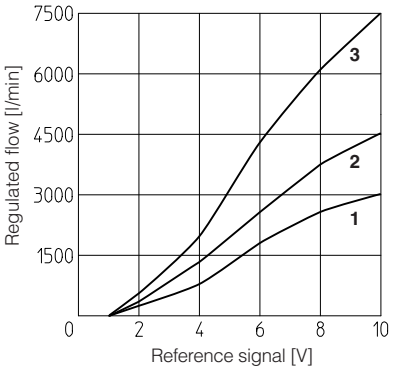
12.6 Bode diagrams
stated at nominal hydraulic conditions

3 = LIQZO-L*-40*: 10% ↔ 90%
4 = LIQZO-L*-40*: 50% ± 5%
5 = LIQZO-L*-50*: 10% ↔ 90%
6 = LIQZO-L*-50*: 50% ± 5%



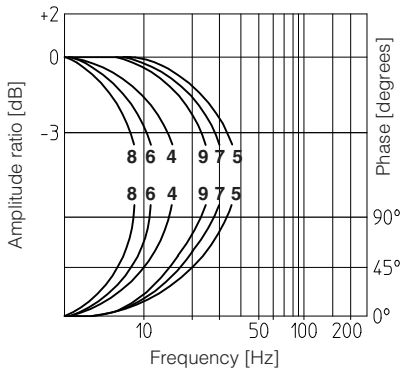
12.7 Regulation diagrams

1 = LIQZO-L*-63*
2 = LIQZO-L*-80*
3 = LIQZO-L*-100*



12.8 Bode diagrams
stated at nominal hydraulic conditions

4 = LIQZO-L*-63*: 10% ↔ 90%
5 = LIQZO-L*-63*: 50% ± 5%
6 = LIQZO-L*-80*: 10% ↔ 90%
7 = LIQZO-L*-80*: 50% ± 5%
8 = LIQZO-L*-100*: 10% ↔ 90%
9 = LIQZO-L*-100*: 50% ± 5%



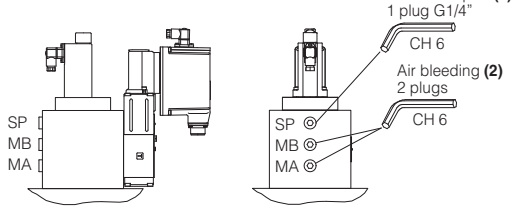
Note:
For the valves with digital electronics, the regulation characteristic can be modified by setting the internal software parameters, see tab. G500.

12.9 Dynamic response

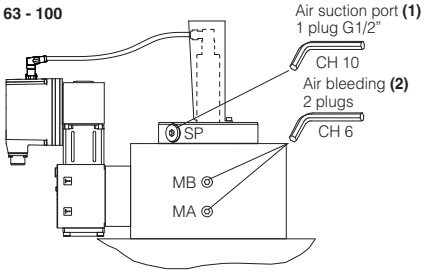
The response times in section 2 and the frequency responses of the bode diagrams in section 12.2, 12.4, 12.6, 12.8, have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

13 AIR BLEEDING

Sizes 16 - 50



Size 63 - 100



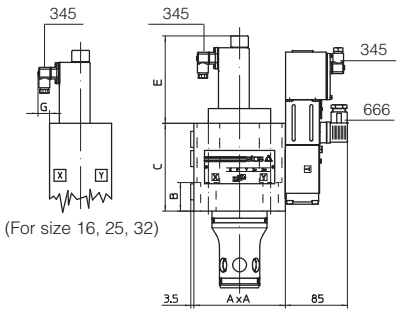
(1) To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

(2) 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.

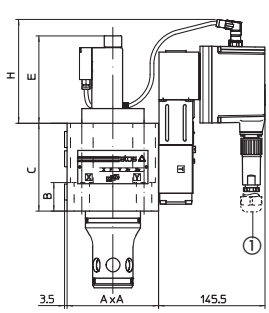
14 INSTALLATION DIMENSIONS [mm]

Size 16, 25, 32 and 40

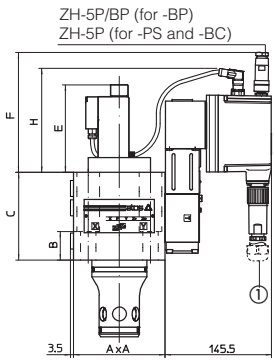
LIQZO-L



LIQZO-LE

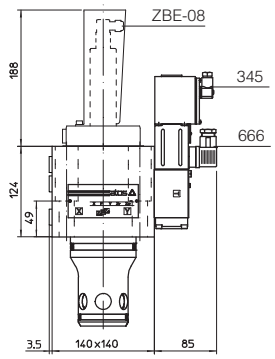


LIQZO-LES

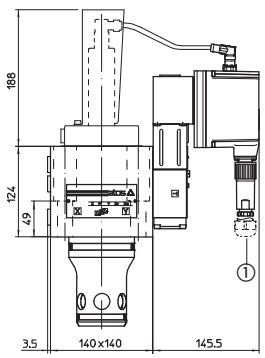


Size 50

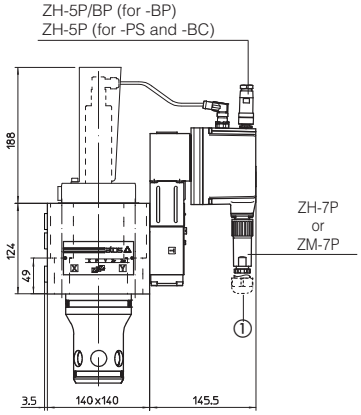
LIQZP-L



LIQZP-LE

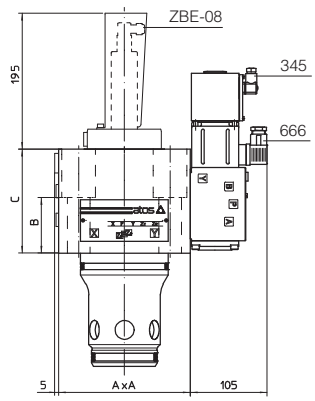


LIQZP-LES

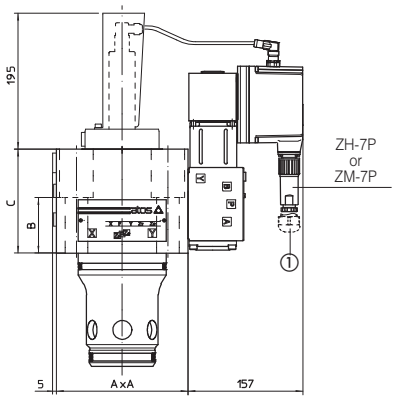


Size 63, 80 and 100

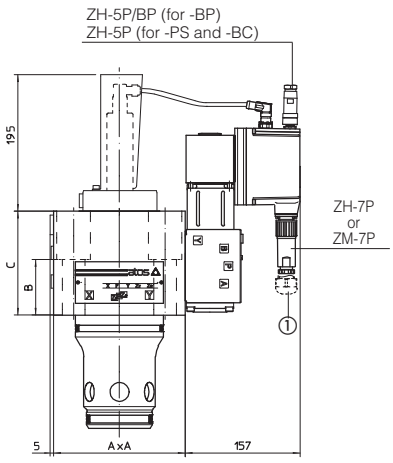
LIQZP-L



LIQZP-LE



LIQZP-LES



Size	A	B	C	D	E	F	G	H	Fastening bolts class 12.9 **(1)**	Tightening torque	Weight (Kg) L	Weight (Kg) LE-LES
16	65	75	98	-	99,5	152	25	158	N°4 M8x90	35 Nm	5,6	6,2
25	85	80	95	241	128	159	16	160	N°4 M12x100	125 Nm	8,2	8,8
32	100	30	105	226	135	166	7	150	N°4 M16x60	300 Nm	10,9	11,2
40	125	39	120	241	148	178	-	135	N°4 M20x70	600 Nm	16,7	17,3
50	see drawing						-	-	N°4 M20x80	600 Nm	23,9	24,6
63	180	76	142	-	-	-	-	-	N°4 M30x120	2100 Nm	44	44,6
80	Ø 250	45	165	-	-	-	-	-	N°8 M24x80	1000 Nm	71,6	72,2
100	Ø 300	70	195	-	-	-	-	-	N°8 M30x120	2100 Nm	122,5	123,1

-LE* EXECUTION

① Dotted line = 12 pin connector ZH-12P for option /Z

Mounting surface and cavity: ISO 7368
(see table P006)

(1) Fastening bolts supplied with the valve

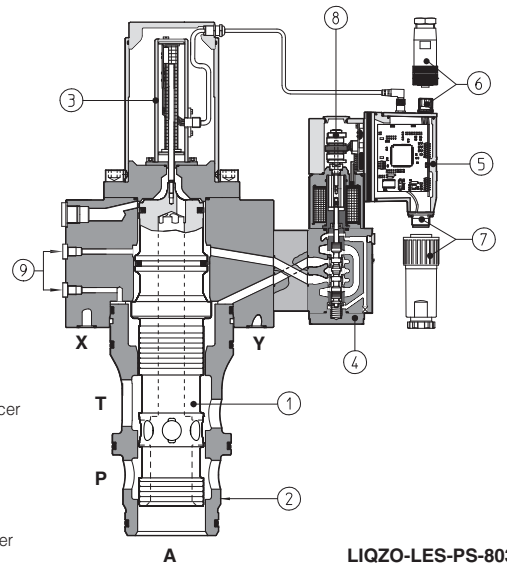
15 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

VALVE VERSION	-L			-LE, -LES		-LE/Z -LES /Z	serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)
	Power supply	Transducer						
CONNECTOR CODE	666	345	ZBE-08	ZH-7P	ZM-7P	ZH-12P	ZH-5P	ZH-5P/BP
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500			G200, G210, K500			G210, K500	

connectors supplied with the valve

Proportional throttle cartridges type LIQZO-L*, 3-way

high dynamics, with two position transducers, sizes from 25 to 80



LIQZO-LES-PS-803L4

① Poppet
② Sleeve
③ Main stage position transducer
④ Pilot valve
⑤ Integral electronics
⑥ Communication connector
⑦ Main connector
⑧ Pilot valve position transducer
⑨ Air bleeding

LIQZO-L* are 3-way proportional cartridge valves, with double position transducer designed for mounting in mainfold blocks which provide both directional and non compensated flow control according to electronic reference signal.

They operate in association with electronic drivers, see section [2], which supply the proportional valves with proper current to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -L, with two integral position transducers ③, ⑧;
- -LE, -LES as -L plus analogue (LE) or digital (LES) integral electronics ⑤.

The regulation is operated by means of a spool ① with double piloting area sliding into a sleeve ② and provided of integral LVDT position transducer ③.

The spool is operated by means of a high performances proportional directional valve ④ in "rugged" executions to withstand high vibrations and mechanical stresses (type DLHZO for cartridge dimensions up to size 50 and type DLKZOR for cartridge dimensions up to size 80) - see tab. F180, provided of high precision sleeve and LVDT position transducer ⑧ for maximum regulating accuracy and dynamic response. It is controlled in double closed loop position by means of the LVDT position transducers ③ and ⑧.

The integral electronics ⑤ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.
Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.
12 pin connector is used for options /Z and /S*.
The special /S* options add a closed loop control of pressure (/SP) or force (/SL) to the basic closed loop spool position one.

Following communication interfaces ⑦ are available for the digital -LES execution:
- -PS, Serial communication interface for configuration, monitoring and firmware updating through Atos PC software
- -BC, CANopen interface
- -BP, PROFIBUS DP interface

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

Typical applications: plastic injection and blow moulding, ceramics, punching & nibbling machines, die-casting, foundry and sheet machinery;

Sizes from 25 to 80

Max flow up to 2100 l/min with differential pressure Δp = 5 bar, see section [2];

Max pressure = 350 bar.

1 MODEL CODE

LIQZO - LES - PS - 25 3 L4 / * ** /*

Flow control valve

L = with two position integral transducers
LE = as L plus integral electronics
LES = as L plus integral digital electronics

Communication interfaces (only for LES)
PS = Serial
BC = CANbus
BP = PROFIBUS-DP

Valve size , see section [3]
25 32 40 50 63 80

Valve configuration, see section [3]
3 = 3 way

Spool type (regulating characteristics):
L4 = linear

Hydraulic options
A = reversed hydraulic configuration of main spool: P-A in rest position

Electronic options for -LE execution
see section [6]:
F = fault signal
I = current reference input and monitor (4÷20 mA)
Q = enable signal
Z = enable, fault and monitor signal (12 pin connector)

Electronic options for -LES execution
see section [8]:
I = current reference input and monitor (4÷20 mA)
Z = double power supply, enable, fault and monitor signals (12 pin connector)

Special options for -LES execution
see section [8]:
SL = additional closed loop force control with one remote load cell
SP = additional closed loop pressure control with one remote pressure transducer
C = current feedback interface for transducer(s) **only for options /SL, /SP**

Series number

Synthetic fluids:
WG = water-glycol
PE = phosphate ester

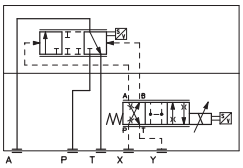
2 ELECTRONIC DRIVERS FOR LIQZO-L*

Valve model	-L	-LE	-LES	-LES / SL, SP
Drivers model	E-ME-L	E-RI-LE	E-RI-LES	E-RI-LES, /SL, /SP
Data sheet	G150	G200	G210	G212

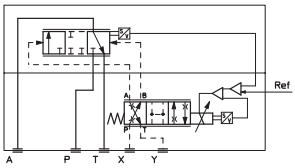
Note: For power supply and communication connector see section [15]

3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C) (3)

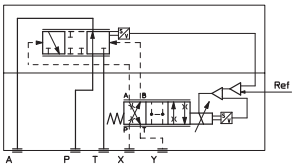
Hydraulic symbols



LIQZO-L



LIQZO-LE, LIQZO-LES



LIQZO-L*/A

Model		LIQZO-L*					
Size		25	32	40	50	63	80
Max regulated flow	[l/min]						
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]	350					
Nominal flow of pilot valve at Δp = 70 bar	[l/min]	4	7	28	40	40	40
Leakage of pilot valve at P = 100 bar	[l/min]	0,2	0,2	0,5	0,7	0,7	0,7
Response time ±100% step signal (1)	[ms]	22	25	27	28	30	31
Pilot volume (2)	[cm³]	2,16	7,2	8,9	17,7	33,8	42,7
Hysteresis	[% of the regulated max flow]	≤ 0,1%					
Repeatability	[% of the regulated max flow]	± 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.
- Recommended piloting pressure is 140 ÷ 160 bar.
- In case of long time shutdown of the hydraulic supply to the pilot valve, the driver has to be switched off to avoid its overheating.

4 GENERAL NOTES

LIQZO-L* proportional cartridges are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.
The electrical signals of the valve (e.g. 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).

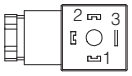
4.1 Option /A

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 reversed 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 valve P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.

5 CONNECTIONS FOR -L EXECUTION

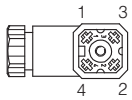
SOLENOID POWER SUPPLY CONNECTOR

PIN	Signal description
1	SUPPLY
2	SUPPLY
3	GND



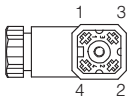
PILOT VALVE POSITION TRANSDUCER CONNECTOR

PIN	Signal description
1	OUTPUT SIGNAL
2	SUPPLY -15 VDC
3	SUPPLY +15 VDC
4	GND



MAIN STAGE POSITION TRANSDUCER CONNECTOR

SIZES 16 ÷ 40		SIZE 50 ÷ 80	
PIN	Signal description	PIN	Signal description
1	OUTPUT SIGNAL	**1**	OUTPUT SIGNAL
2	SUPPLY -15 VDC	**2**	NOT CONNECTED
3	SUPPLY +15 VDC	**3**	SUPPLY +24 VDC
4	GND	**4**	GND



6 ANALOG INTEGRAL DRIVERS -LE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers
Reference input signal - analog differential input with ±10 VDC nominal range (pin D,E), proportional to desired valve spool position
Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10 VDC nominal range

Following options are available to adapt standard execution to special application requirements:

6.1 Option /F

It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

6.2 Option /I

It provides the 4÷20 mA current reference and monitor signals instead of the standard ±10 VDC
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.

6.3 Option /Q

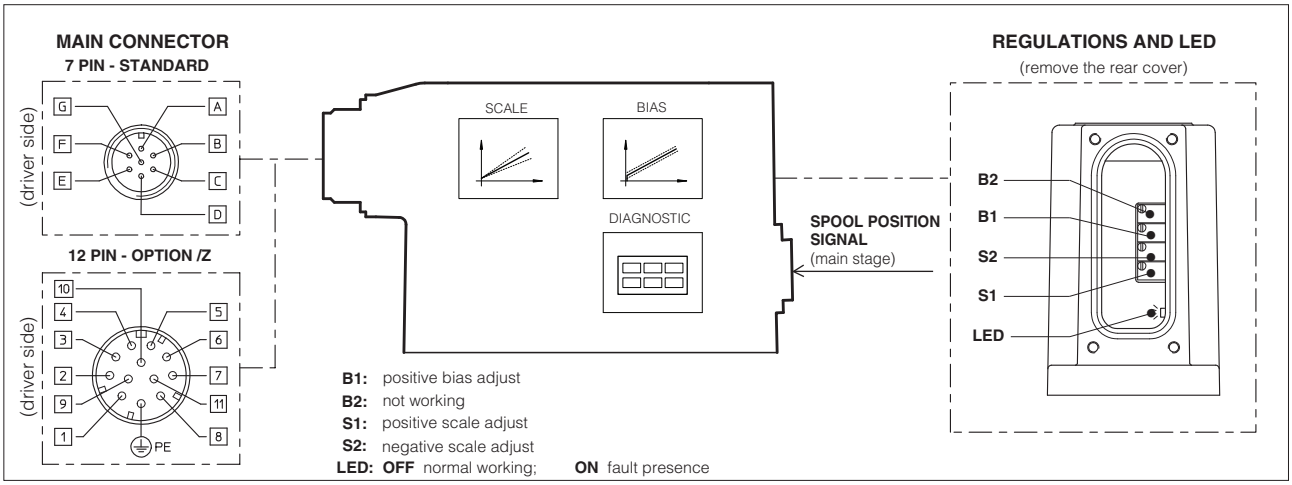
It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

6.4 Option /Z

This option includes **/F** and **/Q** features, plus the Monitor output signal.
When the driver is disabled (0 VDC on Enable signal) Fault output is forced to 0 VDC.

6.5 Possible combined options: /FI and /IZ

7 ANALOG INTEGRAL DRIVERS -LE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



7.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS		NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage and driver logic		Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage and driver logic		Gnd - power supply
C (1)	7	AGND	Ground - signal zero for MONITOR signal	(for standard, /Z option)	Gnd - analog signal
	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	(for /Q and /Z options)	Input - on/off signal
D	4	INPUT+	Reference analog differential input: ±10 VDC maximum range	(4 ÷ 20 mA for /I option)	Input - analog signal
E	5	INPUT -			
F (2)	6	MONITOR	Monitor analog output: ±10 VDC maximum range	(4 ÷ 20 mA for /I option)	Output - analog signal
	11	FAULT	Fault (0V) or normal working (24V)	(for /F and /Z option)	Output - on/off signal
-	8	R_ENABLE	Repeat Enable - output repetition of Enable input		Output - on/off signal
-	9	NC	do not connect		Output - on/off signal
-	10	NC	do not connect		Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing		

Notes:

(1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B

(2) with /F option FAULT signal replaces MONITOR on pin F.

- A minimum time of 50ms to 100ms 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 DIGITAL INTEGRAL DRIVERS -LES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10VDC nominal range

Following options are available to adapt standard execution to special application requirements:

8.1 Option /I

It provides 4÷20 mA current reference and monitor signals instead of the standard ±10 V.

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.

8.2 Option /Z

It provides on the 12 pin main connector the following additional features:

Logic power supply

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).
Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal

To enable the driver, supply 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

8.3 Options /SP and /SL

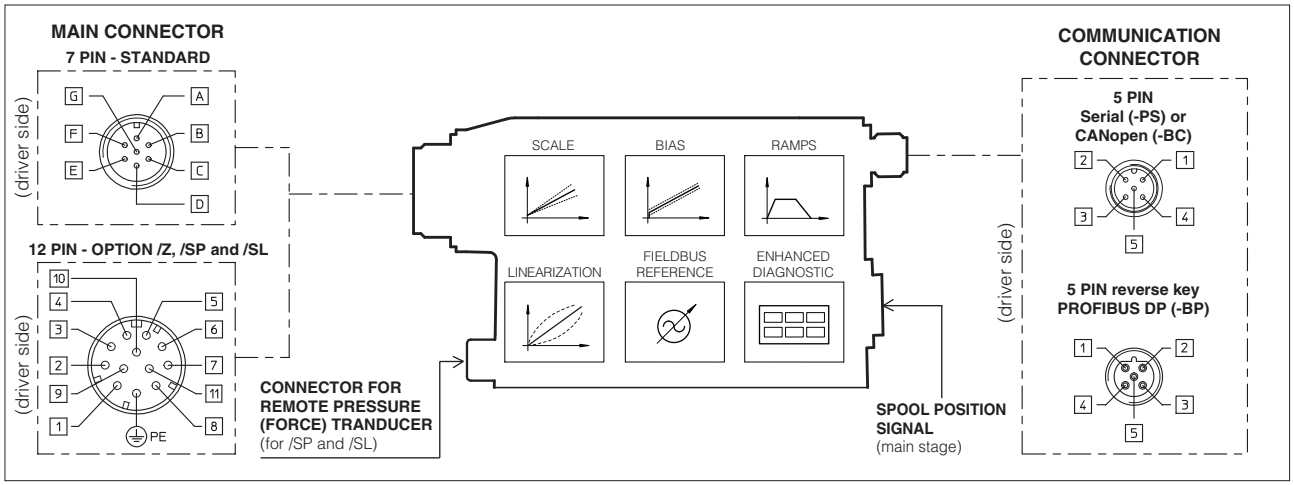
These options add the closed loop control of pressure (/SP) or force (/SL) to the basic functions of proportional directional valves: a dedicated software alternates pressure (force) and valve's spool position controls depending on the actual hydraulic system conditions.
A dedicated connector is available for the additional transducers that are required to be interfaced to the valve's driver (1 pressure transducer for /SP or 1 load cell for /SL).
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control: one for reference (pin 7) and one for monitor (pin 8).
For futher details please refer to the driver technical table **G212.**

8.4 Options /C

Options /CSP and /CSL are available to connect pressure (force) transducers with 4 ÷ 20mA current output signal.

8.5 Possible combined options: /ISP, ISL, /CSP, /CSL, /CISP, /CISL and /IZ

9 DIGITAL INTEGRAL DRIVERS -LES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



9.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
-	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Input - analog signal
E	-	INPUT -	standard: differential input; /Z option: common mode INPUT+ referred to AGND	
C	5	AGND	Ground - signal zero for MONITOR signal signal zero for INPUT+ signal (only for /Z option)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
-	7	NC	do not connect (pressure/force input for /SP and /SL options, see 8.3)	
-	8	NC	do not connect (pressure/force monitor for /SP and /SL options, see 8.3)	
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0V) or normal working (24V)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 300 to 500 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.

9.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION CONNECTORS

	-PS Serial		-BC CANopen		-BP PROFIBUS DP	
PIN	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	

10 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the Atos E-SW programming software, available in three different versions according to the driver's communication execution: **E-SW-PS** (Serial), **E-SW-BC** (CANopen) and **E-SW-BP** (PROFIBUS DP).

For a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table **G500**.

Programming software, must be ordered separately:

E-SW-* (mandatory - first supply) = Dvd including E-SW-* software installer and operator manuals; it allows the registration to Atos digital service

E-SW-*-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com.

Once the registration is completed, the password will be sent by email.

The software remains active for 10 days from the installation date and then it stops until the user inputs his password.

With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

11 MAIN CHARACTERISTICS OF PROPORTIONAL THROTTLE CARTRIDGE VALVES

Assembly position	Any position
Subplate surface finishing	Roughness index, $\sqrt{}^{0.4}$ flatness ratio 0,01/100 (ISO 1101)
Ambient temperature	-20°C ÷ +70°C for -L execution; -20°C ÷ +60°C for -LE and LES executions
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)
Fluid contamination class	ISO 18/15 achieved with in line filters of 10 μm and $\beta_{10} \geq 75$ (recommended)
Fluid temperature	-20°C +60°C (standard and /WG seals) -20°C +80°C (/PE seals)
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Max. solenoid curren	2,6 A
Max. power	35 Watt
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards
Protection degree (CEI EN-60529)	ISO 13732-1 and EN982 must be taken into account IP65 for -L execution; IP67 for -LE and -LES executions
Duty factor	Continuous rating (ED=100%)

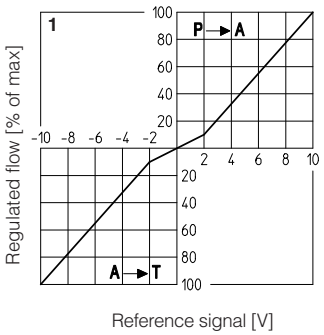
12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

12.1 Regulation diagrams, see note

1 = LIQZO-L* (all sizes)

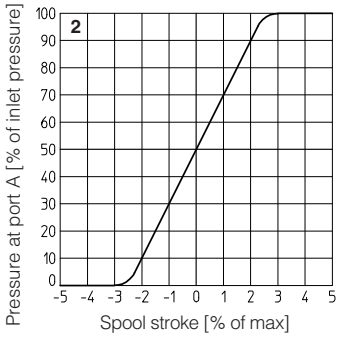
Hydraulic configuration vs. reference signal:

Reference signal	0 ÷+10 V 12÷20 mA	P → A
Reference signal	0 ÷-10 V 4÷12 mA	A → T



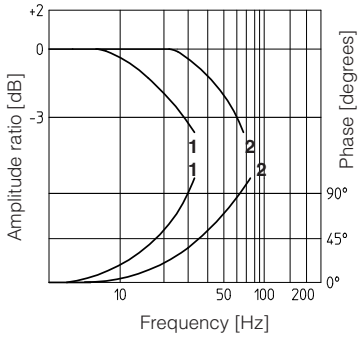
12.2 Pressure gain diagram

2 = LIQZO-L* (all sizes)

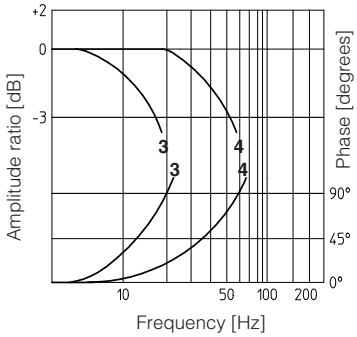


12.3 Bode diagrams

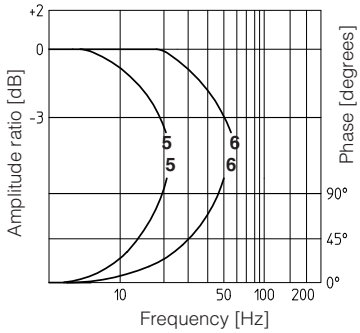
1 = LIQZO-L*-253L4: ± 90%
2 = LIQZO-L*-253L4: ± 5%



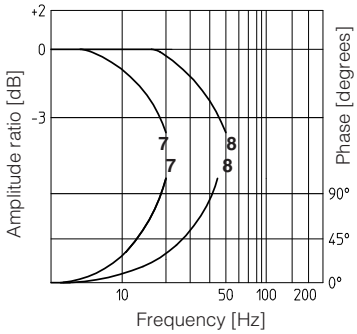
3 = LIQZO-L*-323L4: ± 90%
4 = LIQZO-L*-323L4: ± 5%



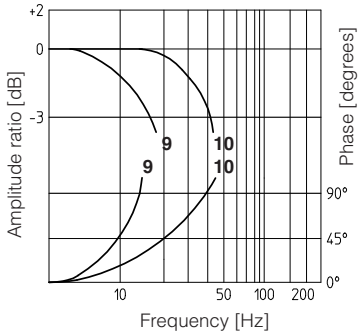
5 = LIQZO-L*-403L4: ± 90%
6 = LIQZO-L*-403L4: ± 5%



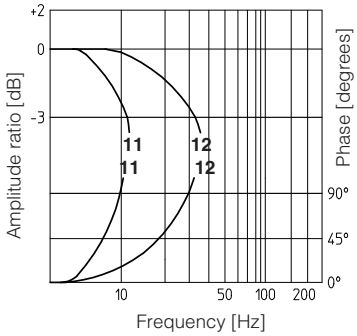
7 = LIQZO-L*-503L4: ± 90%
8 = LIQZO-L*-503L4: ± 5%



9 = LIQZO-L*-633L4: ± 90%
10=LIQZO-L*-633L4: ± 5%



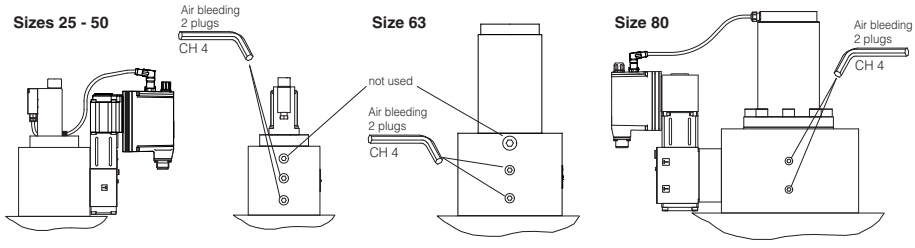
11=LIQZO-L*-803L4: ± 90%
12=LIQZO-L*-803L4: ± 5%



12.4 Dynamic response

The response times in section 2 and the frequency responses of the bode diagrams in sections 6.3, 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 AIR BLEEDING

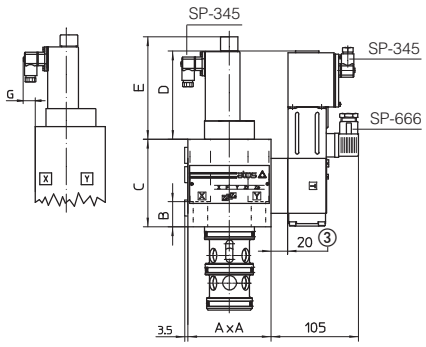


At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.
Operate the valve for few seconds at low pressure and then lock the plugs.

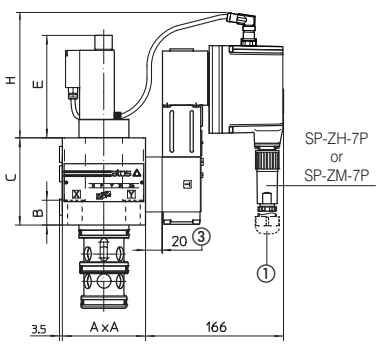
14 INSTALLATION DIMENSIONS [mm]

Size 25, 32 and 40

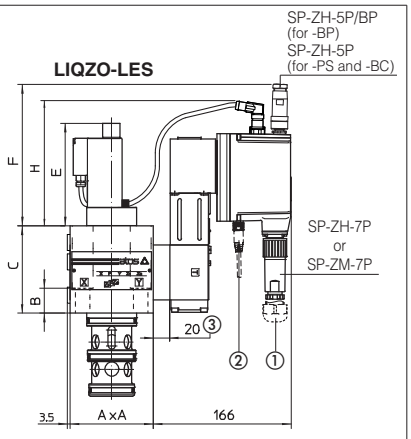
LIQZO-L



LIQZO-LE

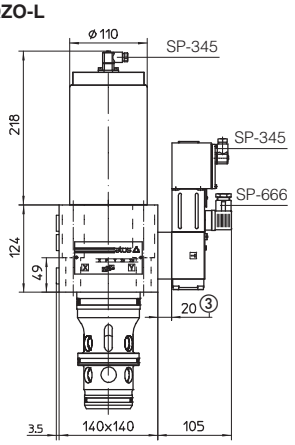


LIQZO-LES

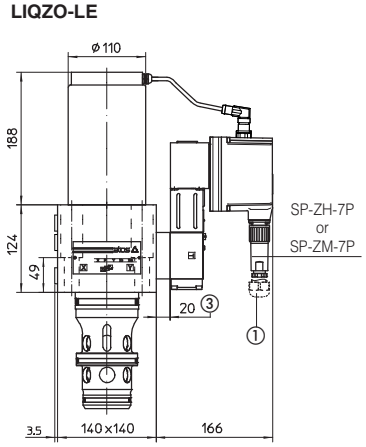


Size 50

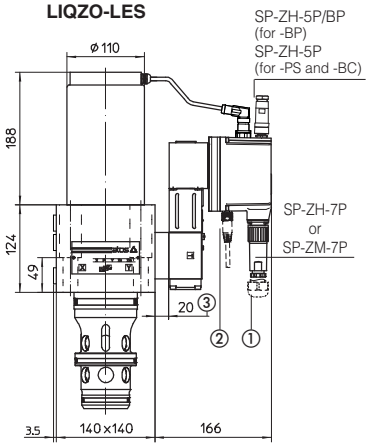
LIQZO-L



LIQZO-LE

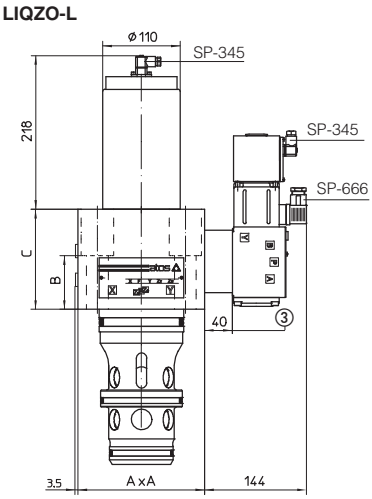


LIQZO-LES

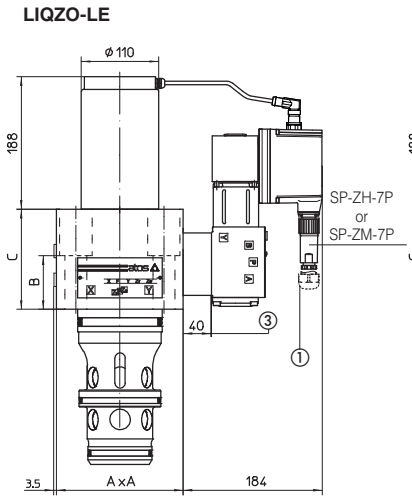


Size 63 and 80

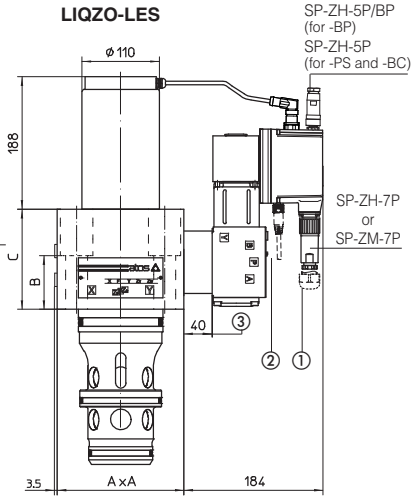
LIQZO-L



LIQZO-LE



LIQZO-LES



① Dotted line =12 pin connector SP-ZH-12P for options /Z
② Dotted line = M8 connector SP-ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)
③ Intermediate plate not present for option /A

Size	A	B	C	D	E	F	G	H	Fastening bolts class 12.9	Tightening torque	Weight (Kg) L	Weight (Kg) LE-LES
25	85	80	95	117	83	-	16	160	N°4 M12x100	125 Nm	9,2	9,8
32	100	30	105	106	123	140	7	150	N°4 M16x60	300 Nm	11,9	12,6
40	125	39	120	95	123	128	-	135	N°4 M20x70	600 Nm	17,7	18,3
50	see drawing						-	-	N°4 M20x80	600 Nm	24,9	25,6
63	180	76	142	-	-	-	-	-	N°4 M30x120	2100 Nm	45	47,6
80	Ø 250	55	165	-	-	-	-	-	N°8 M24x80	1000 Nm	72,6	73,3

15 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

VALVE VERSION	-L		-LE, -LES		-LE/Z -LES /Z, /SL, /SP	serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)	LES /SL, /SP (transducer)
	Power supply	Transducer						
CONNECTOR CODE	SP-666	SP-345	SP-ZH-7P	SP-ZM-7P	SP-ZH-12P	SP-ZH-5P	SP-ZH-5P/BP	SP-ZH-4P-M8/5 (1)
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67	IP67	IP67	IP67
DATA SHEET	K500		G200, G210, K500			G210, K500		G212, K500

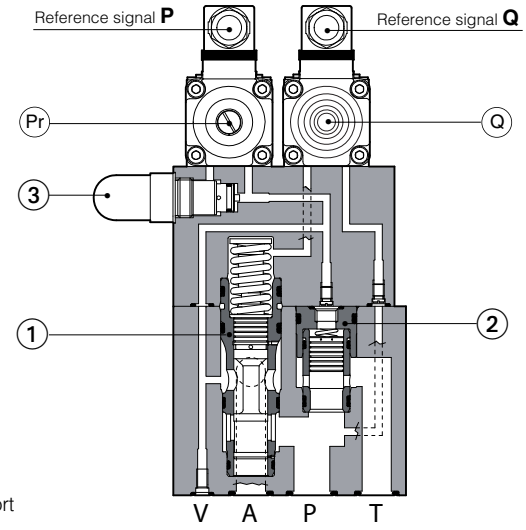
(1) M8 connector SP-ZH-4P-M8/5 moulded on cable 5 mt lenght for pressure or force transducer (options /SL, /SP)

connectors supplied with the valve

Proportional pressure and control valves type QVMZO

indipendent pressure and 3-way compensated flow regulation

QVMZO-A-20



P = Pump port
A = User port
T = Tank port
V = Venting port

QVMZO are double proportional valves, which provide the indipendent flow and pressure control in systems with fixed displacement pump, according to the electronic reference signal.

They operate in association with electronic drivers, see sect. 7, which supply the proportional valves with correct current signal to align valve regulation to the reference signal supplied to the electronic driver.

The cartridge ① regulates the flow at port A according to the reference signal **Q.**
The cartridge ② operates as 3-way pressure compensator between P and A ports discharging excess flow through port T.
The pressure is regulated according to the reference signal **P.**
The pressure relief valve with manual setting ③ operates as safety valve.
The coils are fully plastic encapsulated (insulation class H) and valves have antivibration, antishock and weather-proof features.

Surface mounting: ISO size 16, 25, flange attachment 1 1/4" SAE 3000.
Max flow up to 170 l/min, 280 l/min, 500 l/min respectively with compensating Δp = 7 bar.
Max pressure: 250 bar.

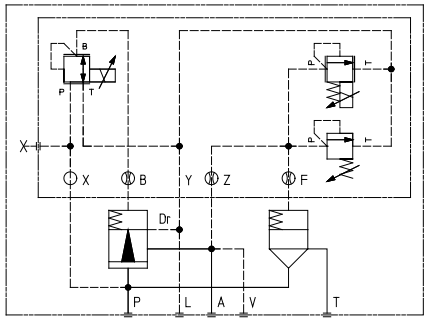
1 MODEL CODE

QVMZO - A - 20 / 3 L4 / 250 / 18 ** /*

- **QVMZO**: Double proportional valve for pressure and flow control
- **A** = without integral transducer
- Size: **20** = ISO 6263 size 20; **32** = ISO 6263 size 25; **40** = flange 1" 1/4 SAE 3000
- **3** = 3-way
- Regulation characteristics: **L2** = linear (only for size 20); **L4** = linear; **S2** = progressive (only for size 20); **S4** = progressive
- Maximum pressure: **250** = 250 bar
- Options: **6** = with 6 VDC coil instead of standard 12 VDC coil; **18** = with 18 VDC coil instead of standard 12 VDC coil
- Series number
- Synthetic fluids: **WG** = water-glycol; **PE** = phosphate ester

2 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Model			QVMZO-20		QVMZO-32	QVMZO-40
Regulation characteristics			L2, S2	L4, S4	L4,S4	L4, S4
Maximum pressure		[bar]	250			
Maximum flow		[l/min]	90	170	280	500
Flow regulation range		[l/min]	1÷90	1÷170	2,5 ÷ 280	5 ÷ 500
Pressure regulation range		[bar]	14 ÷ 250			
FLOW CONTROL Q	Compensating Δp	[bar]	7		7	7
	Hysteresis	[%]	≤ 3			
	Repeatability	[%]	≤1			
PRESSURE CONTROL P	Minimum piloting pressure	[bar]	14			
	Hysteresis	[%]	≤ 2			
	Repeatability	[%]	≤ 1			



Note: plug on port V is normally open.
V port can be used for optional connection to a solenoid valve for venting.

Above performances data refer to valve coupled with Atos electronic drivers, see section 7.

3 MAIN CHARACTERISTICS OF PROPORTIONAL PRESSURE AND FLOW VALVES QVMZO

Assembly position	Any position
Subplate surface finishing	Roughness index, $\sqrt{}^{0.4}$ flatness ratio 0,01/100 (ISO 1101)
Ambient temperature	-20°C ÷ +70°C
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)
Fluid contamination class	ISO 18/15 achieved with in line filters of 10 μm and $\beta_{10} \geq 75$ (recommended)
Fluid temperature	-20°C +60°C (standard and /WG seals) -20°C +80°C (/PE seals)

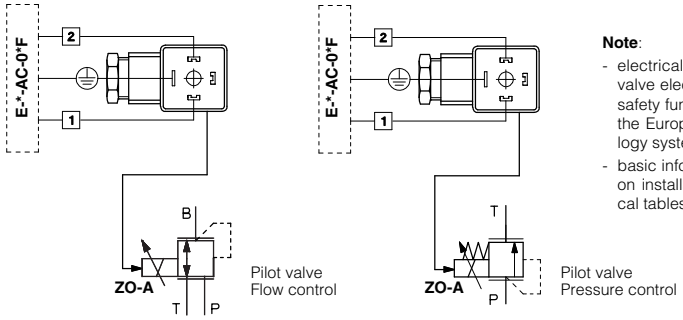
3.1 Coils characteristics

Valve model		QVMZO		
		with 12 Vdc coil	with 6 Vdc coil	with 18 Vdc coil
Coil resistance R at 20°	Flow control Q	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
	Pressure control P			
Max. solenoid current	Flow control Q	1,75 A	2,2 A	0,75 A
	Pressure control P	2 A	2,4 A	0,9 A
Max. power	Flow control Q	30 W	30 W	30 W
	Pressure control P	35 W	35 W	35 W
Protection degree (CEI EN-60529)		IP65		
Duty factor		Continuous rating (ED=100%)		

4 ELECTRIC WIRING

Electric wiring to reference generators must be made using shielded cables: the sheat must be connected to the power supply zero **on the generator side**. The power supply must be properly stabilized or rectified and filtered. For complete electric wiring with all available options, see section G

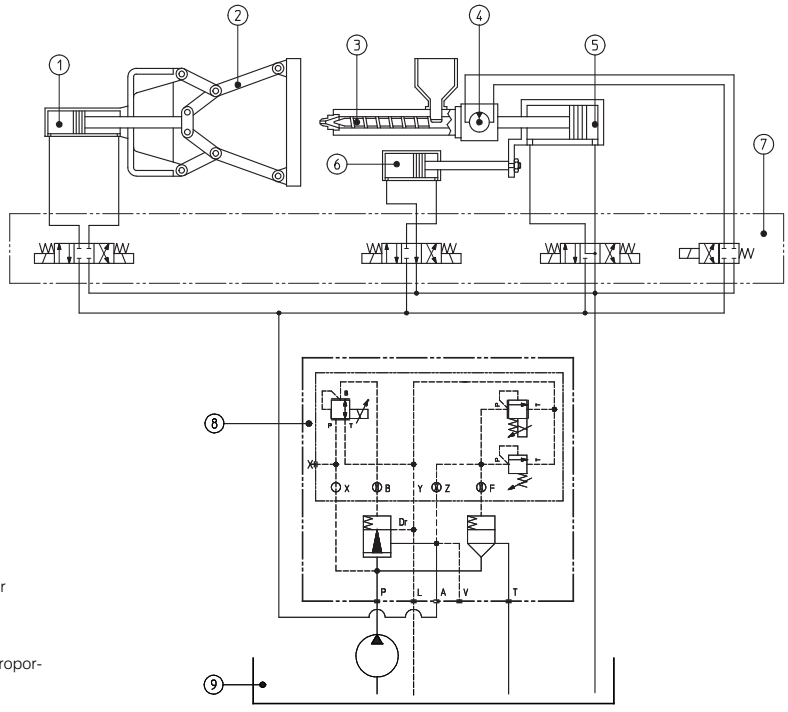
PIN	Connector
1	COIL LEAD
2	COIL LEAD
⏚	EARTH CONDUCTOR



Note:

- electrical signals (e.g. actual - feedback signals) taken via valve electronics must not be used to switch off the machine safety functions. This is in accordance with the regolations to the European standard (Safety requirements of fluid technology systems and components - hydraulics).
- basic information for commissioning and start-up are present on installation notes always enclosed to the specific technical tables and relevant components.

5 TYPICAL APPLICATION IN PLASTIC INJECTION MACHINES

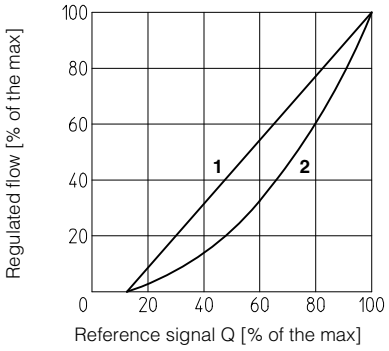


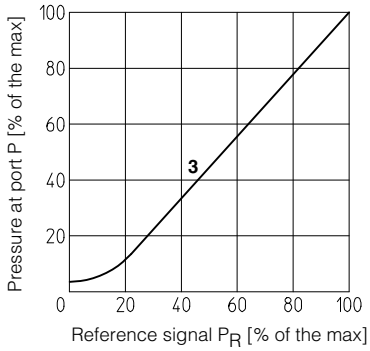
1 = Moulding clamping cylinder
2 = Five-point double toggle joint
3 = Injection screw
4 = Screw-driving hydraulic motor
5 = Injection cylinder
6 = Injection unit sliding cylinder
7 = Injection manifold
8 = Double, flow and pressure, proportional control type QVMZO
9 = Tank and motor pump unit

6 DIAGRAMS

6.1 Regulation diagrams for valves with Atos electronic drivers

1 = QVMZO…L2, L4
2 = QVMZO…S2, S4
3 = QVMZO (pressure regulation)

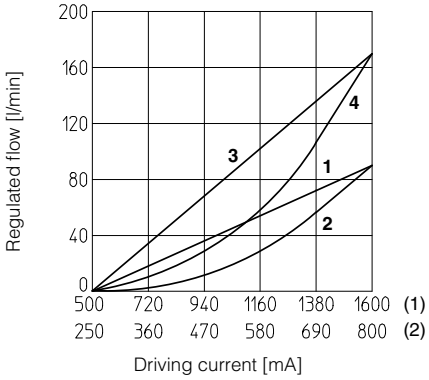


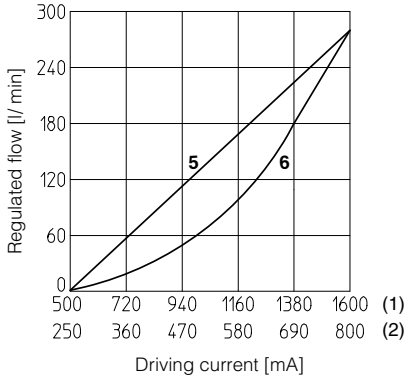


6.2 Regulation diagrams: driving current vs. regulated flow and vs. regulated pressure

1 = QVMZO-A-20/3L2
2 = QVMZO-A-20/3S2
3 = QVMZO-A-20/3L4
4 = QVMZO-A-20/3S4
5 = QVMZO-A-32/3L4
6 = QVMZO-A-32/3S4
7 = QVMZO-A-40/3L4
8 = QVMZO-A-40/3S4

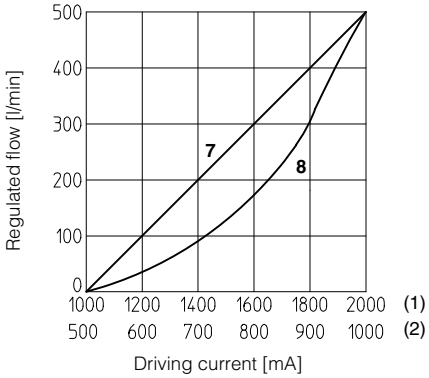
9 = QVMZO (pressure regulation)

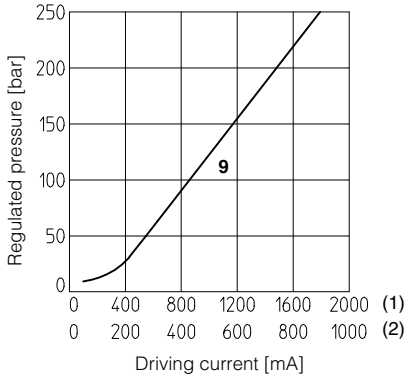




Note:

(1) = with standard coil 12 V_{DC}
(2) = with coil 18 V_{DC}





7 ELECTRONIC DRIVERS FOR QVMZO-A*

Valve model	-A			
Drivers model	E-MI-AC-01F	E-BM-AC-011F	E-ME-AC-01F	E-RP-AC-01F
Data sheet	G010	G025	G035	G100

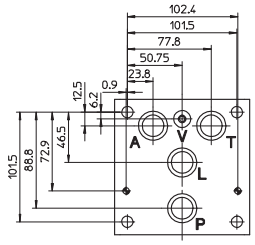
For complete information about the drivers characteristics and relevant options, see the technical data sheet specified in the table.

8 INSTALLATION DIMENSIONS [mm]

QVMZO-20

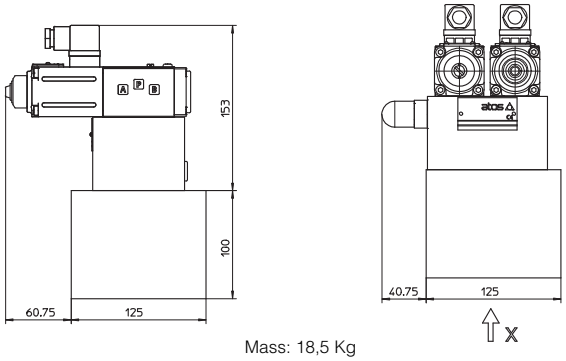
ISO 6263: 1999
Mounting surface: 6263-07-11-1-97
Fastening bolts: 4 socket head screws M10x80 class 12.9
Tightening torque = 70 Nm
Seals: 4 OR 130; 1 OR 2050
Diameter of ports A, P, T: Ø = 20 mm

P = Inlet port
A = Outlet port
T = Tank port
L = Drain port
V = Vent port



View X

QVMZO-A-20

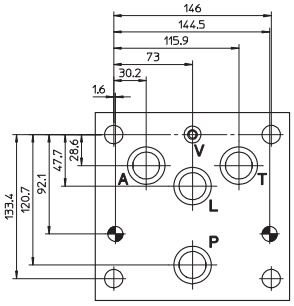


Mass: 18,5 Kg

QVMZO-32

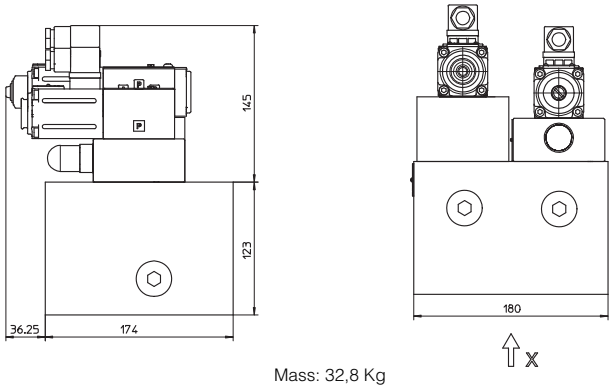
ISO 6263: 1999
Mounting surface: 6263-08-15-1-97
Fastening bolts: 4 socket head screws M16x120 class 12.9
Tightening torque = 300 Nm
Seals: 4 OR 4112, 1 OR 2050
Ports diameter:
Ø 25 mm (P, A, L, T);
Ø 5 mm (V)

P = Inlet port
A = Outlet port
T = Tank port
L = Drain port
V = Vent port



View X

QVMZO-A-32

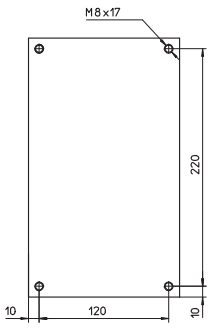


Mass: 32,8 Kg

QVMZO-40

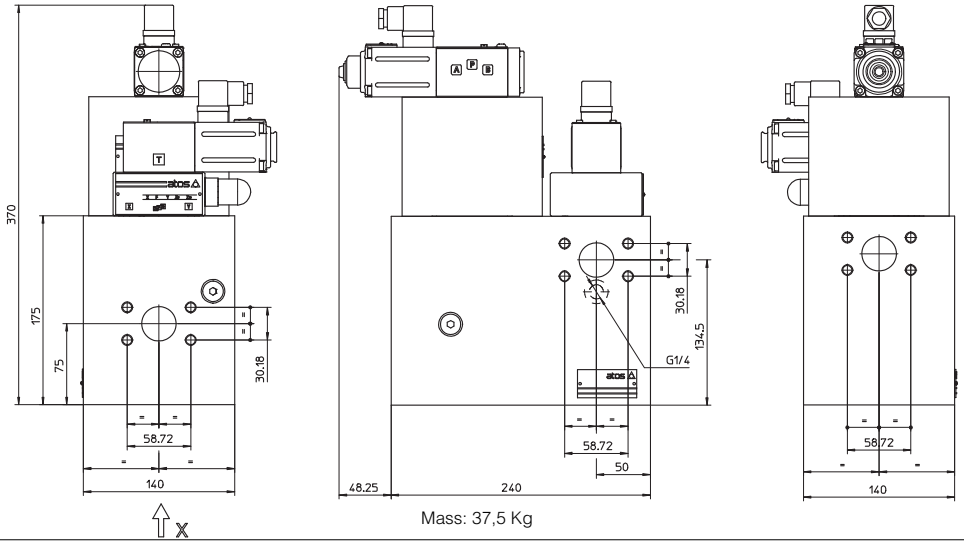
Fastening bolts: M8 class 12.9
Tightening torque = 35 Nm
Port attachments:
A, P, T = 1" 1/4 SAE 3000
L = G 1/4"

P = Inlet port
A = Outlet port
T = Tank port
L = Drain port



View X

QVMZO-A-40



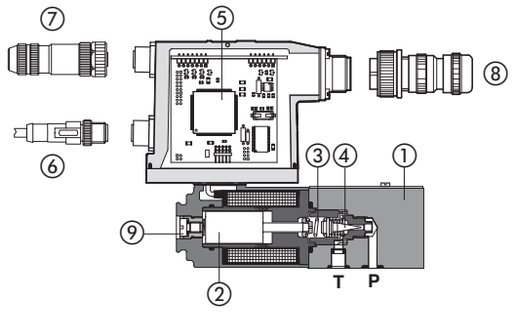
Mass: 37,5 Kg

9 MOUNTING PLATES (only for QVMZO-20)

Size	Model	Ports location	Gas ports P-A-T (L)	Ø Counterbore [mm] P-A-T (L)	Mass [kg]
20	BA-426	Ports P, A, L, T underneath	G 3/4" (G 1/4")	36,5 (21,5)	6
	BA-526	Ports P, A, L, T underneath	G 1" (G 1/4")	46 (21,5)	5,8

Proportional relief valves

digital, direct operated, open loop



① Valve body
② Proportional solenoid
③ Spring
④ Poppet
⑤ Integral electronics
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air bleeding

RZMO-AES-BC-010

RZMO-A, RZMO-AEB, RZMO-AES

Poppet type direct operated digital proportional relief valves for pressure open loop controls.

Executions:
- **A** without integral driver, to be coupled with separated driver, see section 2
- **AEB** with basic integral digital electronic driver, analog reference signals and USB port for software functional parameters setting
- **AES** with full integral digital electronic driver and fieldbus interface for functional parameters setting, reference signals and real-time diagnostics

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting

Size: **06**
Max flow: **4 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO	-	A	EB	-	NP	-	010	/	315	/	*	**	/	*

RZMO — Proportional pressure relief valve size 06

A = open loop pressure control

- = omit for execution with separated driver see section 2
EB = basic integral driver
ES = full integral driver

Fieldbus interfaces - USB port always present **(1)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Configuration:
010 = regulation on port P, discharge in T (direct operated version)

Max regulated pressure (2):
50 = 50 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Coil voltage only for **-A** - see section 8:
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

Electronics options
only for **AEB** and **AES** - see section 9:
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input 0 ÷ 10 V)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

Series number

Seals material, see sect. 5, 6:
- = NBR
PE = FKM
BT = HNBR

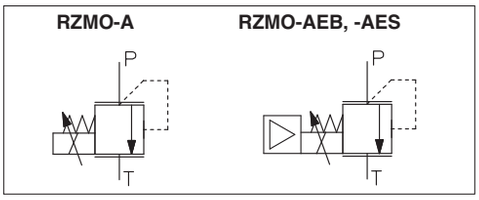
(1) Omit for **A** execution; **AEB** available only in version **NP**; **AES** available only in version **BC**, **BP**, **EH**
(2) Special execution with max regulated pressure **500 bar** available on request

2 ELECTRONIC DRIVERS

Valve model	A										AEB	AES
Drivers model	E-MI-AC-01F		E-BM-AC-01F		E-ME-AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	E-RI-AEB	E-RI-AES
Type	Analog					Digital						
Voltage supply (V$_{DC}$)	12	24	12	24	24	12	24	12	24	24	24	
Valve coil option	/6	std	/6	std	std	/6	std	/6	std	std	std	
Format	plug-in to solenoid		DIN 43700 UNDECAL		EUROCARD	plug-in to solenoid		DIN-rail panel			Integral to valve	
Data sheet	G010		G025		G035	G020		G030		GS050	GS115	

Note: for main and communication connector see sections 11 , 12

Hydraulic symbol



3 GENERAL NOTES

RZMO-A* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

4 FIELDBUS - only for **AES**

Fieldbus allows the direct communication of the proportional valve 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**.

5 MAIN CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Assembly position / location	Any position			
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)			
MTTF valves according to EN ISO 13849	150 years, see technical table P007			
Ambient temperature range	**A**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +60°C **AEB, AES**: **standard** = -20°C ÷ +60°C, **/BT** option = -40°C ÷ +60°C			
Storage temperature range	**A**: **standard** = -20°C ÷ +80°C, **/BT** option = -40°C ÷ +70°C **AEB, AES**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +70°C			
Coil resistance R at 20°C	Standard = 3 ÷ 3,3 Ω	Option /6 = 2 ÷ 2,2 Ω	Option /18 = 13 ÷ 13,4 Ω	
Max. solenoid current	Standard = 2,6 A	Option /6 = 3,25 A	Option /18 = 1,5 A	
Max. power	**A** = 30 Watt	**AEB, AES** = 50 Watt		
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	IP66/67 with mating connectors			
Tropicalization (only AEB, AES)	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface (only AEB, AES)	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer (only AEB, AES)	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Max regulated pressure	[bar]	**50**	**100**	**210**	**315**	**350**
Min. regulated pressure	[bar]	see min. pressure / flow diagrams at sect. 7				
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)** (depending on installation)	[ms]	≤ 70				
Hysteresis	[% of the max pressure]	≤ 1,5				
Linearity	[% of the max pressure]	≤ 3				
Repeatability	[% of the max pressure]	≤ 2				

Notes: above performance data refer to valves coupled with Atos electronic drivers, see section 2

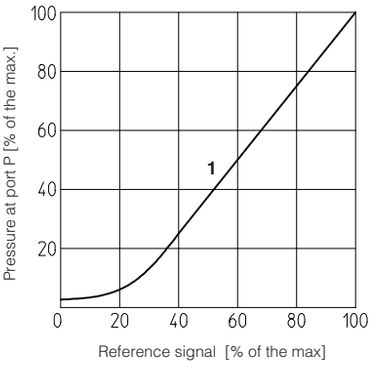
(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.

6 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

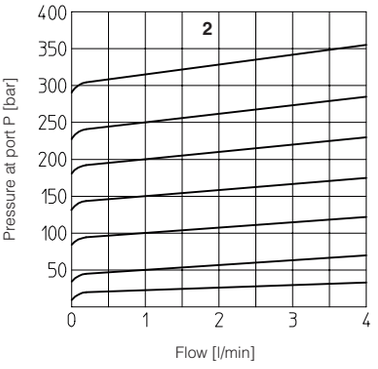
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
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	

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

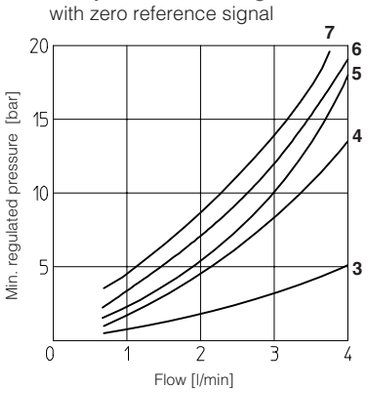
1 Regulation diagrams
with flow rate Q = 1 l/min



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.

8 OPTIONS for -A

8.1 Coil voltage

Option /6 optional coil to be used with Atos drivers with power supply 12 VDC
Option /18 optional coil to be used with electronic drivers not supplied by Atos

9 ELECTRONIC OPTIONS - for AEB and AES

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A fuse time lag is required in series to each driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with 0÷+10 VDC nominal range (pin D,E), proportional to desired valve pressure regulation

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Note: a minimum booting time of 500 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero.

9.1 Option /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 V 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

9.2 Option /Q

To enable the driver, supply 24 VDC on pin C referred to pin B: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

9.3 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication

Separate power supply (pin 9,10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, serial and fieldbus communication. A safety fuse is required in series to each driver power supply: 500 mA fast fuse.

9.4 Possible combined options: /IQ, /IZ

10 ELECTRONIC CONNECTIONS

10.1 Main connector signals - 7 pin - **standard** and **/Q** option - **RZMO-AEB** and **RZMO-AES** (A1)

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	**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	**MONITOR** referred to: AGND / V0		Pressure 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	

10.2 Main connector signals - 12 pin - **/Z** option - **RZMO-AEB** and **RZMO-AES** (A2)

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 V0	Input - on/off signal
4	**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	**MONITOR**	Pressure monitor output signal: ±5 VDC maximum range Defaults 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 V0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

10.3 Communication connectors - **RZMO-AEB** (B) and **RZMO-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)**

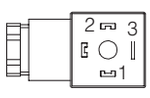
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

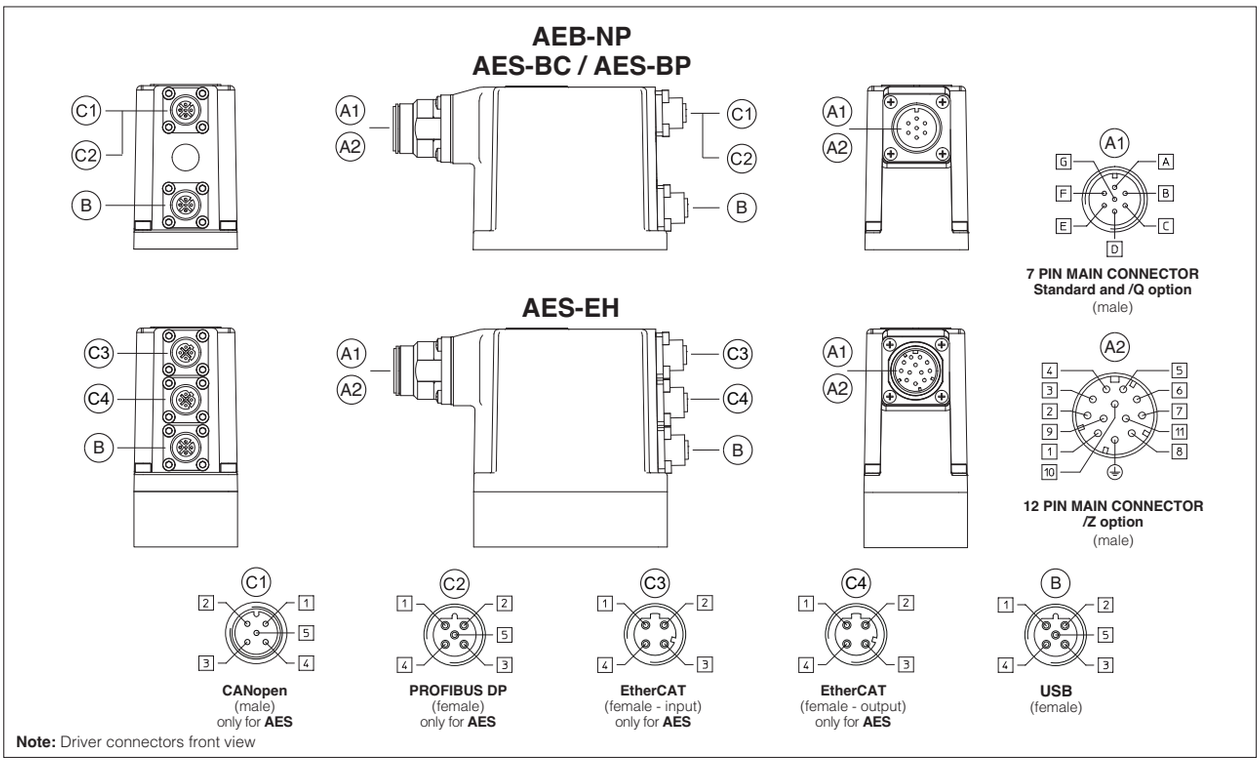
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

Notes: (1) shield connection on connector's housing is recommended **(2)** only for **AES** execution

10.4 Solenoid connection - only for **RZMO-A**

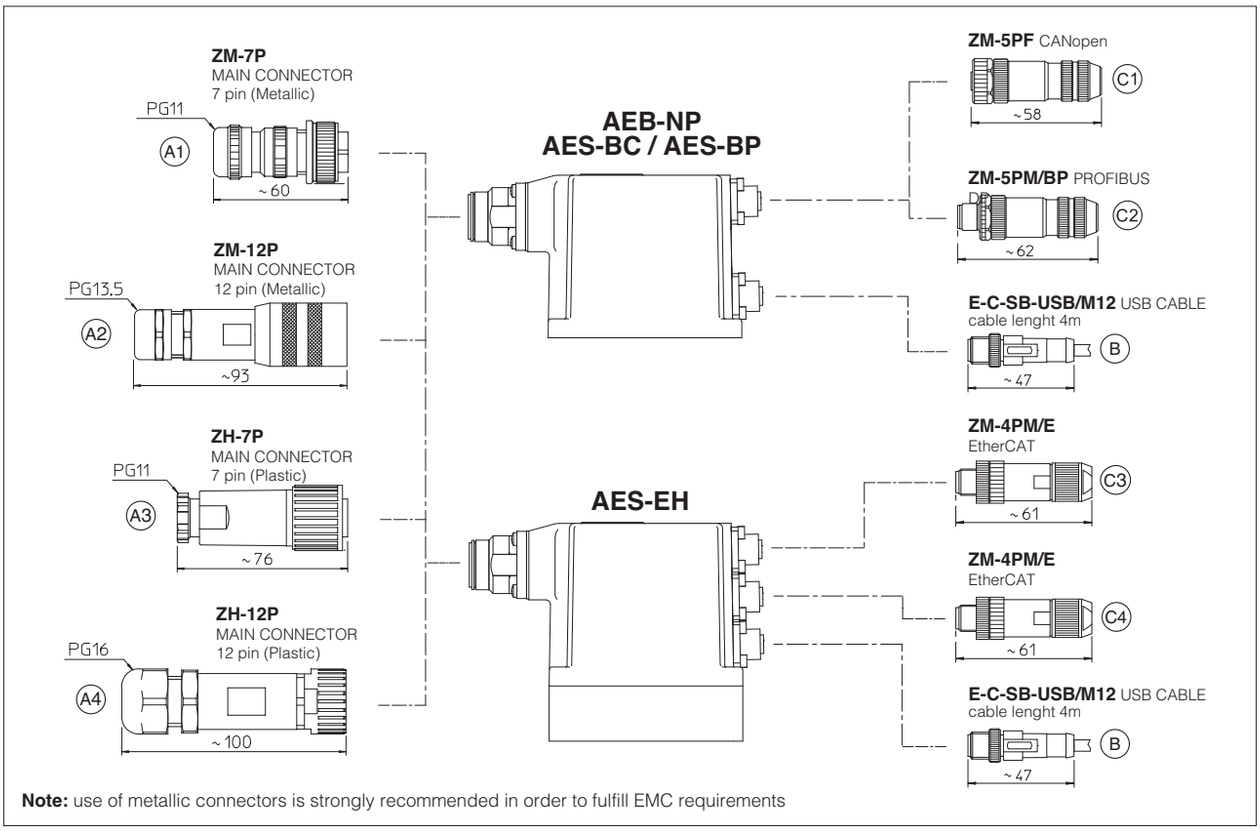
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.5 Connections layout - only for **AEB** and **AES**



Note: Driver connectors front view

11 CONNECTORS



Note: use of metallic connectors is strongly recommended in order to fulfill EMC requirements

12 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	A (1) Power supply	AEB AES	AEB/Z AES/Z	BC - CANopen	BP - PROFIBUS DP	EH - EtherCAT
CONNECTOR CODE	666	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PM/BP (C2)	ZM-4PM/E (C3)
		ZH-7P (A3)	ZH-12P (A4)			ZM-4PM/E (C4)
PROTECTION DEGREE	IP67	IP67				
DATA SHEET	K500	GS115, K500				

(1) Connectors supplied with the valve

only for **AES**

13 PROGRAMMING TOOLS - see tech table **GS500**

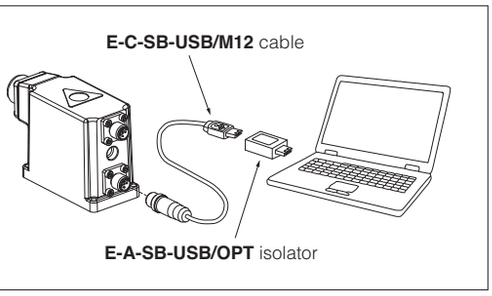
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver. For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options:

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)	
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

USB connection

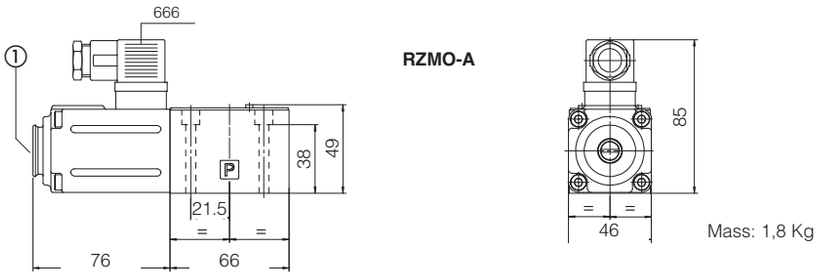


14 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface:
4401-03-02-0-05 (see table P005)
(without ports A and B)

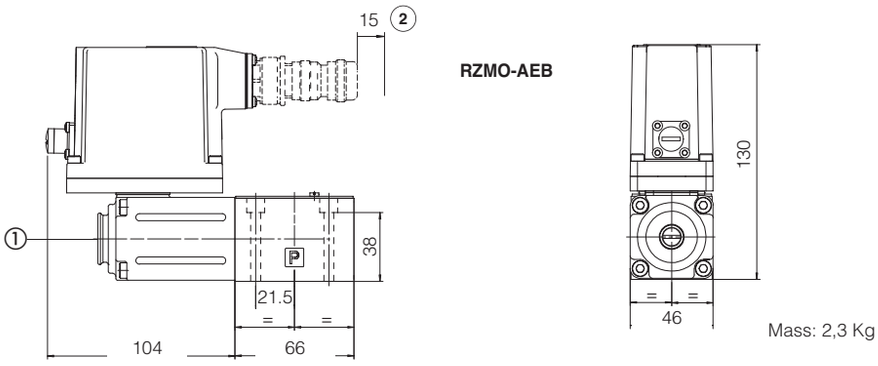
Fastening bolts:
4 socket head screws
M5X50 class 12.9 Tightening torque = 8 Nm
Seals: 2 OR 108
Ports P, T: Ø = 5 mm

RZMO-A



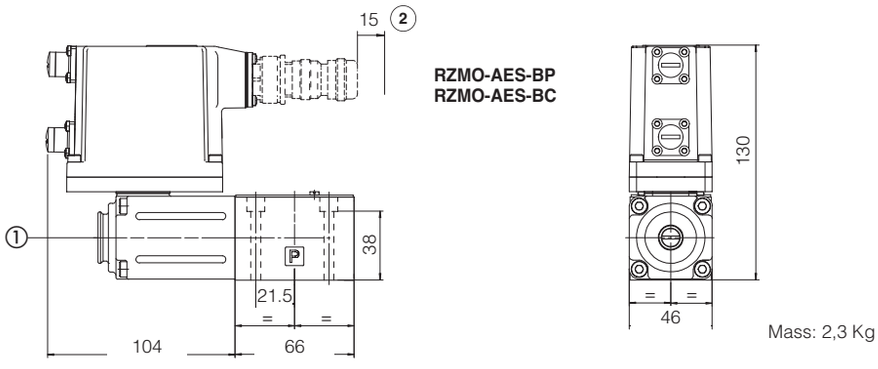
Mass: 1,8 Kg

RZMO-AEB



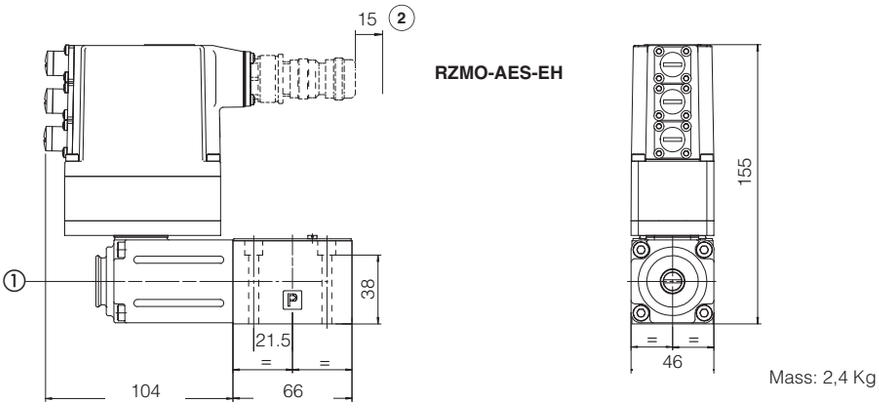
Mass: 2,3 Kg

RZMO-AES-BP
RZMO-AES-BC

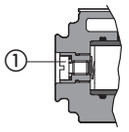


Mass: 2,3 Kg

RZMO-AES-EH



Mass: 2,4 Kg

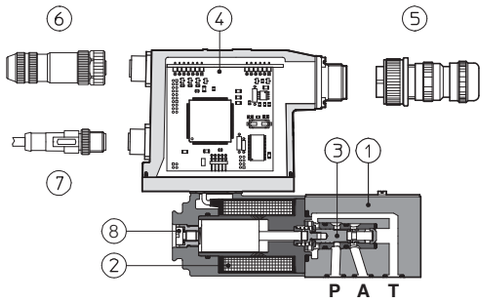


① = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ①

② = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 11, 12

Proportional reducing valves

digital, direct operated, open loop



① Valve body
② Proportional solenoid
③ Spool
④ Integral electronics
⑤ Main connector
⑥ Fieldbus connector
⑦ USB connector
⑧ Screw for air blending

RZGO-AES-BC-010

RZGO-A , RZGO-AEB, RZGO-AES

Spool type direct operated digital proportional reducing valves for pressure open loop controls.

Executions:
- **A** without integral driver, to be coupled with separated driver, see section 2
- **AEB** with basic integral digital electronic driver, analog reference signals and USB port for software functional parameters setting
- **AES** with full integral digital electronic driver and fieldbus interface for functional parameters setting, reference signals and real-time diagnostics

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting

Size: **06**
Max flow: **12 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZGO	-	A	EB	-	NP	-	010	/	210	/	*	**	/	*

RZGO — Proportional pressure reducing valve size 06

A = open loop pressure control

- = omit for execution with separated driver see section 2
EB = basic integral driver
ES = full integral driver

Fieldbus interfaces - USB port always present **(1)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Configuration:
010 = regulation on port A, discharge in T (direct operated version)

Max regulated pressure:
32 = 32 bar
100 = 100 bar
210= 210 bar

Coil voltage only for **-A** - see section 8:
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

Electronics options
only for **AEB** and **AES** - see section 9:
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input 0 ÷ 10 V)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

Series number

Seals material, see sect. 5, 6:
- = NBR
PE = FKM
BT = HNBR

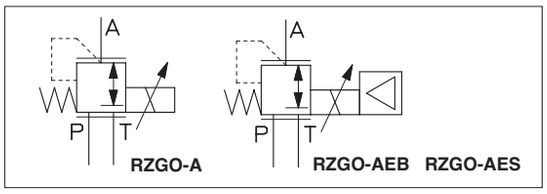
(1) Omit for **A** execution; **AEB** available only in version **NP**; **AES** available only in version **BC**, **BP**, **EH**

2 ELECTRONIC DRIVERS

Valve model	A										AEB	AES
Drivers model	E-MI-AC-01F		E-BM-AC-01F		E-ME-AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	E-RI-AEB	E-RI-AES
Type	Analog					Digital						
Voltage supply (V$_{DC}$)	12	24	12	24	24	12	24	12	24	24	24	
Valve coil option	/6	std	/6	std	std	/6	std	/6	std	std	std	
Format	plug-in to solenoid		DIN 43700 UNDECAL		EUROCARD	plug-in to solenoid		DIN-rail panel			Integral to valve	
Data sheet	G010		G025		G035	G020		G030		GS050	GS115	

Note: for main and communication connector see sections 11 , 12

Hydraulic symbol



3 GENERAL NOTES

RZGO-A* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

4 FIELDBUS - only for **AES**

Fieldbus allows the direct communication of the proportional valve 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**.

5 MAIN CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Assembly position	Any position			
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)			
MTTFd valves according to EN ISO 13849	150 years, see technical table P007			
Ambient temperature range	**A**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +60°C **AEB, AES**: **standard** = -20°C ÷ +60°C, **/BT** option = -40°C ÷ +60°C			
Storage temperature range	**A**: **standard** = -20°C ÷ +80°C, **/BT** option = -40°C ÷ +70°C **AEB, AES**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +70°C			
Coil resistance R at 20°C	Standard = 3 ÷ 3,3 Ω	Option /6 = 2 ÷ 2,2 Ω	Option /18 = 13 ÷ 13,4 Ω	
Max. solenoid current	Standard = 2,4A (1,8 for /32)	Option /6 = 3A (2,25A for /32)	Option /18 = 1A (0,8A for /32)	
Max. power	**A** = 30 Watt **AEB, AES** = 50 Watt			
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	IP66/67 with mating connectors			
Tropicalization (only AEB, AES)	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface (only AEB, AES)	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer (only AEB, AES)	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Max regulated pressure [bar]	**32**	**100**	**210**	
Min. regulated pressure **(1)** [bar]	0,8			
Max. pressure at port P [bar]	350			
Max. pressure at port T [bar]	210			
Max. flow [l/min]	12			
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			
Repeatability [% of the max pressure]	≤ 2			

Notes: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) Min pressure value to be increased of T line pressure

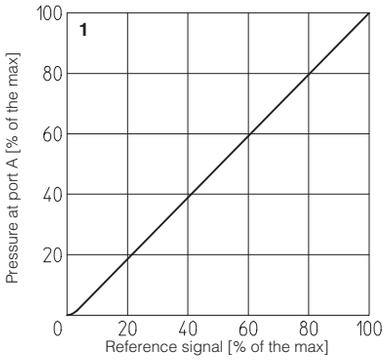
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

6 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

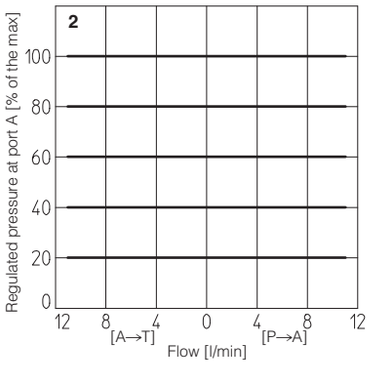
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
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	

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

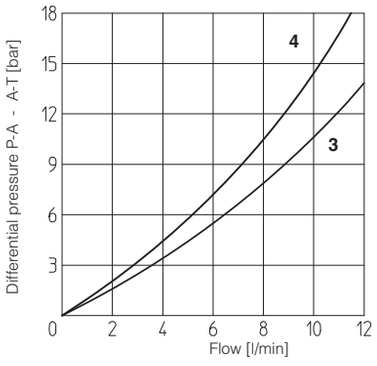
1 Regulation diagrams
with flow rate Q = 1 l/min



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

8 OPTIONS for -A

8.1 Coil voltage

Option /6 optional coil to be used with Atos drivers with power supply 12 VDC

Option /18 optional coil to be used with electronic drivers not supplied by Atos

9 ELECTRONIC OPTIONS - for AEB and AES

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A fuse time lag is required in series to each driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with 0÷+10 VDC nominal range (pin D,E), proportional to desired valve pressure regulation

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Note: a minimum booting time of 500 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero.

9.1 Option /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 V 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

9.2 Option /Q

To enable the driver, supply 24 VDC on pin C referred to pin B: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

9.3 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication

Separate power supply (pin 9,10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, serial and fieldbus communication. A safety fuse is required in series to each driver power supply: 500 mA fast fuse

9.4 Possible combined options: /IQ, /IZ

10 ELECTRONIC CONNECTIONS

10.1 Main connector signals - 7 pin - **standard** and **/Q** option - **RZGO-AEB** and **RZGO-AES** (A1)

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	**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	**MONITOR** referred to: AGND / V0		Pressure 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	

10.2 Main connector signals - 12 pin - **/Z** option - **RZGO-AEB** and **RZGO-AES** (A2)

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 V0	Input - on/off signal
4	**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	**MONITOR**	Pressure monitor output signal: ±5 VDC maximum range Defaults 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 V0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

10.3 Communication connectors - **RZGO-AEB** (B) and **RZGO-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 +

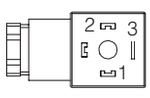
(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(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**	

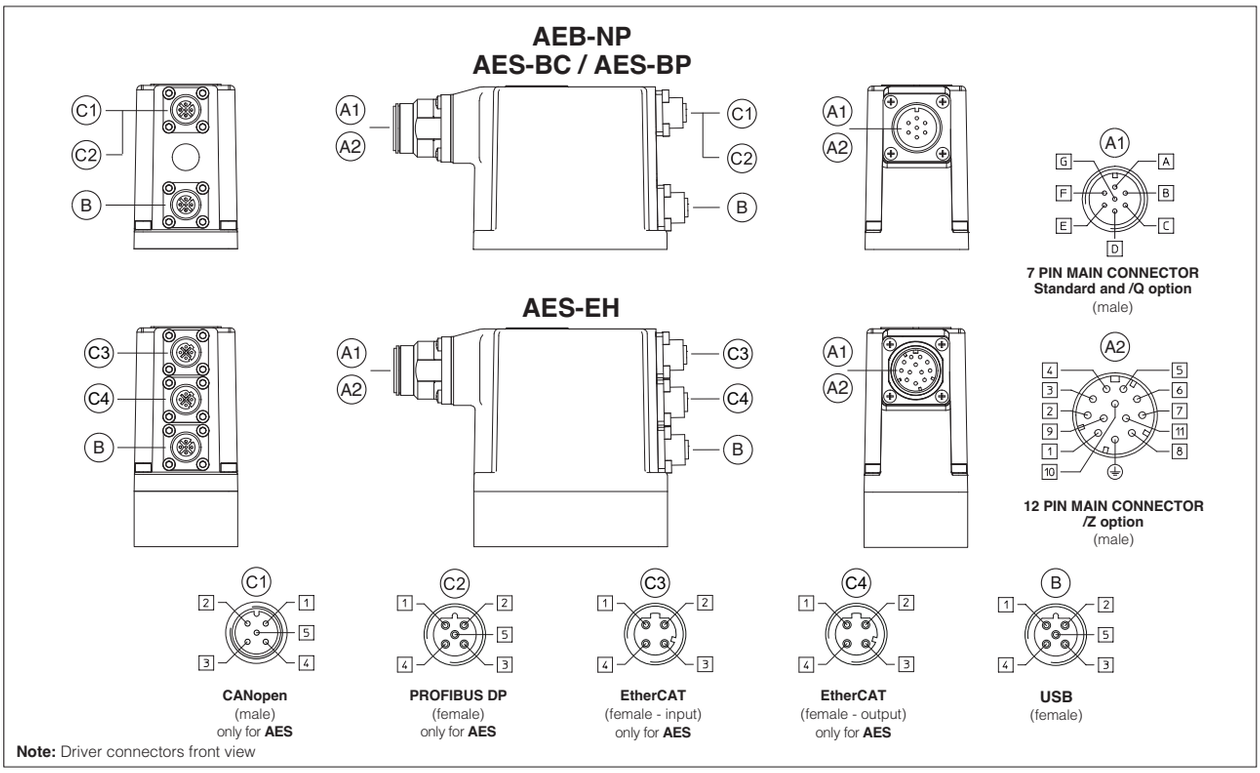
(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

Notes: (1) shield connection on connector's housing is recommended **(2)** only for **AES** execution

10.4 Solenoid connection - only for **RZGO-A**

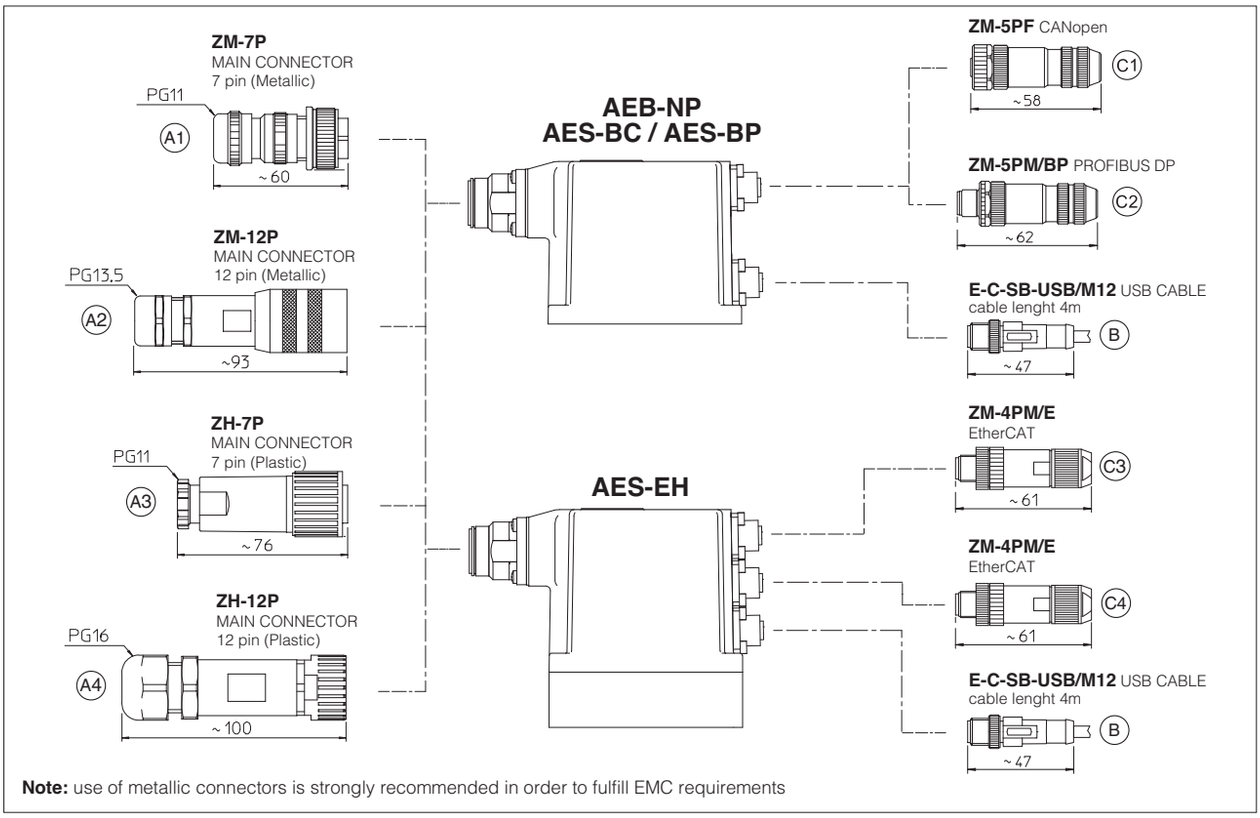
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.5 Connections layout - only for **AEB** and **AES**



Note: Driver connectors front view

11 CONNECTORS



Note: use of metallic connectors is strongly recommended in order to fulfill EMC requirements

12 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	A (1) Power supply	AEB AES	AEB/Z AES/Z	BC - CANopen	BP - PROFIBUS DP	EH - EtherCAT
CONNECTOR CODE	666	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PM/BP (C2)	ZM-4PM/E (C3)
		ZH-7P (A3)	ZH-12P (A4)			ZM-4PM/E (C4)
PROTECTION DEGREE	IP67	IP67				
DATA SHEET	K500	GS115, K500				

(1) Connectors supplied with the valve

only for **AES**

13 PROGRAMMING TOOLS - see tech table **GS500**

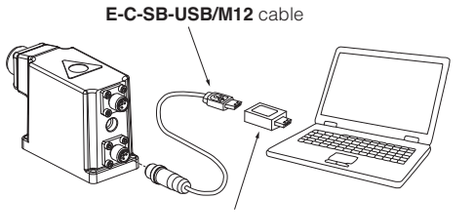
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver. For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options:

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)	
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

USB connection

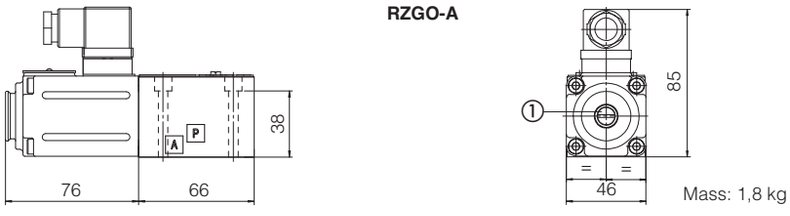


14 INSTALLATION DIMENSIONS [mm]

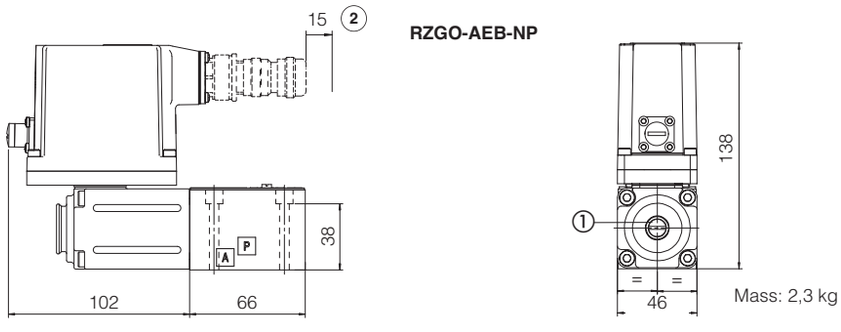
ISO 4401: 2005
Mounting surface:
4401-03-02-0-05 (see table P005)

Fastening bolts:
4 socket head screws M5X50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P, A, T: Ø = 5 mm
Port B not used

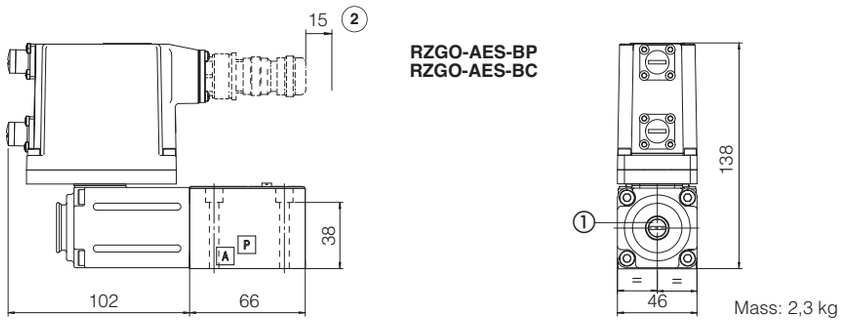
RZGO-A



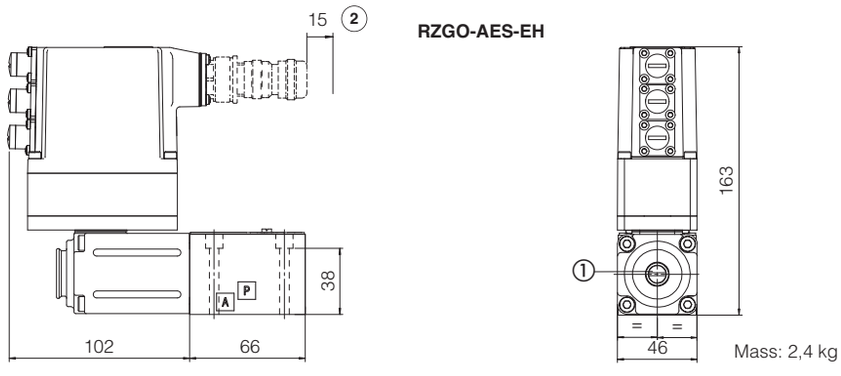
RZGO-AEB-NP

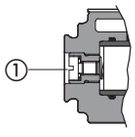


RZGO-AES-BP
RZGO-AES-BC



RZGO-AES-EH



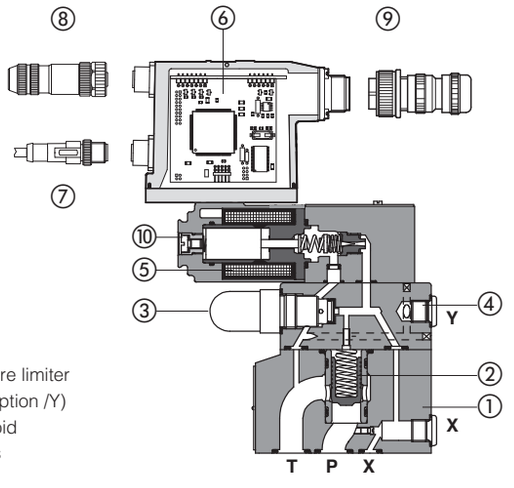


① = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ①

② = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 11, 12

Proportional relief valves

digital, pilot operated, open loop



① Valve main body
② Main poppet
③ Mechanical pressure limiter
④ Drain port G 1/4" (option /Y)
⑤ Proportional solenoid
⑥ Integral electronics
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, pilot operated proportional relief valves for pressure open loop controls.

Executions:
- **A** without integral driver, to be coupled with separated driver, see section 2
- **AEB** with basic integral digital electronic driver, analog reference signals and USB port for software functional parameters setting
- **AES** with full integral digital electronic driver and fieldbus interface for functional parameters setting, reference signals and real-time diagnostics

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting

Size: **10, 20, 32**
Max flow: **200, 400, 600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGMZO	-	A	EB	-	NP	-	10	/	315	/	*	/	*	/	**	/	*

AGMZO: Proportional pressure relief valve, pilot operated

A = open loop pressure control

- = omit for execution with separated driver see section 2
EB = basic integral driver
ES = full integral driver

Fieldbus interfaces - USB port always present **(1)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Valve size ISO 6264: **10, 20, 32**

Max regulated pressure:
50 = 50 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Series number

Seals material, see sect. 5, 6:
- = NBR
PE = FKM
BT = HNBR

Coil voltage only for **A** - see section 12:
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

Hydraulic options - see sect. 8
E = external pilot
Y = external drain (only pipe connection G1/4")

Electronics options
only for **AEB** and **AES** - see section 13:
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input 0 ÷ 10 V)
Q = enable signal
Z = double power supply, enable fault and monitor signals - 12 pin connector

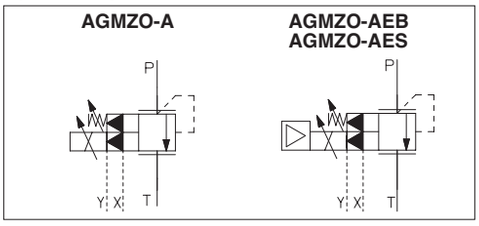
(1) Omit for **A** execution; **AEB** available only in version **NP**; **AES** available only in version **BC**, **BP**, **EH**

2 ELECTRONIC DRIVERS

Valve model	A										AEB	AES
Drivers model	E-MI-AC-01F		E-BM-AC-01F		E-ME-AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	E-RI-AEB	E-RI-AES
Type	Analog					Digital						
Voltage supply (V$_{DC}$)	12	24	12	24	24	12	24	12	24	24	24	
Valve coil option	/6	std	/6	std	std	/6	std	/6	std	std	std	
Format	plug-in to solenoid		DIN 43700 UNDECAL		EUROCARD	plug-in to solenoid		DIN-rail panel			Integral to valve	
Data sheet	G010		G025		G035	G020		G030		GS050	GS115	

Note: for main and communication connector see sections 16, 17

Hydraulic symbol



3 GENERAL NOTES

AGMZO-A* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

4 FIELDBUS - only for **AES**

Fieldbus allows the direct communication of the proportional valve 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**.

5 MAIN CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Assembly position	Any position			
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)			
MTTFd valves according to EN ISO 13849	75 years, see technical table P007			
Ambient temperature range	**A**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +60°C **AEB, AES**: **standard** = -20°C ÷ +60°C, **/BT** option = -40°C ÷ +60°C			
Storage temperature range	**A**: **standard** = -20°C ÷ +80°C, **/BT** option = -40°C ÷ +70°C **AEB, AES**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +70°C			
Coil resistance R at 20°C	Standard = 3 ÷ 3,3 Ω	Option /6 = 2 ÷ 2,2 Ω	Option /18 = 13 ÷ 13,4 Ω	
Max. solenoid current	Standard = 2,6 A	Option /6 = 3,25 A	Option /18 = 1,5 A	
Max. power	**A** = 30 Watt	**AEB, AES** = 50 Watt		
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	IP66/67 with mating connectors			
Tropicalization (only AEB, AES)	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface (only REB, RES)	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer (only REB, RES)	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Valve size		**10**	**20**	**32**
Max regulated pressure	[bar]	50; 100; 210; 315; 350		
Min. regulated pressure	[bar]	see min. pressure / flow diagrams at sect. 7		
Max. pressure at port P	[bar]	350		
Max. pressure at port T	[bar]	210		
Max. flow	[l/min]	200	400	600
Response time 0-100% step signal **(1)** (depending on installation)	[ms]	120	135	150
Hysteresis	[% of the max pressure]	≤ 0,5		
Linearity	[% of the max pressure]	≤ 1,0		
Repeatability	[% of the max pressure]	≤ 0,2		

Notes: above performance data refer to valves coupled with Atos electronic drivers, see section 2.

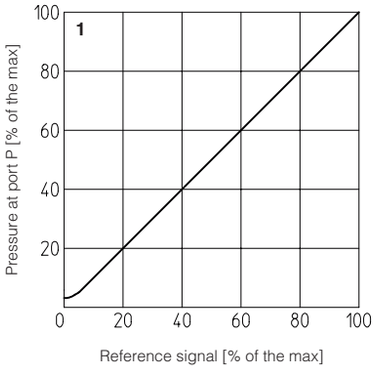
(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.

6 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

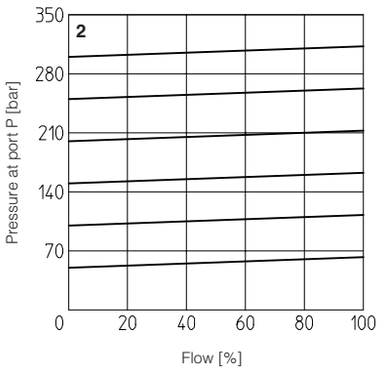
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, achievable with in line filter - 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	

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

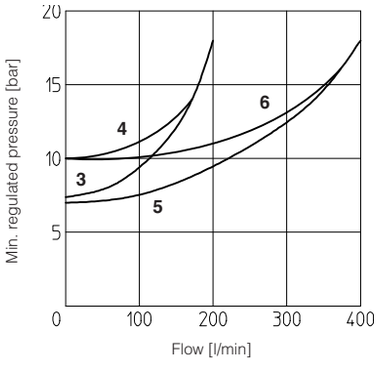


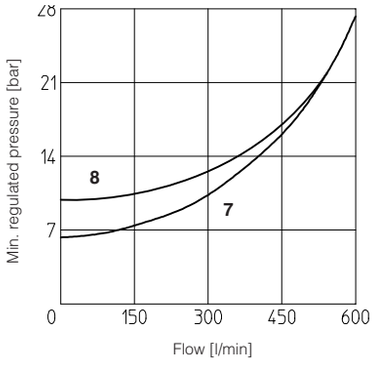
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



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



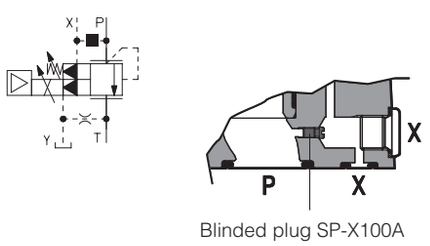


8 HYDRAULIC OPTIONS

8.1 Option 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").

AGMZO-*/E

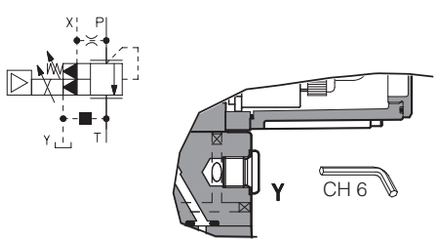


Blinded plug SP-X100A

8.2 Option 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.

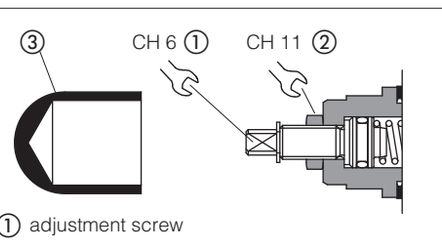
AGMZO-*/Y



9 MECHANICAL PRESSURE LIMITER

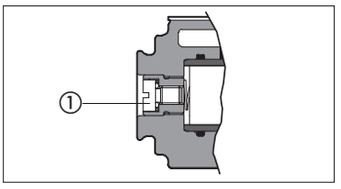
The AGMZO are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated 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.



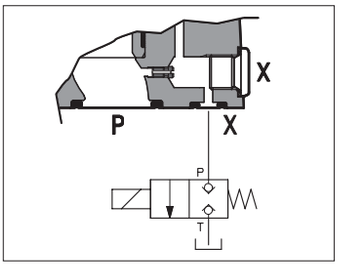
① adjustment screw
② locking nut
③ protection cap

10 AIR BLEEDING



At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

11 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.

12 OPTIONS for -A

12.1 Coil voltage

Option /6 optional coil to be used with Atos drivers with power supply 12 VDC

Option /18 optional coil to be used with electronic drivers not supplied by Atos

13 ELECTRONIC OPTIONS - for AEB and AES

Standard driver execution provides on the 7 pin main connector:

Power supply - 24 VDC must be appropriately stabilized or rectified and filtered; a 2,5 A fuse time lag is required in series to each driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with 0÷+10 VDC nominal range (pin D, E), proportional to desired valve pressure regulation

Monitor output signal - analog output signal proportional to the actual valve coil current (1V monitor = 1A coil current)

Note: a minimum booting time of 500 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero..

13.1 Option /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 V 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.

13.2 Option /Q

To enable the driver, supply 24 VDC on pin C referred to pin B: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

13.3 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal.

Power supply for driver's logics and communication

Separate power supply (pin 9, 10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, serial and fieldbus communication.
A safety fuse is required in series to each driver power supply: 500 mA fast fuse

13.4 Possible combined options: /IQ, /IZ

14 PROGRAMMING TOOLS - see tech table GS500

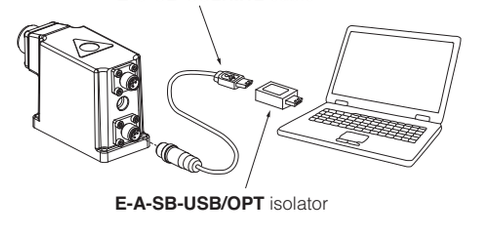
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver. For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options:

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)	
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

USB connection



15 ELECTRONIC CONNECTIONS

15.1 Main connector signals - 7 pin - **standard** and **/Q** option - **AGMZO-AEB** and **AGMZO-AES** (A1)

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	**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	**MONITOR** referred to: AGND | V0		Pressure 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	

15.2 Main connector signals - 12 pin - **/Z** option - **AGMZO-AEB** and **AGMZO-AES** (A2)

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 V0	Input - on/off signal
4	**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	**MONITOR**	Pressure monitor output signal: ±5 VDC maximum range Defaults 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 V0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

15.3 Communication connectors - **AGMZO-AEB** (B) and **AGMZO-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)**

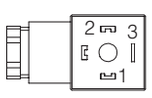
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

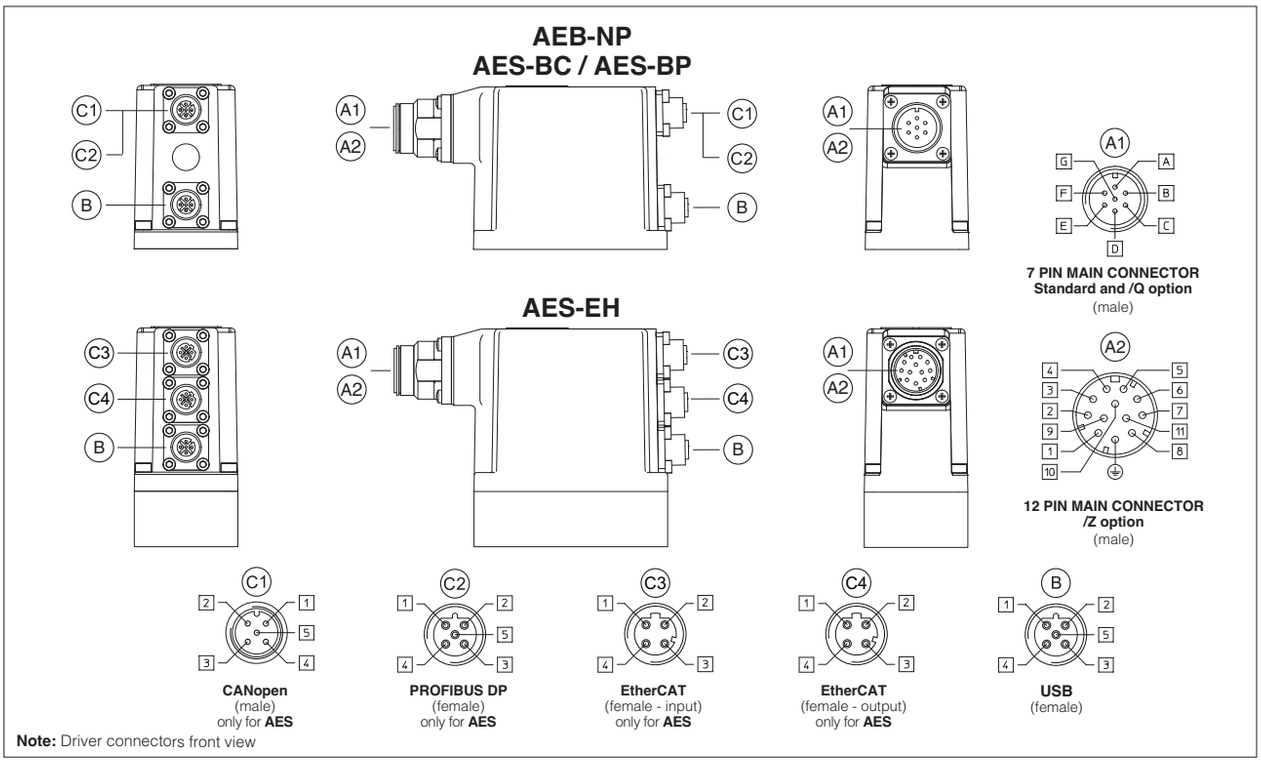
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

Notes: (1) shield connection on connector's housing is recommended **(2)** only for **AES** execution

15.4 Solenoid connection - only for **AGMZO-A**

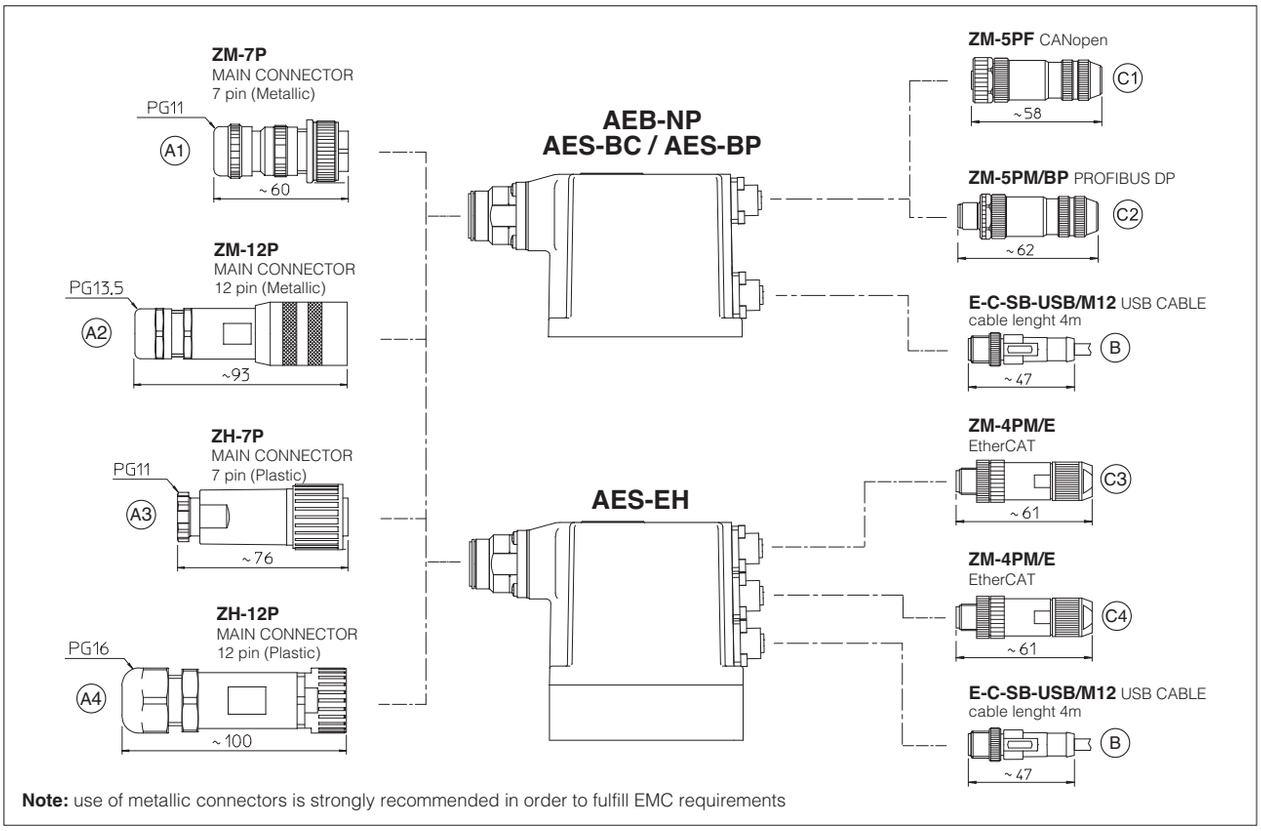
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

15.5 Connections layout - only for **AEB** and **AES**



Note: Driver connectors front view

16 CONNECTORS



Note: use of metallic connectors is strongly recommended in order to fulfill EMC requirements

17 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	A (1) Power supply	AEB AES	AEB/Z AES/Z	BC - CANopen	BP - PROFIBUS DP	EH - EtherCAT
CONNECTOR CODE	666	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PM/BP (C2)	ZM-4PM/E (C3)
		ZH-7P (A3)	ZH-12P (A4)			ZM-4PM/E (C4)
PROTECTION DEGREE	IP67	IP67				
DATA SHEET	K500	GS115, K500				

(1) Connectors supplied with the valve

only for **AES**

18 INSTALLATION DIMENSIONS of AGMZO [mm]

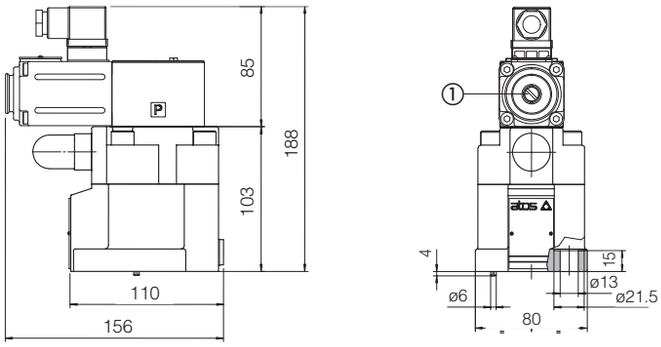
SIZE 10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)
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 mm
Port X: Ø = 3,2 mm

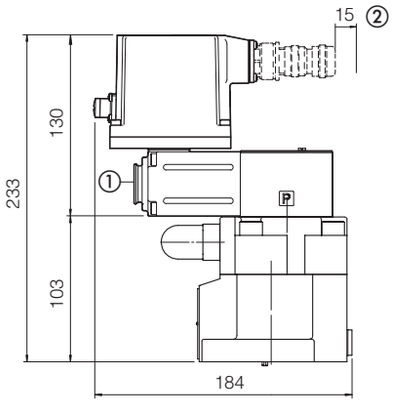
Mass [kg]

	A	AEB, AES	AES-EH
AGMZO-*-10	5,4	5,9	6,0

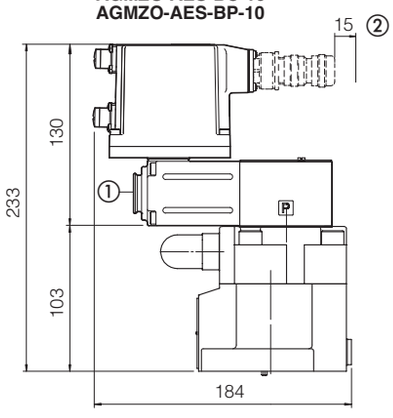
AGMZO-A-10



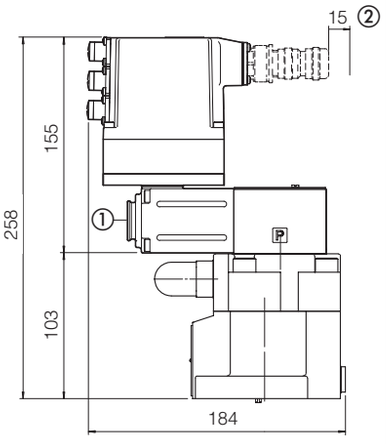
AGMZO-AEB-NP-10



AGMZO-AES-BC-10
AGMZO-AES-BP-10



AGMZO-AES-EH-10



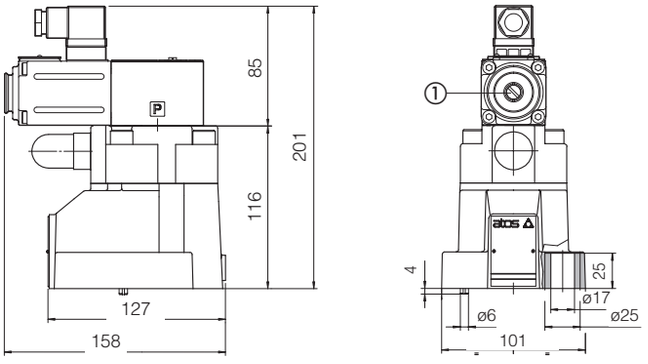
SIZE 20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)
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
Port X: Ø = 3,2 mm

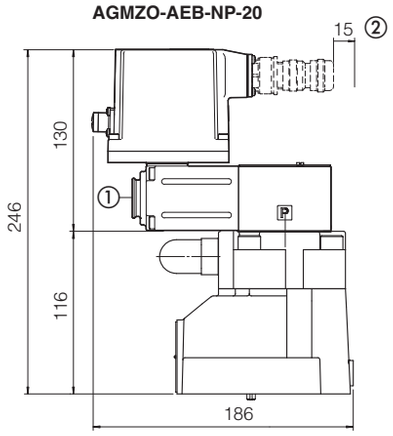
Mass [kg]

	A	AEB, AES	AES-EH
AGMZO-*-20	6,6	7,1	7,2

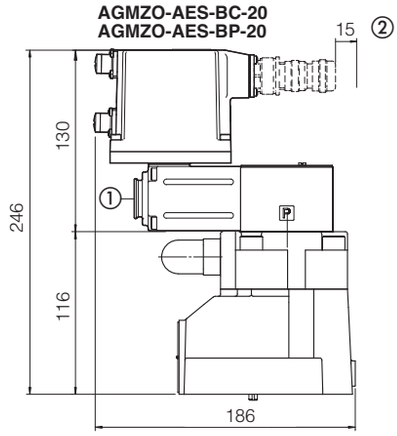
AGMZO-A-20



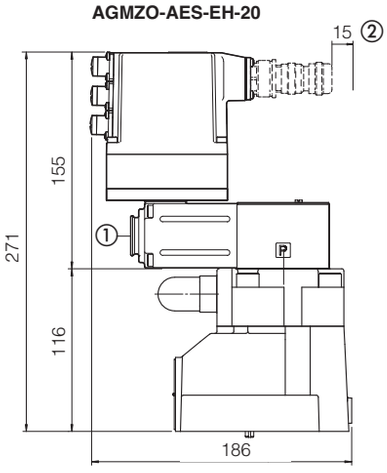
AGMZO-AEB-NP-20



AGMZO-AES-BC-20
AGMZO-AES-BP-20



AGMZO-AES-EH-20



① = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ①

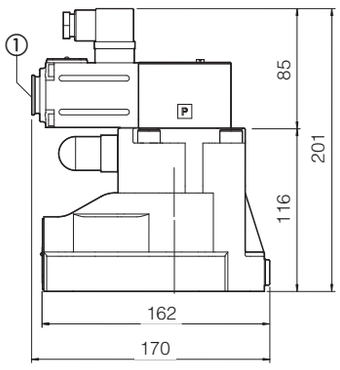
② = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 16, 17

SIZE 32

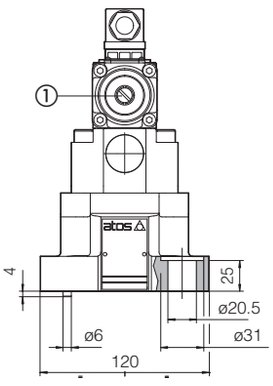
ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)
(with M20 fixing holes instead of standard M18)
Fastening bolts: 4 socket head screws
M20x60 class 12.9
Tightening torque = 600 Nm
Seals: 2 OR 4131, 1 OR 109/70
Ports P, T: Ø = 28 mm
Port X: Ø = 3,2 mm

Mass [kg]

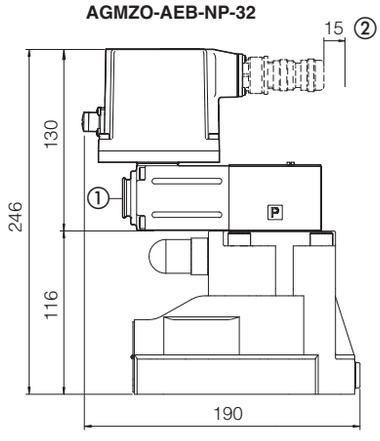
	A	AEB, AES	AES-EH
AGMZO-*-32	8	8,5	8,6



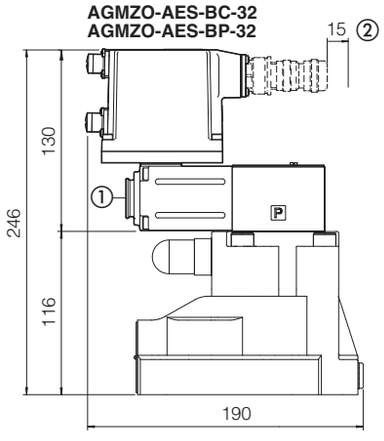
AGMZO-A-32



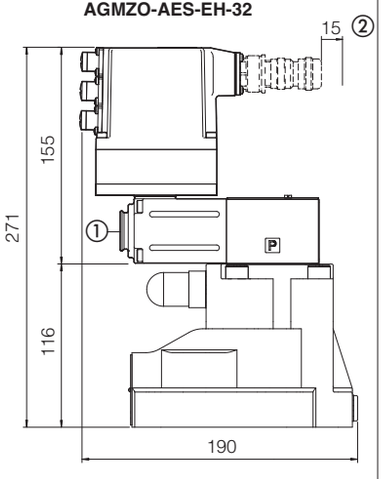
AGMZO-AEB-NP-32



AGMZO-AES-BC-32
AGMZO-AES-BP-32



AGMZO-AES-EH-32

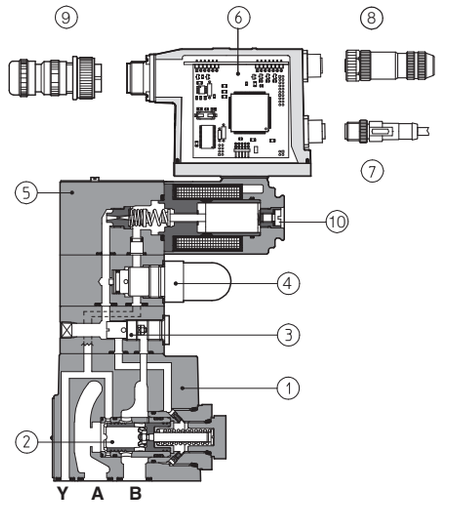


① = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ①

② = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 16, 17

Proportional reducing valves

digital, pilot operated, open loop



① Valve body
② Main spool
③ Pilot flow compensator
④ Integral pressure limiter
⑤ Pilot relief valve
⑥ Integral electronics
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector
⑩ Screw for air bleeding

AGRCZO-AES-BC-10/*/P**

AGRCZO-A, AGRCZO-AEB, AGRCZO-AES

Pilot operated digital proportional reducing valves for pressure open loop controls.
Executions:

- **A** without integral driver, to be coupled with separated drivers, see section 2
- **AEB** with basic integral digital electronic driver, analog reference signals and USB port for software functional parameters setting
- **AES** with full integral digital electronic driver and fieldbus interface for functional parameters setting, reference signals and real-time diagnostics

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting
Size: **10 and 20**
Max flow: **160 and 300 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGRCZO	-	A	EB	-	NP	-	10	/	315	/	*	/	*	/	**	/	*

AGRCZO: Proportional pressure relief valve, two stage

A = open loop pressure control

- = omit for execution with separated driver see section 2
EB = basic integral driver
ES = full integral driver

Fieldbus interfaces - USB port always present **(1)**:
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

Hydraulic options - see section 8:
P = with integral mechanical pressure limiter
R = with integral check valve for free reverse flow

Electronics options
only for AEB and AES - see section 11:
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input 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 10:
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

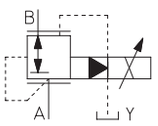
Series number

Seals material, see sect. 5, 6:
- = NBR
PE = FKM
BT = HNBR

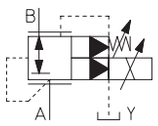
(1) Omit for **A** execution; **AEB** available only in version **NP**; **AES** available only in version **BC**, **BP**, **EH**

Hydraulic symbol

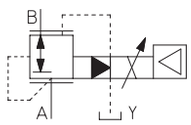
AGRCZO-A



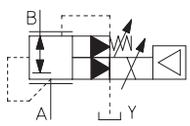
AGRCZO-A-*/P



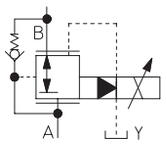
AGRCZO-AEB
AGRCZO-AES



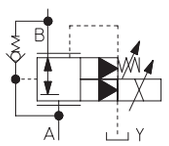
AGRCZO-AEB-*/P
AGRCZO-AES-*/P



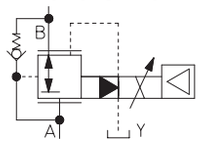
AGRCZO-A-*/R



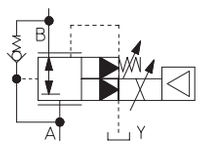
AGRCZO-A-*/PR



AGRCZO-AEB-*/R
AGRCZO-AES-*/R



AGRCZO-AEB-*/PR
AGRCZO-AES-*/PR



2 ELECTRONIC DRIVERS

Valve model	A										AEB	AES
Drivers model	E-MI-AC-01F		E-BM-AC-01F		E-ME-AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	E-RI-AEB	E-RI-AES
Type	Analog					Digital						
Voltage supply (V_{DC})	12	24	12	24	24	12	24	12	24	24	24	
Valve coil option	/6	std	/6	std	std	/6	std	/6	std	std	std	
Format	plug-in to solenoid		DIN 43700 UNDECAL		EUROCARD	plug-in to solenoid		DIN-rail panel			Integral to valve	
Data sheet	G010		G025		G035	G020		G030		GS050	GS115	

Note: for main and communication connector see sections 14 , 15

3 GENERAL NOTES

AGRCZO proportional valve are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

4 FIELDBUS - only for **AES**

Fieldbus allows the direct communication of the proportional valve 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**.

5 MAIN CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Assembly position	Any position			
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)			
MTTFd valves according to EN ISO 13849	75 years, see technical table P007			
Ambient temperature range	**A**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +60°C **AEB, AES**: **standard** = -20°C ÷ +60°C, **/BT** option = -40°C ÷ +60°C			
Storage temperature range	**A**: **standard** = -20°C ÷ +80°C, **/BT** option = -40°C ÷ +70°C **AEB, AES**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +70°C			
Coil resistance R at 20°C	Standard = 3 ÷ 3,3 Ω	Option /6 = 2 ÷ 2,2 Ω	Option /18 = 13 ÷ 13,4 Ω	
Max. solenoid current	Standard = 2,6 A	Option /6 = 3,25 A	Option /18 = 1,5 A	
Max. power	**A** = 30 Watt **AEB, AES** = 50 Watt			
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	IP66/67 with mating connectors			
Tropicalization (only REB, RES)	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface (only REB, RES)	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer (only REB, RES)	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Valve size		**10**	**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 **(2)** (depending on installation)	[ms]	≤ 45	≤ 50
Hysteresis	[% of the max pressure]	≤ 2.0	
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 2

(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

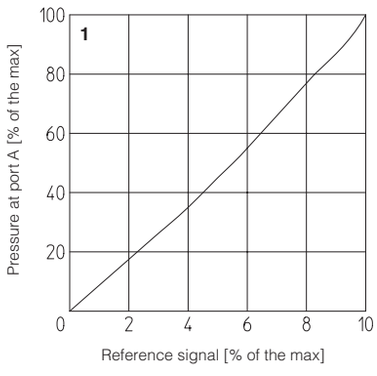
6 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

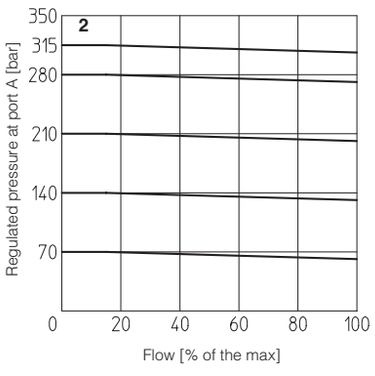
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, achievable with in line filter - 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	

7 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

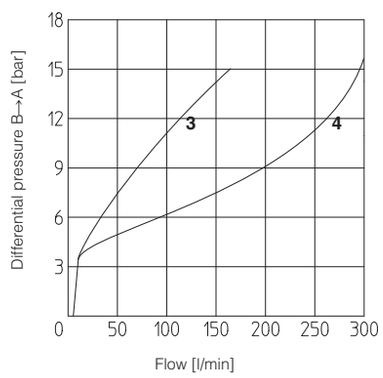


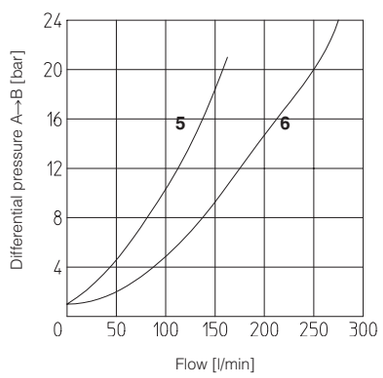


3-6 Pressure drop/flow diagrams
with zero reference signal

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



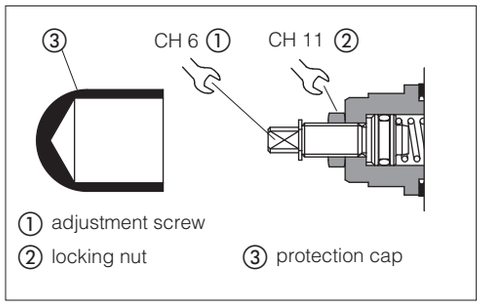


8 HYDRAULIC OPTIONS

8.1 Option /P - integral mechanical pressure limiter

The AGRCZO-***/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:

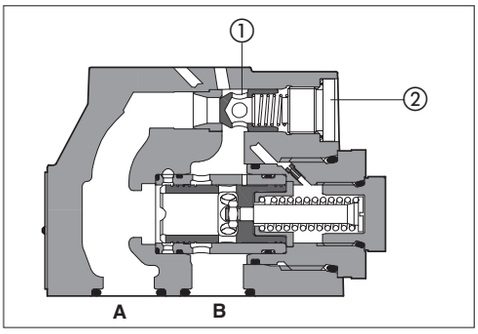
- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max 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.



8.2 Option /R - integral check valve for free reverse flow

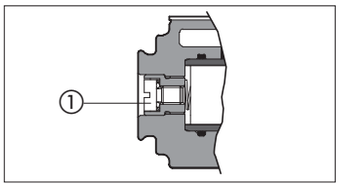
The AGRCZO-***/R** are provided with integral check valve for free reverse flow A→B

① Check valve - cracking pressure = 0,5 bar
② Plug



9 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



10 OPTIONS for -A

10.1 Coil voltage

Option /6 optional coil to be used with Atos drivers with power supply 12 VDC
Option /18 optional coil to be used with electronic drivers not supplied by Atos

11 ELECTRONIC OPTIONS - for AEB and AES

Standard driver execution provides on the 7 pin main connector:
Power supply - 24 VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers
Reference input signal - analog differential input with 0÷+10 VDC nominal range (pin D,E), proportional to desired valve pressure regulation
Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Note: a minimum booting time of 500 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero.

11.1 Option /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 V 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

11.2 Option /Q

To enable the driver, supply 24 VDC on pin C referred to pin B: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

11.3 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication

Separate power supply (pin 9,10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, serial and fieldbus communication.
A safety fuse is required in series to each driver power supply: 500 mA fast fuse.

11.4 Possible combined options: /IQ, /IZ

12 PROGRAMMING TOOLS - see tech table GS500

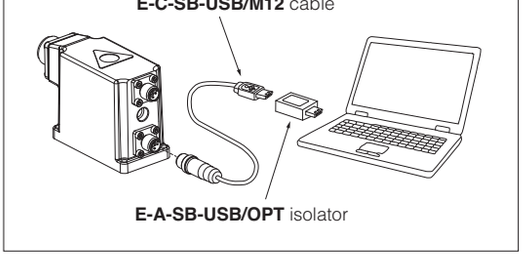
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver. For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options:

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)	
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

USB connection



13 ELECTRONIC CONNECTIONS

13.1 Main connector signals - 7 pin - **standard** and **/Q** option - **AGRCZO-AEB** and **AGRCZO-AES** (A1)

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	**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	**MONITOR** referred to: AGND | V0		Pressure 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	

13.2 Main connector signals - 12 pin - **/Z** option - **AGRCZO-AEB** and **AGRCZO-AES** (A2)

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 V0	Input - on/off signal
4	**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	**MONITOR**	Pressure monitor output signal: ±5 VDC maximum range Defaults 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 V0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

13.3 Communication connectors - **AGRCZO-AEB** (B) and **AGRCZO-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)**

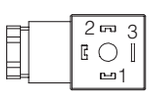
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

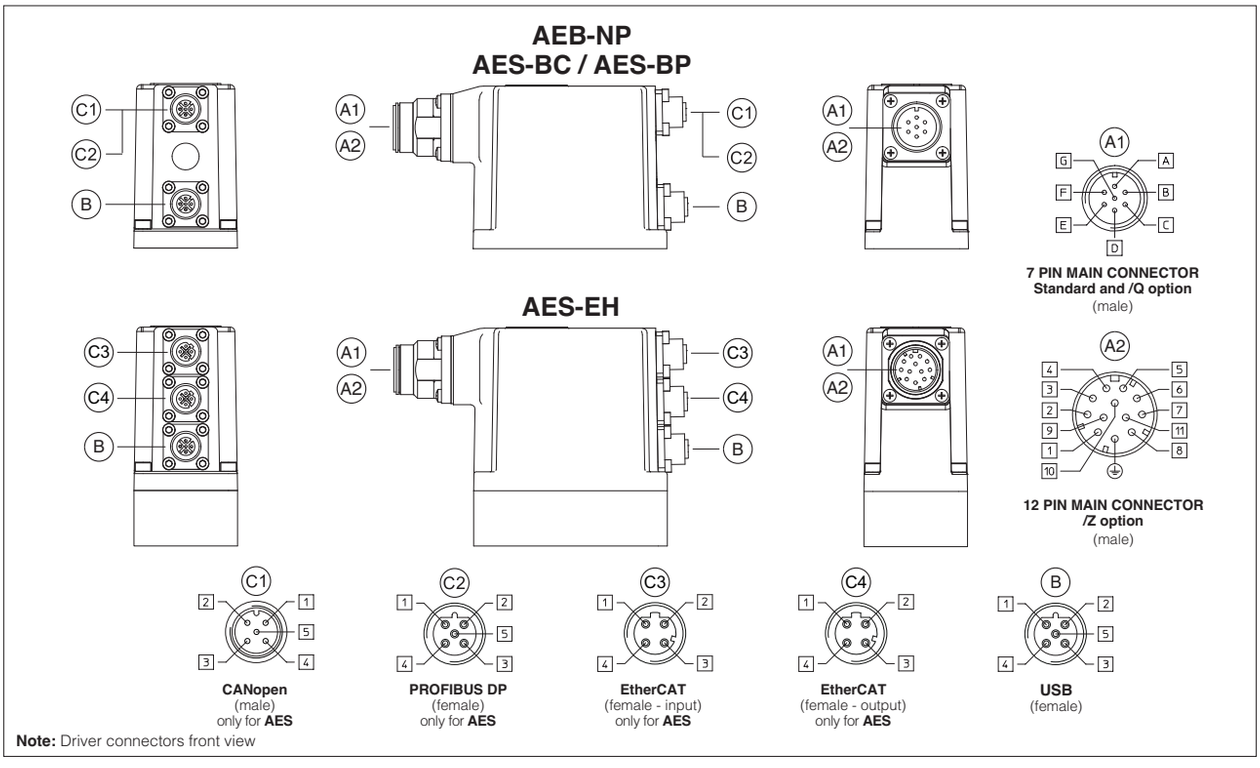
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

Notes: (1) shield connection on connector's housing is recommended **(2)** only for **AES** execution

13.4 Solenoid connection - only for **AGRCZO-A**

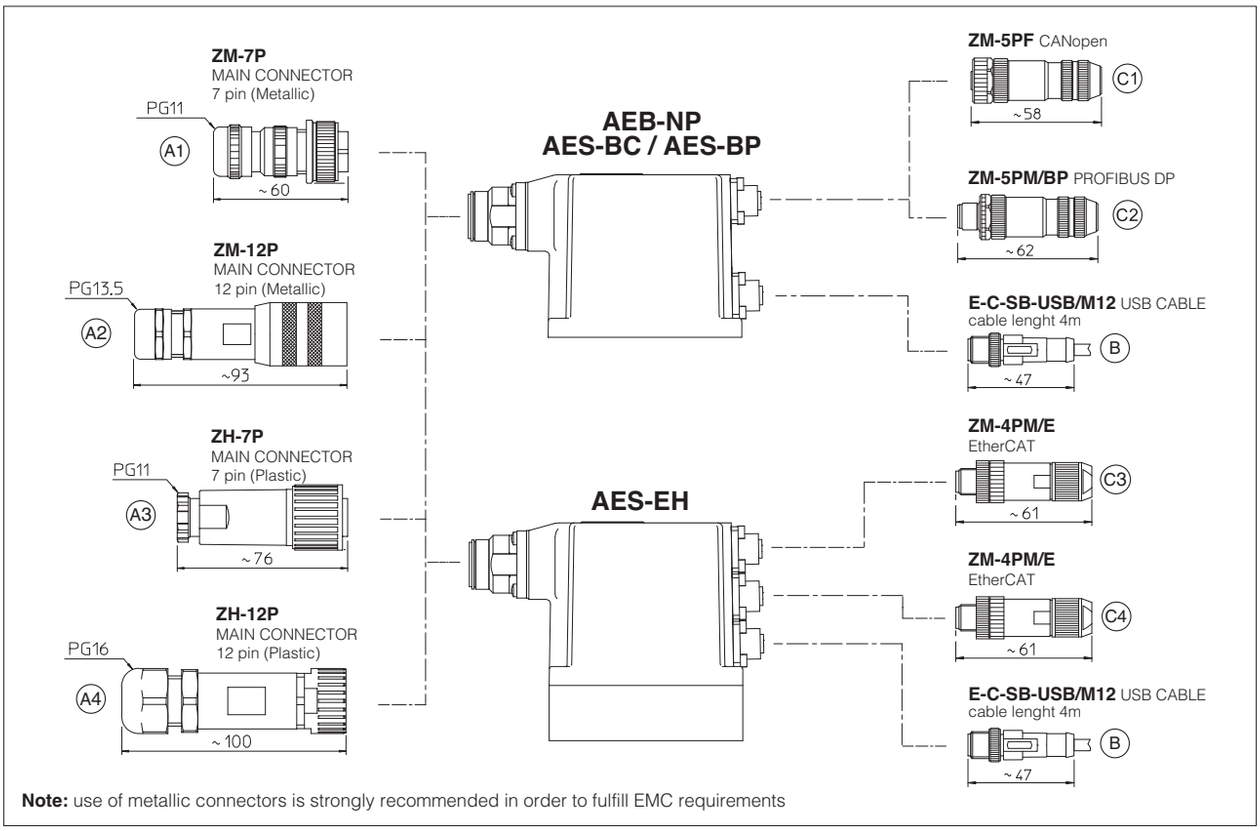
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

13.5 Connections layout - only for **AEB** and **AES**



Note: Driver connectors front view

14 CONNECTORS



Note: use of metallic connectors is strongly recommended in order to fulfill EMC requirements

15 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	A (1) Power supply	AEB AES	AEB/Z AES/Z	BC - CANopen	BP - PROFIBUS DP	EH - EtherCAT
CONNECTOR CODE	666	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PM/BP (C2)	ZM-4PM/E (C3)
		ZH-7P (A3)	ZH-12P (A4)			ZM-4PM/E (C4)
PROTECTION DEGREE	IP67	IP67				
DATA SHEET	K500	GS115, K500				

(1) Connectors supplied with the valve

only for **AES**

SIZE 10

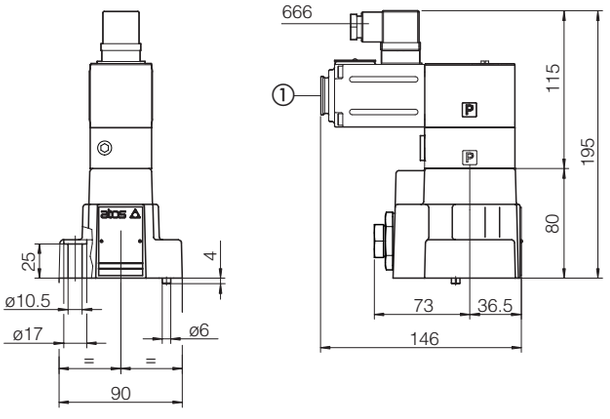
ISO 5781: 2000
Mounting surface: 5781-06-07-0-00 (see table P005)

Fastening bolts:
4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 109/70; 2 OR 3068
Diameters of ports A, B: Ø = 14 mm
Diameters of ports X, Y: Ø = 5 mm

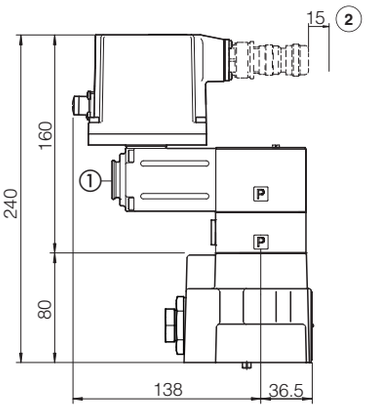
Mass [kg]

	A	AEB, AES	AES-EH
AGRCZO-*-10	5,0	5,6	5,7
Option /P	+0,5		

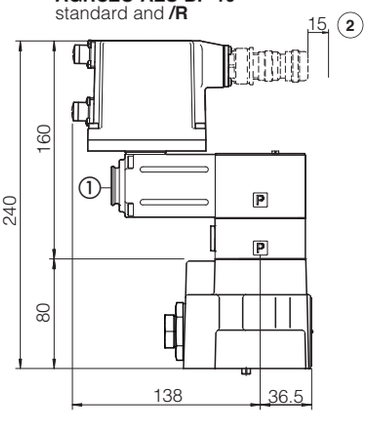
AGRCZO-A-10
standard and **/R**



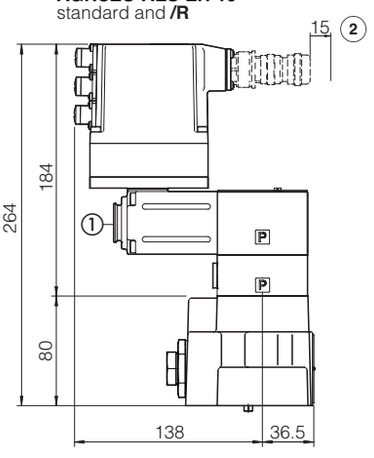
AGRCZO-AEB-NP-10
standard and **/R**



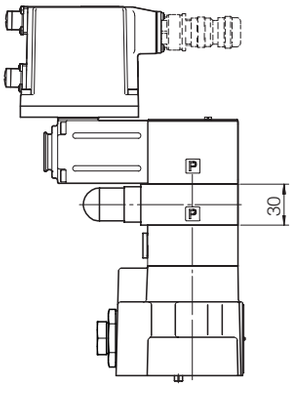
AGRCZO-AES-BC-10
AGRCZO-AES-BP-10
standard and **/R**



AGRCZO-AES-EH-10
standard and **/R**



Option /P



① = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ①

② = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 14, 15

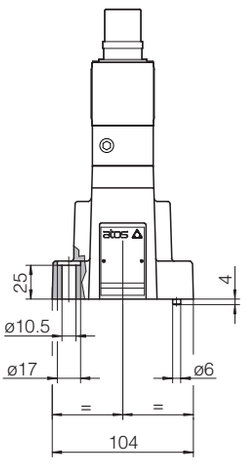
SIZE 20

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00 (see table P005)

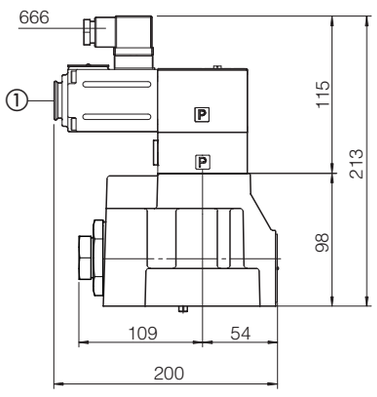
Fastening bolts:
4 socket head screws M10x45 class 12.9
Tightening torque = 70 Nm
Seals: 2 OR 109/70 ; 2 OR 4100
Diameters of ports A, B: Ø = 22 mm
Diameters of ports X, Y: Ø = 5 mm

Mass [kg]

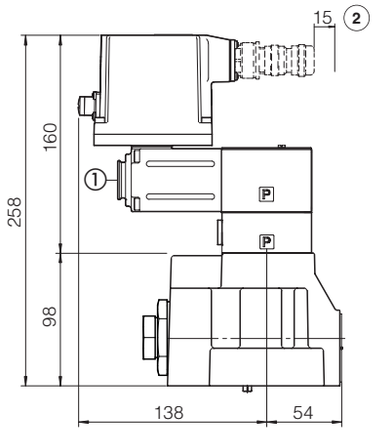
	A	AEB, AES	AES-EH
AGRCZO-*-20	7,5	8,1	8,2
Option /P	+0,5		



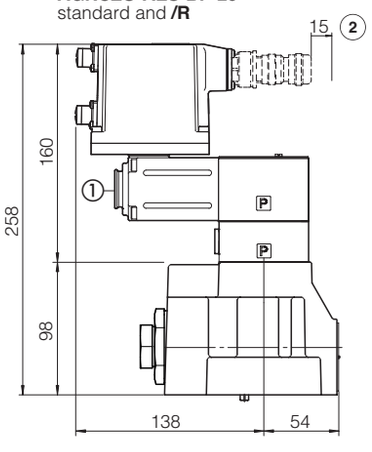
AGRCZO-A-20
standard and **/R**



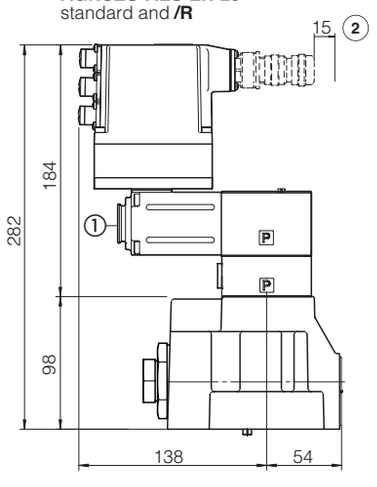
AGRCZO-AEB-NP-20
standard and **/R**



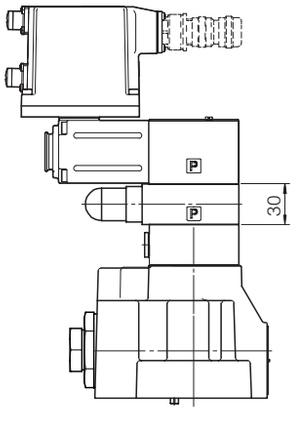
AGRCZO-AES-BC-20
AGRCZO-AES-BP-20
standard and **/R**



AGRCZO-AES-EH-20
standard and **/R**



Option /P

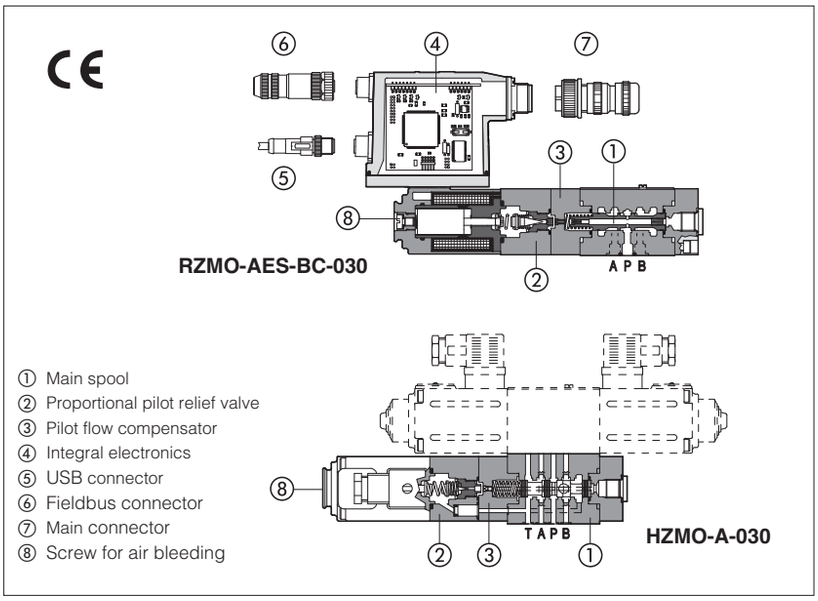


① = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ①

② = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 14, 15

Proportional relief valves

digital, pilot operated, open loop, subplate or modular mounting



① Main spool
② Proportional pilot relief valve
③ Pilot flow compensator
④ Integral electronics
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector
⑧ Screw for air bleeding

RZMO-A, RZMO-AEB, RZMO-AES
HZMO-A

Spool type pilot operated digital proportional relief valves for pressure open loop controls, available in subplate or modular mounting.

Executions:
- **A** without integral driver, to be coupled with separated drivers, see section 2
- **AEB** with basic integral digital electronic driver, analog reference signals and USB port for software functional parameters setting
- **AES** with full integral digital electronic driver and fieldbus interface for functional parameters setting, reference signals and real-time diagnostics

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting

Size: **06**
Max flow: **40 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO	-	A	EB	-	NP	-	030	/	315	/	*	**	/	*

RZMO = subplate
HZMO = modular
Proportional pressure relief valve size 06

A = open loop pressure control

- = omit for execution with separated driver see section 2

Only for RZMO:
EB = basic integral driver
ES = full integral driver

Fieldbus interfaces - USB port always present **(1)**:
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

Electronics options
only for **AEB, AES** - see sect. 9:
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input 0 ÷ 10 V)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

Coil voltage only for **A** - see sect. 8:
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

Series number

Seals material, see sect. 5, 6:
- = NBR
PE = FKM
BT = HNBR

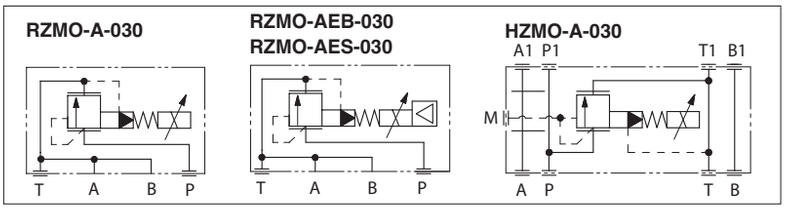
(1) Omit for **A** execution; **AEB** available only in version **NP**; **AES** available only in version **BC**, **BP**, **EH**

2 ELECTRONIC DRIVERS

Valve model	A										AEB	AES
Drivers model	E-MI-AC-01F		E-BM-AC-01F		E-ME-AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	E-RI-AEB	E-RI-AES
Type	Analog					Digital						
Voltage supply (V$_{DC}$)	12	24	12	24	24	12	24	12	24	24	24	
Valve coil option	/6	std	/6	std	std	/6	std	/6	std	std	std	
Format	plug-in to solenoid		DIN 43700 UNDECAL		EUROCARD	plug-in to solenoid		DIN-rail panel			Integral to valve	
Data sheet	G010		G025		G035	G020		G030		GS050	GS115	

Note: for main and communication connector see sections 12 , 13

Hydraulic symbol



3 GENERAL NOTES

RZMO-A* and HZMO-A proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

4 FIELDBUS - only for **AES**

Fieldbus allows the direct communication of the proportional valve 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**.

5 MAIN CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Assembly position / location	Any position			
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)			
MTTF valves according to EN ISO 13849	75 years, see technical table P007			
Ambient temperature range	**A**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +60°C **AEB, AES**: **standard** = -20°C ÷ +60°C, **/BT** option = -40°C ÷ +60°C			
Storage temperature range	**A**: **standard** = -20°C ÷ +80°C, **/BT** option = -40°C ÷ +70°C **AEB, AES**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +70°C			
Coil resistance R at 20°C	Standard = 3 ÷ 3,3 Ω	Option /6 = 2 ÷ 2,2 Ω	Option /18 = 13 ÷ 13,4 Ω	
Max. solenoid current	Standard = 2,6 A	Option /6 = 3,25 A	Option /18 = 1,5 A	
Max. power	**A** = 30 Watt	**AEB, AES** = 50 Watt		
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	IP66/67 with mating connectors			
Tropicalization (only AEB, AES)	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface (only AEB, AES)	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer (only AEB, AES)	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Max regulated pressure	[bar]	**50**	**100**	**210**	**315**	**350**
Min. regulated pressure	[bar]	see min. pressure / flow diagrams at sect. 7				
Max. pressure at port P	[bar]	350				
Max. pressure at port T	[bar]	210				
Min. ÷ Max. flow	[l/min]	2,5 ÷ 40				
Response time 0-100% step signal **(1)** (depending on installation)	[ms]	≤ 60				
Hysteresis	[% of the max pressure]	≤ 2				
Linearity	[% of the max pressure]	≤ 3				
Repeatability	[% of the max pressure]	≤ 2				

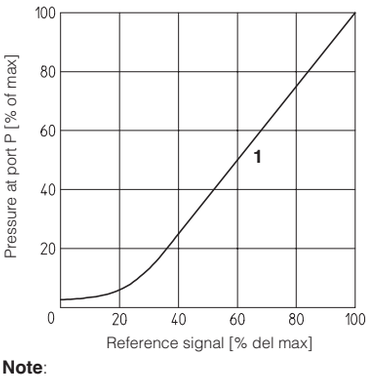
(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.

6 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

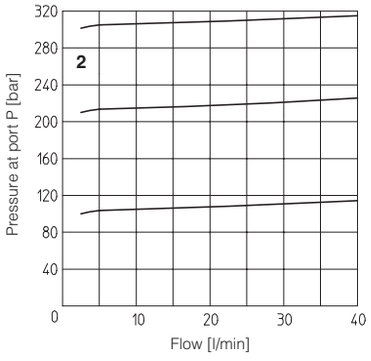
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
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	

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

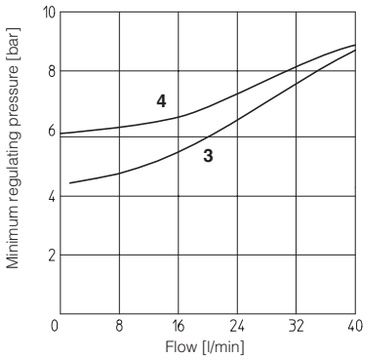
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



Note:
The presence of counter pressure at port T can affect the pressure regulation and the minimum pressure.

3 = All the models (except /350)
4 = All the models (only /350)

8 OPTIONS for **-A**

8.1 Coil voltage

Option /6 optional coil to be used with Atos drivers with power supply 12 VDC

Option /18 optional coil to be used with electronic drivers not supplied by Atos

9 ELECTRONIC OPTIONS - for **AEB** and **AES**

Standard driver execution provides on the 7 pin main connector:

Power supply - 24 VDC must be appropriately stabilized or rectified and filtered; a 2,5 A fuse time lag is required in series to each driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with 0÷+10 VDC nominal range (pin D, E), proportional to desired valve pressure regulation

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Note: a minimum booting time of 500 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero.

9.1 Option /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 V 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

9.2 Option /Q

To enable the driver, supply 24 VDC on pin C referred to pin B: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

9.3 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication

Separate power supply (pin 9,10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, serial and fieldbus communication.

A safety fuse is required in series to each driver power supply: 500 mA fast fuse.

9.4 Possible combined options: /IQ, /IZ

10 PROGRAMMING TOOLS - see tech table **GS500**

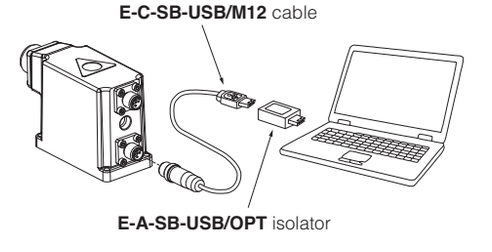
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver. For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options:

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)	
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

USB connection



11 ELECTRONIC CONNECTIONS

11.1 Main connector signals - 7 pin - **standard** and **/Q** option - **RZMO-AEB** and **RZMO-AES** (A1)

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	**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	**MONITOR** referred to: AGND / V0		Pressure 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	

11.2 Main connector signals - 12 pin - **/Z** option - **RZMO-AEB** and **RZMO-AES** (A2)

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 V0	Input - on/off signal
4	**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	**MONITOR**	Pressure monitor output signal: ±5 VDC maximum range Defaults 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 V0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

11.3 Communication connectors - **RZMO-AEB** (B) and **RZMO-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)**

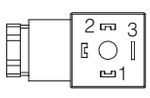
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

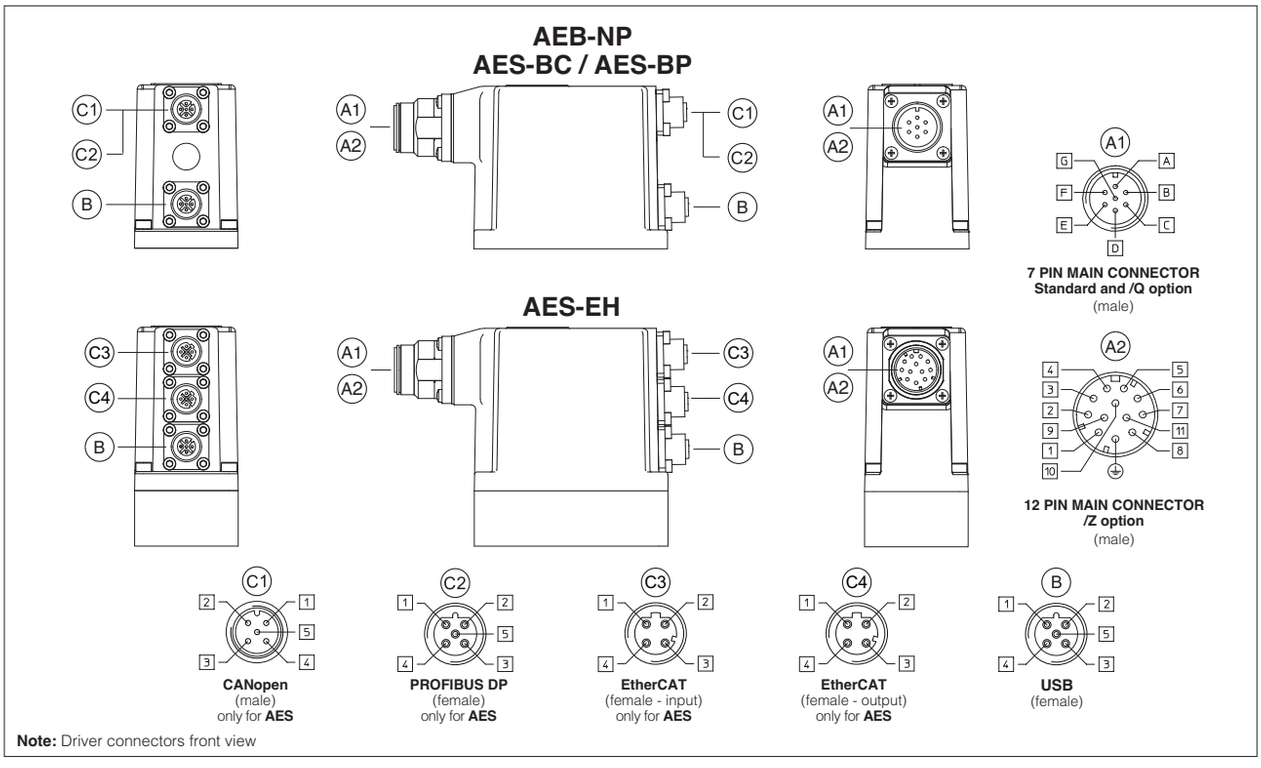
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

Notes: (1) shield connection on connector's housing is recommended **(2)** only for **AES** execution

11.4 Solenoid connection - only for **RZMO-A** and **HZMO-A**

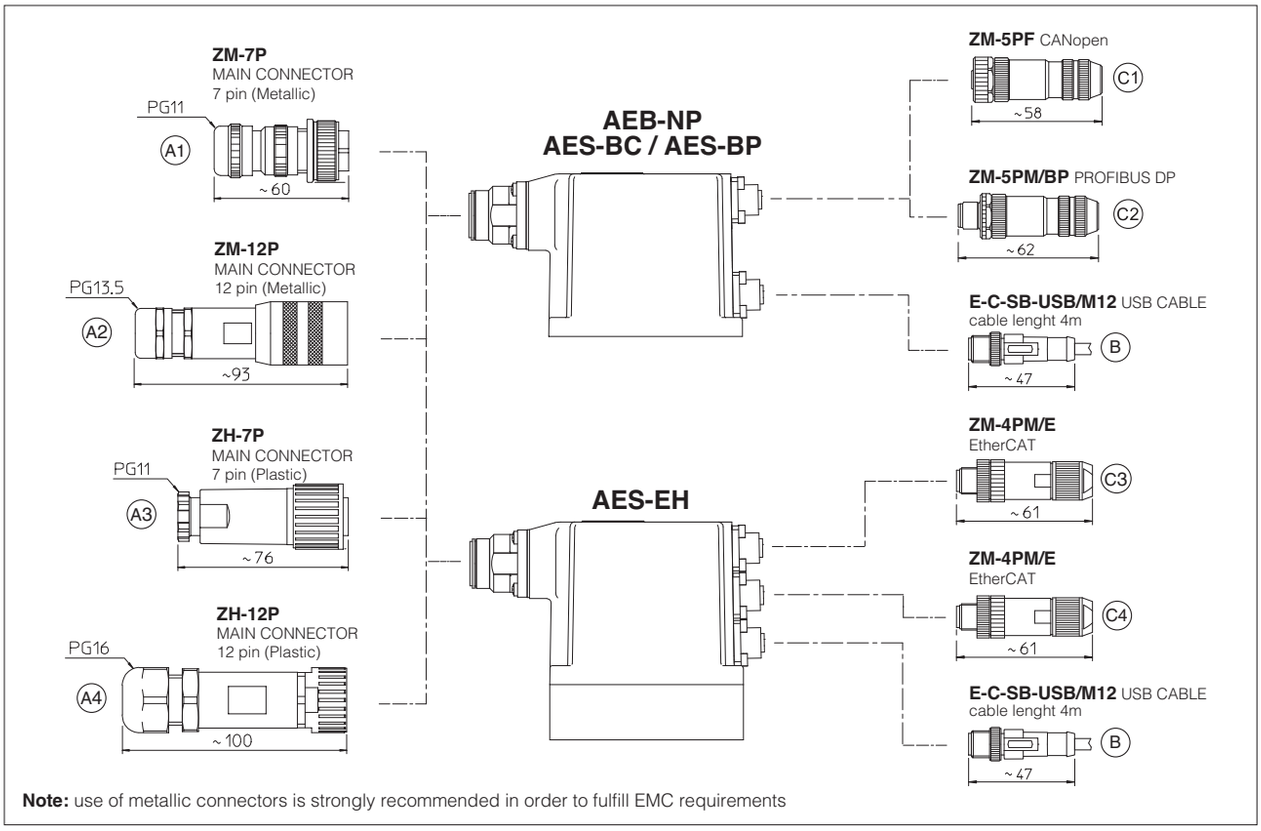
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

11.5 Connections layout - only for **AEB** and **AES**



Note: Driver connectors front view

12 CONNECTORS



Note: use of metallic connectors is strongly recommended in order to fulfill EMC requirements

13 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	A (1) Power supply	AEB AES	AEB/Z AES/Z	BC - CANopen	BP - PROFIBUS DP	EH - EtherCAT
CONNECTOR CODE	666	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PM/BP (C2)	ZM-4PM/E (C3)
		ZH-7P (A3)	ZH-12P (A4)			ZM-4PM/E (C4)
PROTECTION DEGREE	IP67	IP67				
DATA SHEET	K500	GS115, K500				

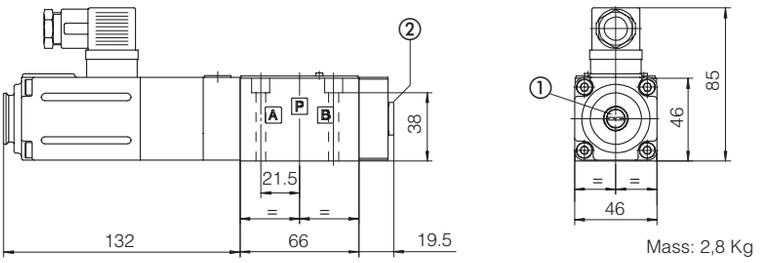
(1) Connectors supplied with the valve

only for **AES**

14 INSTALLATION DIMENSIONS [mm]

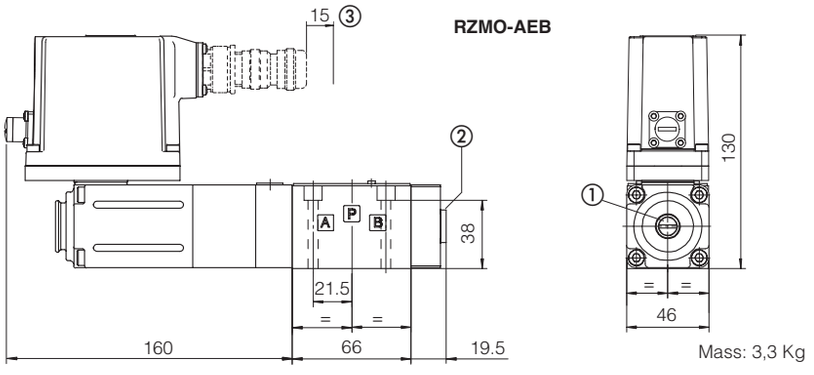
ISO 4401: 2000
Mounting surface: 4401-03-02-0-05
(see table P005)
Fastening bolts:
4 socket head screws M5X50 bolts class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P, T: Ø = 7,5 mm
Ports A, B connected to port T

RZMO-A



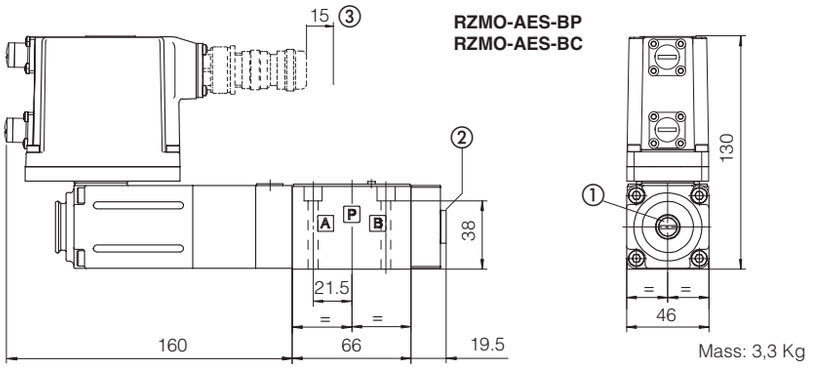
Mass: 2,8 Kg

RZMO-AEB



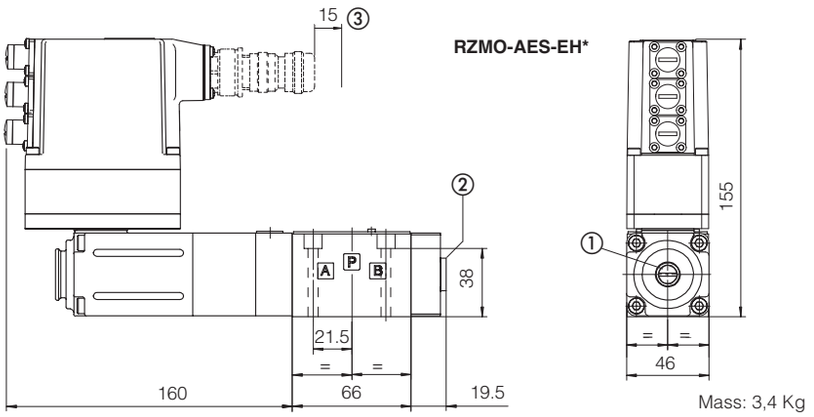
Mass: 3,3 Kg

RZMO-AES-BP
RZMO-AES-BC

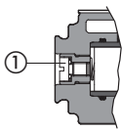


Mass: 3,3 Kg

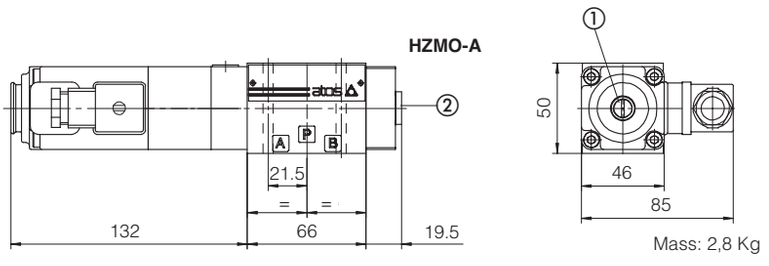
RZMO-AES-EH*



Mass: 3,4 Kg



HZMO-A



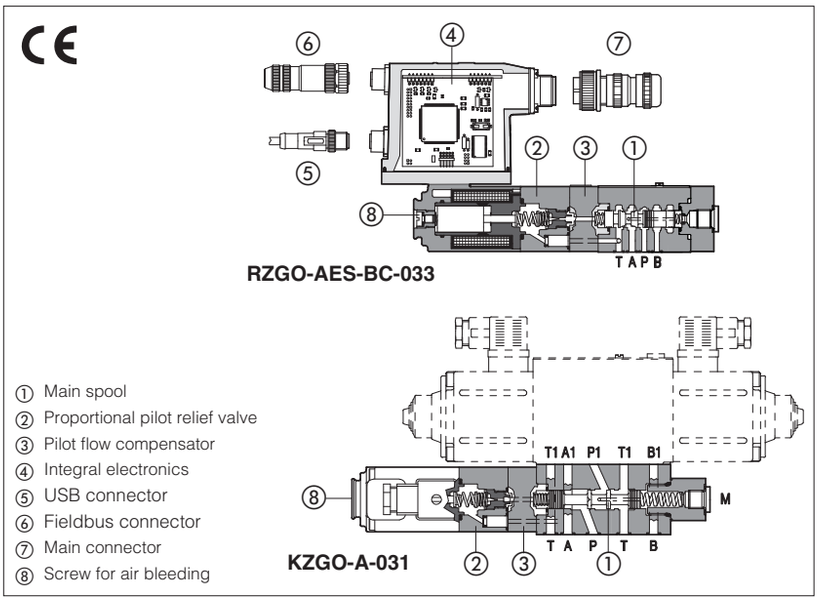
Mass: 2,8 Kg

ISO 4401: 2000
Mounting surface: 4401-03-02-0-05
(see table P005)
Seals: 4 OR 108
Ports P, T, A, B: Ø = 6.5 mm

① = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ①
② = Pressure gauge port = G1/4"
③ = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 12, 13

Proportional reducing valves

digital, pilot operated, open loop, subplate or modular mounting



① Main spool
② Proportional pilot relief valve
③ Pilot flow compensator
④ Integral electronics
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector
⑧ Screw for air bleeding

RZGO-A, RZGO-AEB, RZGO-AES
HZGO-A, KZGO-A

Spool type pilot operated digital proportional reducing valves for pressure open loop controls, available in subplate size 06 or modular mounting size 06 and 10

Executions:
- **A** without integral driver, to be coupled with separated driver, see section 2
- **AEB**, only for **RZGO**, with basic integral digital electronic driver, analog reference signals and USB port for software functional parameters setting
- **AES**, only for **RZGO**, with full integral digital electronic driver and fieldbus interface for functional parameters setting, reference signals and real-time diagnostics

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting

Size: **06** and **10**
Max flow: **40** and **100 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZGO	-	A	EB	-	NP	-	033	/	210	/	*	**	/	*

RZGO
Proportional pressure reducing valves
RZGO subplate, size 06
HZGO modular, size 06
KZGO modular, size 10

A = open loop pressure control

- = omit for execution with separated driver see section 2

only for **RZGO**:
EB = basic integral driver
ES = full integral driver

Fieldbus interfaces - USB port always present **(1)**:
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

Coil voltage only for **-A** - see section 8:
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

Electronics options
only for **AEB** and **AES** - see section 9:
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input 0 ÷ 10 V)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

Series number

Seals material, see sect. 5, 6:
- = NBR
PE = FKM
BT = HNBR

(1) Omit for **A** execution; **AEB** available only in version **NP**; **AES** available only in version **BC**, **BP**, **EH**

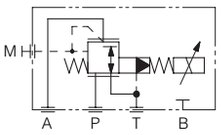
2 ELECTRONIC DRIVERS

Valve model	A										AEB	AES
Drivers model	E-MI-AC-01F		E-BM-AC-01F		E-ME-AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	E-RI-AEB	E-RI-AES
Type	Analog					Digital						
Voltage supply (V$_{DC}$)	12	24	12	24	24	12	24	12	24	24	24	
Valve coil option	/6	std	/6	std	std	/6	std	/6	std	std	std	
Format	plug-in to solenoid		DIN 43700 UNDECAL		EUROCARD	plug-in to solenoid		DIN-rail panel			Integral to valve	
Data sheet	G010		G025		G035	G020		G030		GS050	GS115	

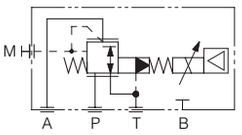
Note: for main and communication connector see sections 12 , 13

Hydraulic symbols

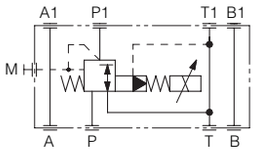
RZGO-A-033



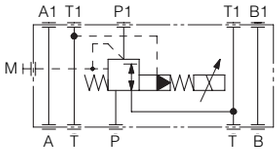
RZGO-AES-033



HZGO-A-031



KZGO-A-031



3 GENERAL NOTES

RZGO-A*, HZGO-A*, KZGO-A* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

4 FIELDBUS - only for **AES**

Fieldbus allows the direct communication of the proportional valve 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**.

5 MAIN CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Assembly position	Any position			
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)			
MTTFd valves according to EN ISO 13849	75 years, see technical table P007			
Ambient temperature range	**A**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +60°C **AEB, AES**: **standard** = -20°C ÷ +60°C, **/BT** option = -40°C ÷ +60°C			
Storage temperature range	**A**: **standard** = -20°C ÷ +80°C, **/BT** option = -40°C ÷ +70°C **AEB, AES**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +70°C			
Coil resistance R at 20°C	Standard = 3 ÷ 3,3 Ω	Option /6 = 2 ÷ 2,2 Ω	Option /18 = 13 ÷ 13,4 Ω	
Max. solenoid current	Standard = 2,6 A	Option /6 = 3,25 A	Option /18 = 1,5 A	
Max. power	**A** = 30 Watt	**AEB, AES** = 50 Watt		
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	IP66/67 with mating connectors			
Tropicalization (only AEB, AES)	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface (only AEB, AES)	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer (only AEB, AES)	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Valve model		**RZGO-A, -AE, -AES, HZGO-A**					**KZGO-A**			
Max regulated pressure	[bar]	**50**	**100**	**210**	**315**	**350**	**100**	**210**	**315**	**350**
Min. regulated pressure **(1)**	[bar]	1,0 ; 3,0 (only for /350)								
Max. pressure at port P	[bar]	350								
Max. pressure at port T	[bar]	210								
Min. flow	[l/min]	2,5					3			
Max. flow	[l/min]	40					100			
Response time 0-100% step signal **(2)** (depending on installation)	[ms]	≤ 50					≤ 80			
Hysteresis	[% of the max pressure]	≤ 2								
Linearity	[% of the max pressure]	≤ 3								
Repeatability	[% of the max pressure]	≤ 2								

Notes: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) Min pressure values 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

5 **SEALS AND HYDRAULIC FLUID** - for other fluids not included in below table, consult our technical office

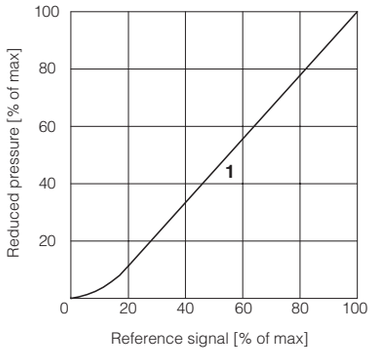
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/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	

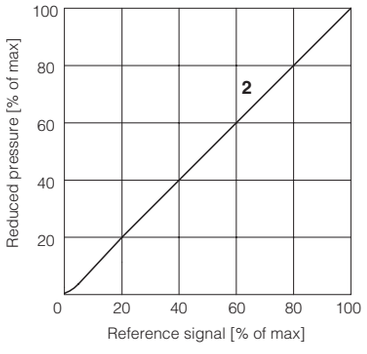
6 **DIAGRAMS** (based on mineral oil ISO VG 46 at 50 °C)

6.1 Regulation diagrams
with flow rate Q = 10 l/min

1 = RZGO, HZGO
2 = KZGO

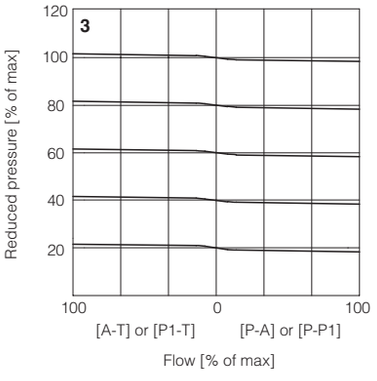
Note:
The presence of counter pressure at port T can affect the effective pressure regulation.





6.2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min

3 = RZGO, KZGO



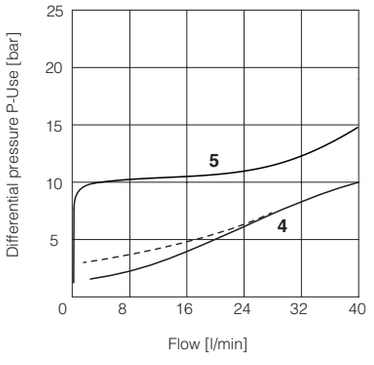
6.3 Pressure drop/flow diagram

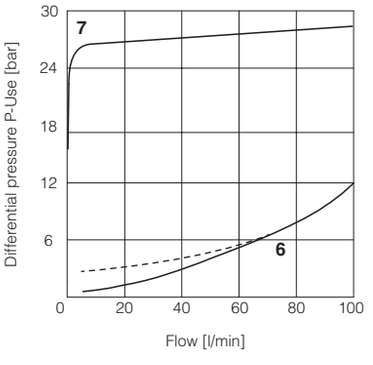
RZGO, HZGO

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





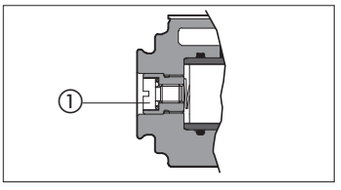
7 OPTIONS FOR -A EXECUTION

7.1 Option /6 optional coil to be used with Atos drivers with power supply 12 VDC

7.2 Option /18 optional coil to be used with electronic drivers not supplied by Atos

8 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



9 ELECTRONIC OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24 VDC must be appropriately stabilized or rectified and filtered; a 2,5 A fuse time lag is required in series to each driver power supply. Apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with 0÷+10 VDC nominal range (pin D, E), proportional to desired valve pressure regulation

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Note: a minimum booting time of 500 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero.

9.1 Option /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 V 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

9.2 Option /Q

To enable the driver, supply 24 VDC on pin C referred to pin B: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

9.3 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication

Separate power supply (pin 9, 10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, USB and fieldbus communication.

A safety fuse is required in series to each driver power supply: 500 mA fast fuse.

9.4 Possible combined options: /IQ, /IZ

10 PROGRAMMING TOOLS - see tech table **GS500**

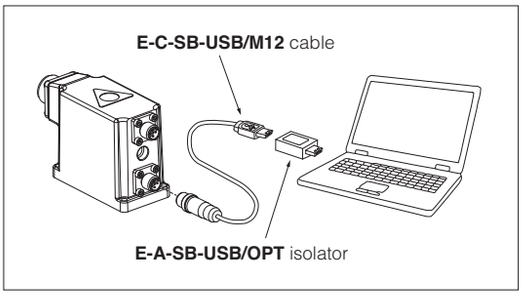
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver. For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options:

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)	
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

USB connection



11 ELECTRONIC CONNECTIONS

11.1 Main connector signals - 7 pin - **standard** and **/Q** option - **RZGO-AEB** and **RZGO-AES** (A1)

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	**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	**MONITOR** referred to: AGND | V0		Pressure 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	

11.2 Main connector signals - 12 pin - **/Z** option - **RZGO-AEB** and **RZGO-AES** (A2)

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 V0	Input - on/off signal
4	**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	**MONITOR**	Pressure monitor output signal: ±5 VDC maximum range Defaults 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 V0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

11.3 Communication connectors - RZGO-AEB (B) and RZGO-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)**

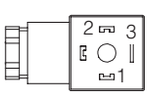
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

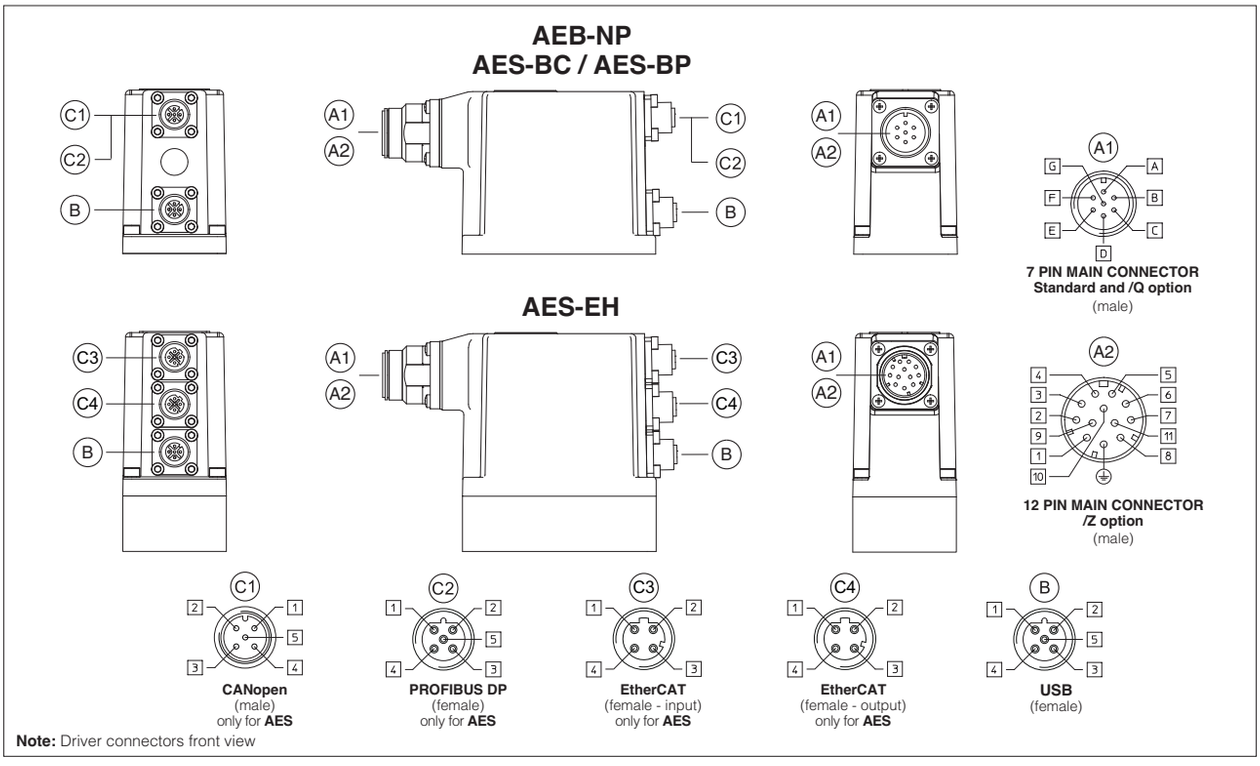
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

Notes: (1) shield connection on connector's housing is recommended **(2)** only for **AES** execution

11.4 Solenoid connection - only for **RZGO-A, HZGO-A, KZGO,A**

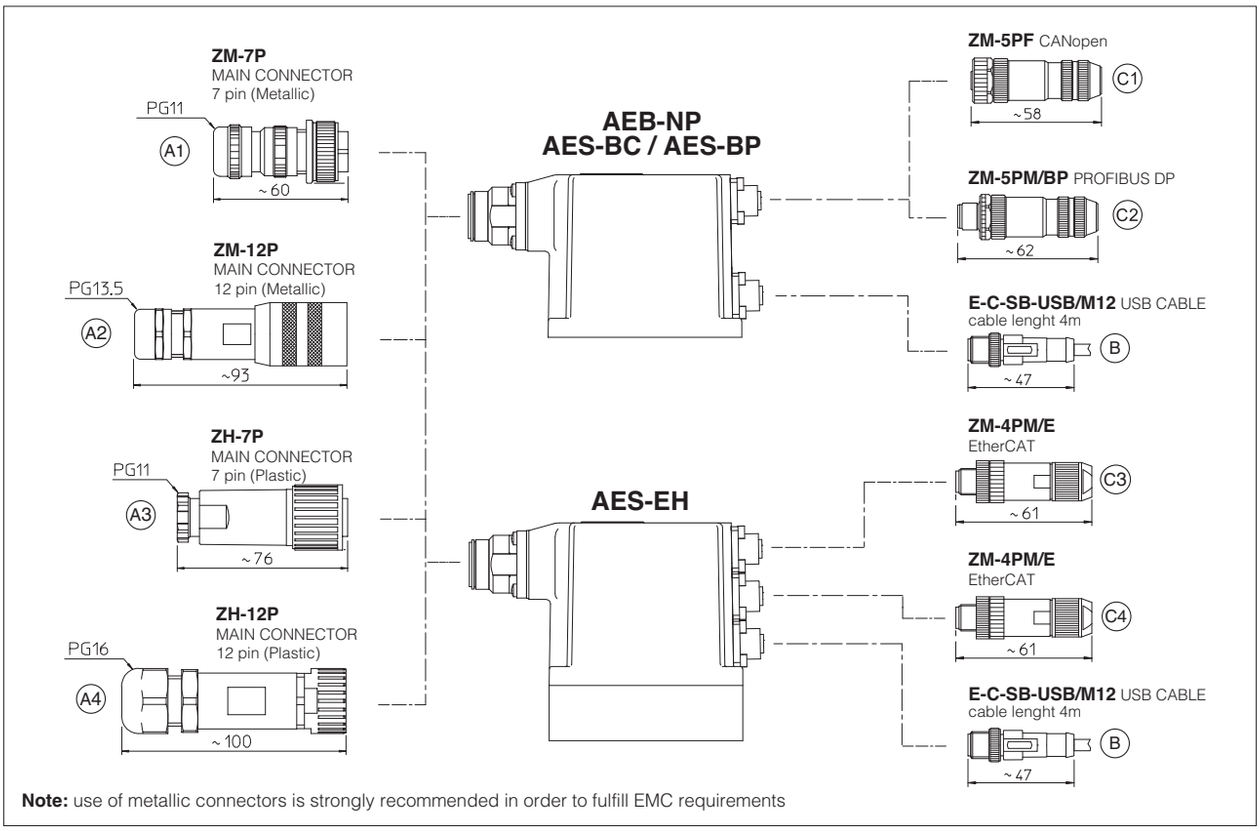
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

11.5 Connections layout - only for **AEB** and **AES**



Note: Driver connectors front view

12 CONNECTORS



Note: use of metallic connectors is strongly recommended in order to fulfill EMC requirements

13 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	A (1) Power supply	AEB AES	AEB/Z AES/Z	BC - CANopen	BP - PROFIBUS DP	EH - EtherCAT
CONNECTOR CODE	666	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PM/BP (C2)	ZM-4PM/E (C3)
		ZH-7P (A3)	ZH-12P (A4)			ZM-4PM/E (C4)
PROTECTION DEGREE	IP67	IP67				
DATA SHEET	K500	GS115, K500				

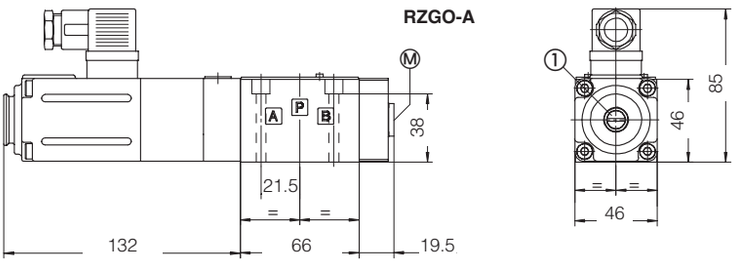
(1) Connectors supplied with the valve

only for **AES**

14 INSTALLATION DIMENSIONS [mm]

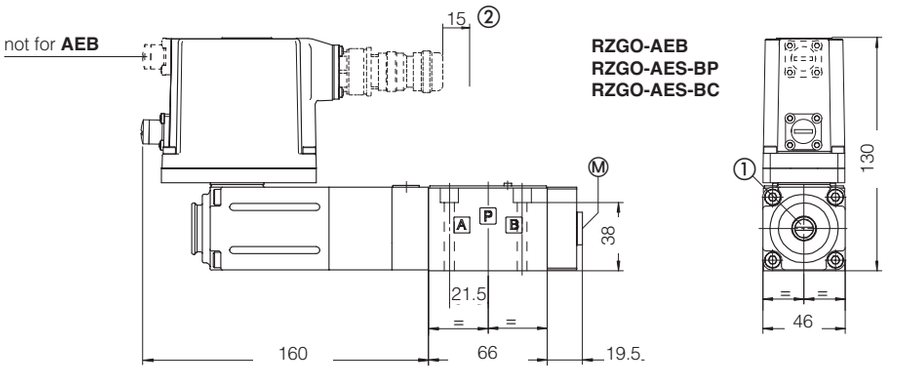
ISO 4401: 2000
Mounting surface: 4401-03-02-0-05
(see table P005)
Fastening bolts:
4 socket head screws M5X50 bolts class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P, A, T: Ø = 7,5 mm
Port B not used

RZGO-A

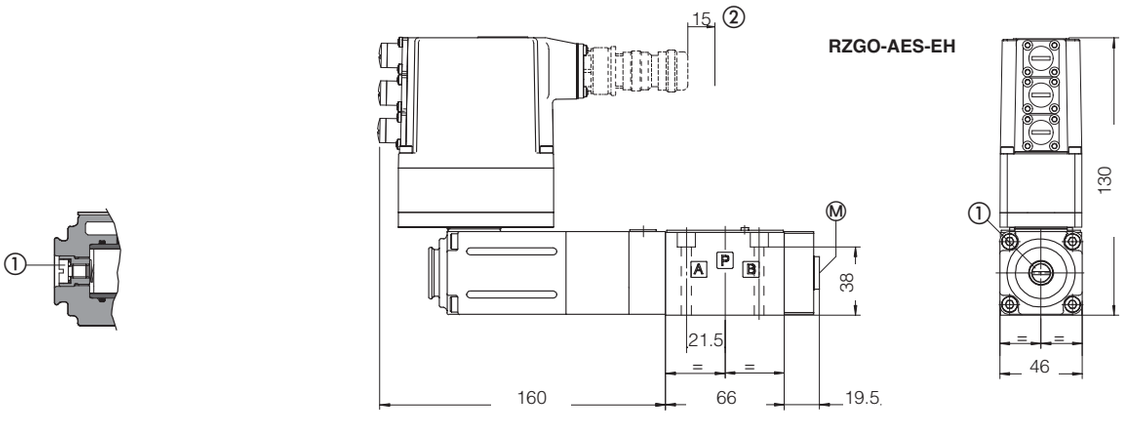


not for **AEB**

RZGO-AEB
RZGO-AES-BP
RZGO-AES-BC

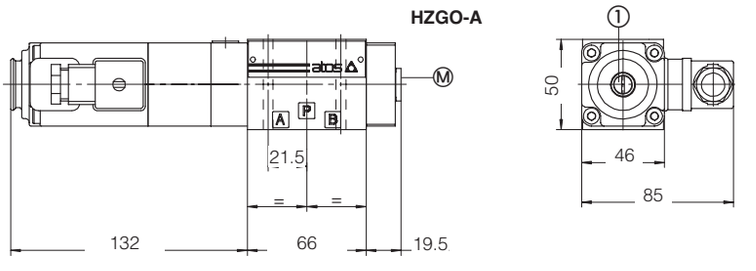


RZGO-AES-EH



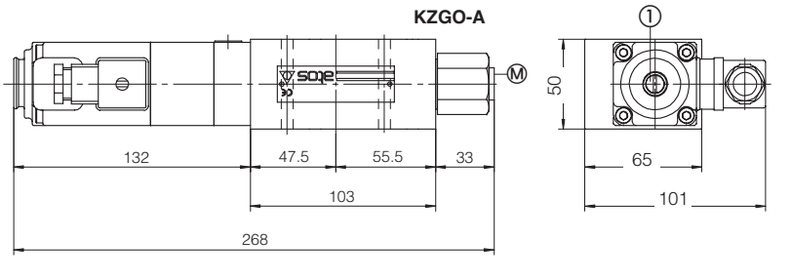
HZGO-A

ISO 4401: 2000
Mounting surface: 4401-03-02-0-05
(see tab. P005)
Fastening bolts: M5 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P, A, B, T: Ø = 6,5 mm



KZGO-A

ISO 4401: 2000
Mounting surface: 4401-05-04-0-05
(see tab. P005)
Fastening bolts: M6 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050.1 OR 108
Ports P,A,B,T: Ø = 10.5 mm (max)



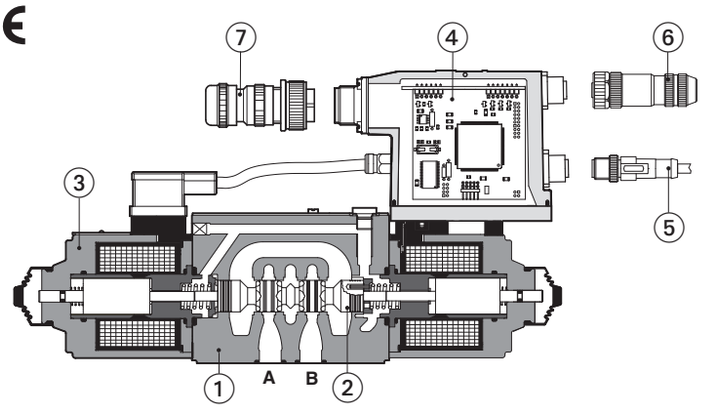
Ⓜ = Pressure gauge connection port = G1/4"

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

② = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 12, 13

Proportional directional valves

digital, direct operated, open loop, with **positive spool overlap**



DKZOR-AES-BC-171

① Valve body
② Spool
③ Proportional solenoid
④ Integral electronics
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector

DHZO-A, DHZO-AEB, DHZO-AES
DKZOR-A, DKZOR-AEB, DKZOR-AES

Direct operated digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

Executions:
- **A** without integral driver, to be coupled with separated drivers, see section 2.
- **AEB** with basic integral digital electronic driver, analog reference signals and USB port for software functional parameters setting.
- **AES** with full integral digital electronic driver and fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting

Size: **06** and **10**
Max flow: up to **70** and **160 l/min**
Max pressure: **350 bar** (DHZO)
315 bar (DKZOR)

1 MODEL CODE for STANDARD SPOOLS

DHZO	-	A	ES	-	BP	-	0	71	-	L	5	/	*	/	*	*	/	*

DHZO = size 06
DKZOR = size 10

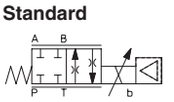
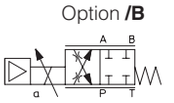
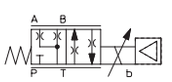
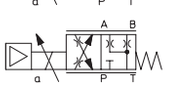
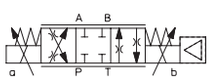
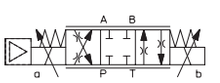
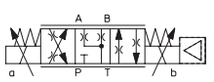
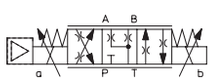
A = open loop

- = omit for execution with separated driver see section 2
EB = basic integral driver
ES = full integral driver

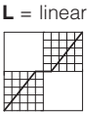
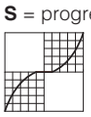
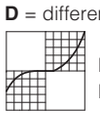
Fieldbus interfaces - USB port always present **(1)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Valve size - ISO 4401: **0** = 06 **1** = 10

Configuration (2):

	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 sect. 5, 6:
- = NBR
PE = FKM
BT = HNBR

Series number

Coil voltage only for **A** - see sect. 10 :
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

Hydraulic options - see sect. 9:
B = solenoid and integral electronics at side of port A **(3)**
Y = external drain

Hand lever options, only for **A** - see sect. 10 :
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, AES** - see sect. 11:
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 V)
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) Omit for **A** execution; **AEB** available only in version **NP**; **AES** available only in version **BC**, **BP**, **EH**
(2) Hydraulic symbols are rapresented with integral digital driver
(3) In standard configuration the solenoid (config. 51 and 53) and integral electronics (AEB, AES) are at side of port B
Special DHZO execution with max pressure **420 bar** available on request

2 ELECTRONIC DRIVERS

Valve model	A										AEB	AES
Drivers model	E-MI-AC-01F		E-BM-AC-01F		E-ME-AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	E-RI-AEB	E-RI-AES
Type	Analog					Digital						
Voltage supply (V_{DC})	12	24	12	24	24	12	24	12	24	24	24	
Valve coil option	/6	std	/6	std	std	/6	std	/6	std	std	std	
Format	plug-in to solenoid		DIN 43700 UNDECAL		EUROCARD	plug-in to solenoid		DIN-rail panel			Integral to valve	
Data sheet	G010		G025		G035	G020		G030		GS050	GS115	

Note: For main and communication connector see sections 13 , 14

3 GENERAL NOTES

DHZO-A* and DKZOR-A* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

4 FIELDBUS - only for **AES**

Fieldbus allows the direct communication of the proportional valve 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**.

5 MAIN CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Assembly position	Any position					
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)					
MTTFd valves according to EN ISO 13849	150 years, see technical table P007					
Ambient temperature range	**A**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +60°C **AEB, AES**: **standard** = -20°C ÷ +60°C, **/BT** option = -40°C ÷ +60°C					
Storage temperature range	**A**: **standard** = -20°C ÷ +80°C, **/BT** option = -40°C ÷ +70°C **AEB, AES**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +70°C					
Coil code	**DHZO**			**DKZOR**		
	standard	option /6	option /18	standard	option /6	option /18
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
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A
Max. power	**A** = 30W **AEB, AES** = 50W			**A** = 35W **AEB, AES** = 50W		
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	IP66/67 with mating connectors					
Tropicalization	Tropical coating on electronics PCB					
Duty factor	Continuous rating (ED=100%)					
EMC, climate and mechanical load	See technical table G004					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408		PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898		optical insulated RS485	Fast Ethernet, insulated 100 Base TX	

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		**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**	**L3,S3,D3**	**L5,S5,D5**
Nominal flow [l/min] **(1)**	Δp= 10 bar	1	4,5	8	18	28	45	60
Δp P-T	Δp= 30 bar	1,7	8	14	30	50	80	105
max	Δp= 70 bar	2,6	12	21	45	70	120	160
permissible flow **(2)**		4	18	30	50	70	120	160
Response time [ms] (0-100% step signal) **(3)**		30					40	
Leakage [cm^3/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]						

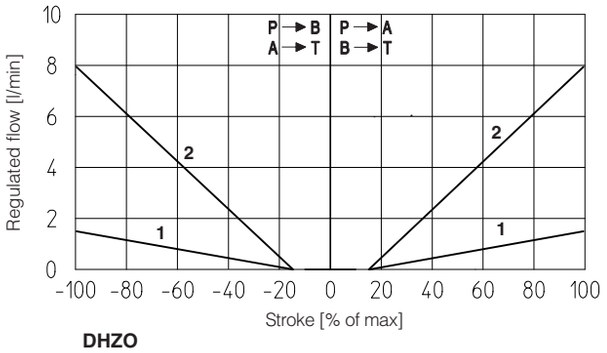
Notes: above performance data refer to valves coupled with Atos electronic drivers, see section 2
(1) for different Δp, the max flow is in accordance to the diagrams in section 7.2 **(2)** see detailed diagrams in section 7.3
(3) see detailed diagrams in section 7.4

6 **SEALS AND HYDRAULIC FLUID** - for other fluids not included in below table, consult our technical office

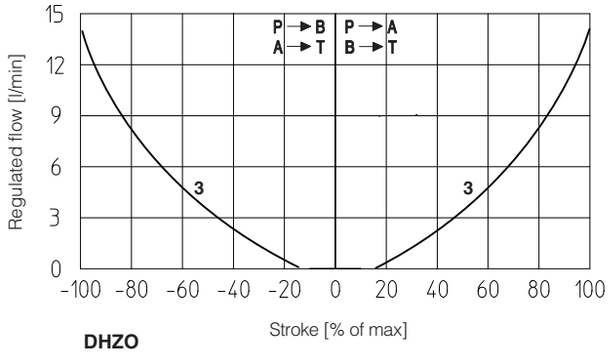
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
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	

7 **DIAGRAMS** - based on mineral oil ISO VG 46 at 50 °C

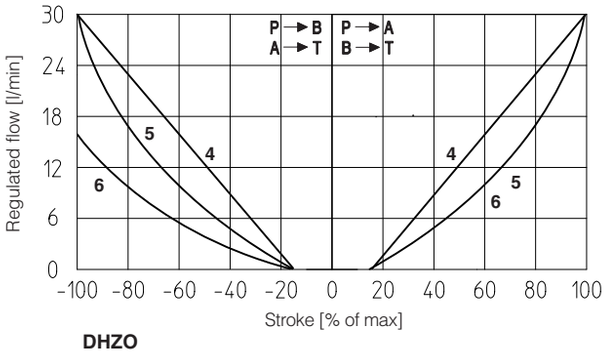
7.1 **Regulation diagrams** - values measure at Δp 30 bar P-T



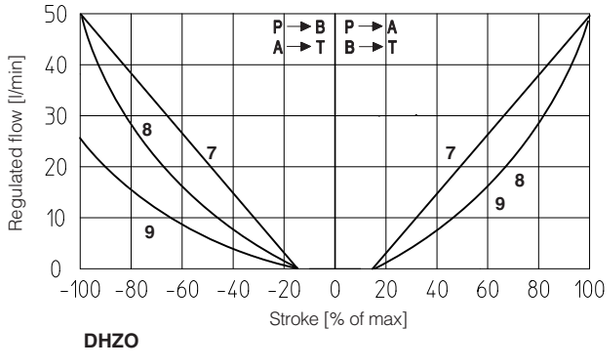
DHZO
1 = L14 **2** = L1



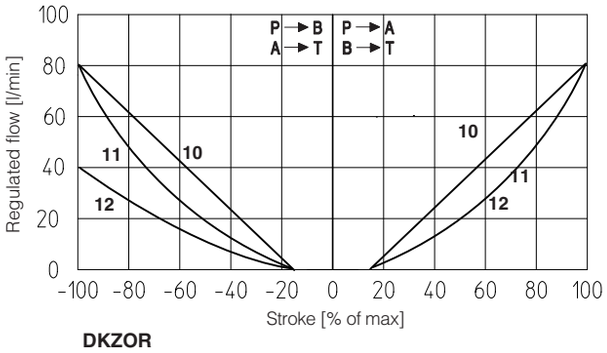
DHZO
3 = S2



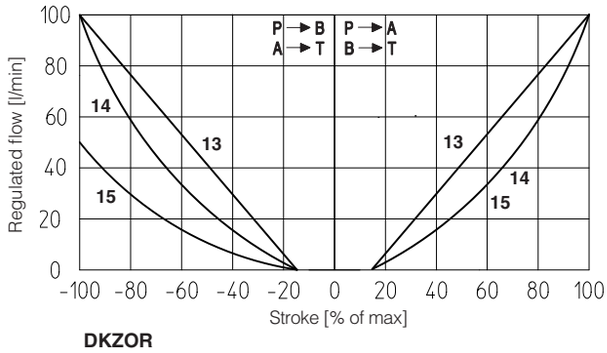
DHZO
4 = L3 **5** = S3 **6** = D3



DHZO
7 = L5 **8** = S5 **9** = D5



DKZOR
10 = L3 **11** = S3 **12** = D3



DKZOR
13 = L5 **14** = S5 **15** = 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

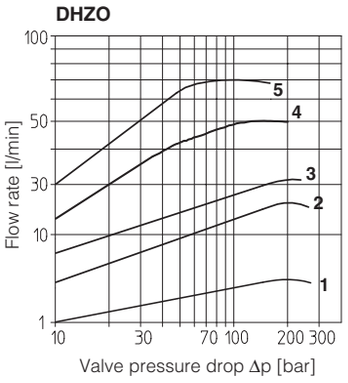
7.2 Flow /Δp diagrams
stated at 100% of valve stroke

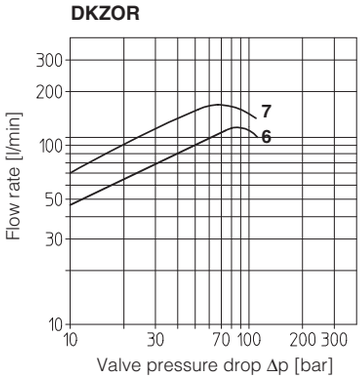
DHZO

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





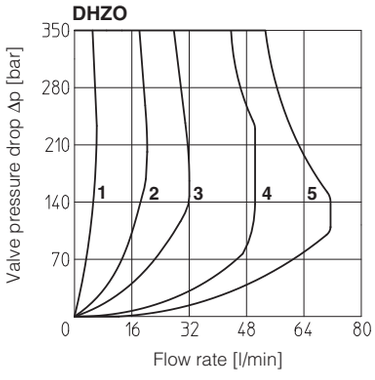
7.3 Operating limits

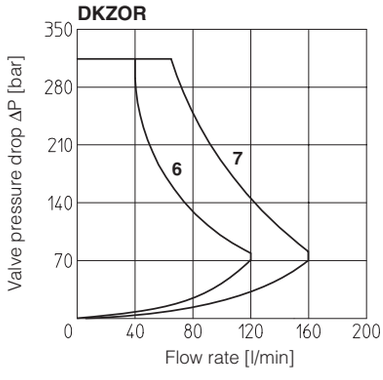
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5

DKZOR

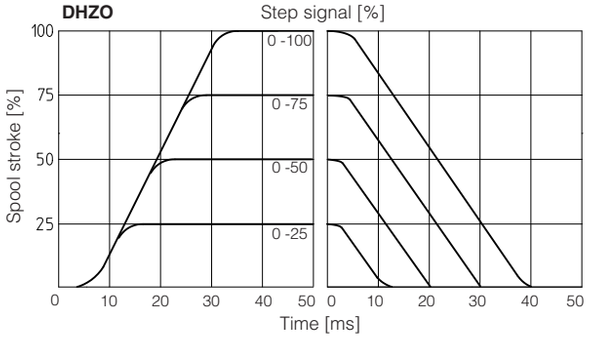
6 = spool S3, L3, D3
7 = spool S5, L5, D5

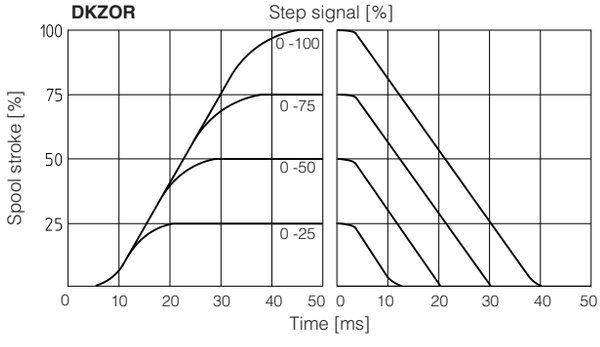




7.4 Response time

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.

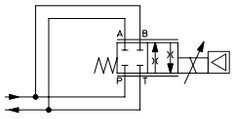




7.5 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)

Max flow Δp= 30bar [l/min]	SPOOL TYPE				
	L14	**L1**	**S2**	**L3 S3**	**L5 S5**
DHZO	4	16	28	60	100
DKZOR				130	170



8 **PROGRAMMING TOOLS** - see tech table **GS500**

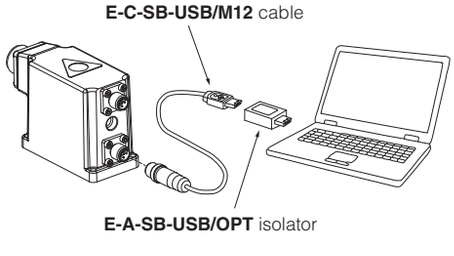
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver. For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options:

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)	
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

USB connection



9 HYDRAULIC OPTIONS

9.1 Option /B

DHZO-05 and DKZOR-15: solenoid and integral electronics at side of port A of the main stage.
DHZO-07 and DKZOR-17: integral electronics at side of port A of the main stage.

9.2 Option /Y

External drain advisable when the valve is used in double flow path, see section 7.5. Option /Y is mandatory if the pressure in port T exceeds 210 bar.

10 OPTIONS for -A

10.1 Coil voltage

Option /6 optional coil to be used with Atos drivers with power supply 12 VDC
Option /18 optional coil to be used with electronic drivers not supplied by Atos

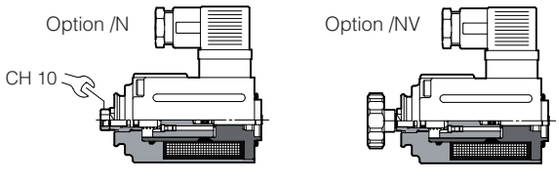
10.2 Hand lever

This option is available 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

Option /MO horizontal hand lever
Option /BMO horizontal hand lever installed at side of port A
Option /MV vertical hand lever
Option /BMV vertical hand lever installed at side of port A

The following supplementary options allow to operate the valve in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see tech. table TK150

Option /N manual micrometric adjustment
Option /NV as /N plus handwheel and graduated scale



11 ELECTRONIC OPTIONS for AEB and AES

Standard driver execution provides on the 7 pin main connector:

Power supply - 24 VDC must be appropriately stabilized or rectified and filtered; **2,5 A** fuse time lag is required in series to each driver power supply Apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10 VDC nominal range (pin D, E), proportional to desired coil current

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Note: a minimum booting time of 500 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero.

11.1 Option /I

It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 V.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V 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.

11.2 Option /Q

To enable the driver, supply 24 VDC on pin C referred to pin B: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

11.3 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication

Separate power supply (pin 9,10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, USB and fieldbus communication.
A safety fuse is required in series to each driver power supply: 500 mA fast fuse.

11.4 Option /W - only for valves coupled with pressure compensator type HC-011 or KC-011 (see tab. D150).

It provides, on the 12 pin main connector, the above option /Z features plus 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:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}}\ ;\ \text{Flow Reference [INPUT+]}\right)$$

For detailed information on hydraulic power limitation, see tab. GS115

11.5 Option /C - only in combination with option **/W**

Option /C is available to connect pressure transducer with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10V .
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V or ±20 mA.

11.6 Possible combined options: /IQ, /IZ, /IW, /CW and **/CWI**

12 ELECTRONIC CONNECTIONS

12.1 Main connector signals - 7 pin - **standard** and **/Q** options - **AEB** and **AES** (A1)

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	**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	

12.2 Main connector signals - 12 pin - **/Z** and **/W** options - **AEB** and **AES** (A2)

PIN	/Z	/W	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 V0	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
7	**NC**		Do not connect	
8	**NC**		Do not connect	
		MONITOR2	2nd monitor output signal: ±5 VDC maximum range, 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 V0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

12.3 Communication connectors - **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**	

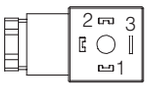
(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

Notes: (1) shield connection on connector's housing is recommended **(2)** only for **AES** execution

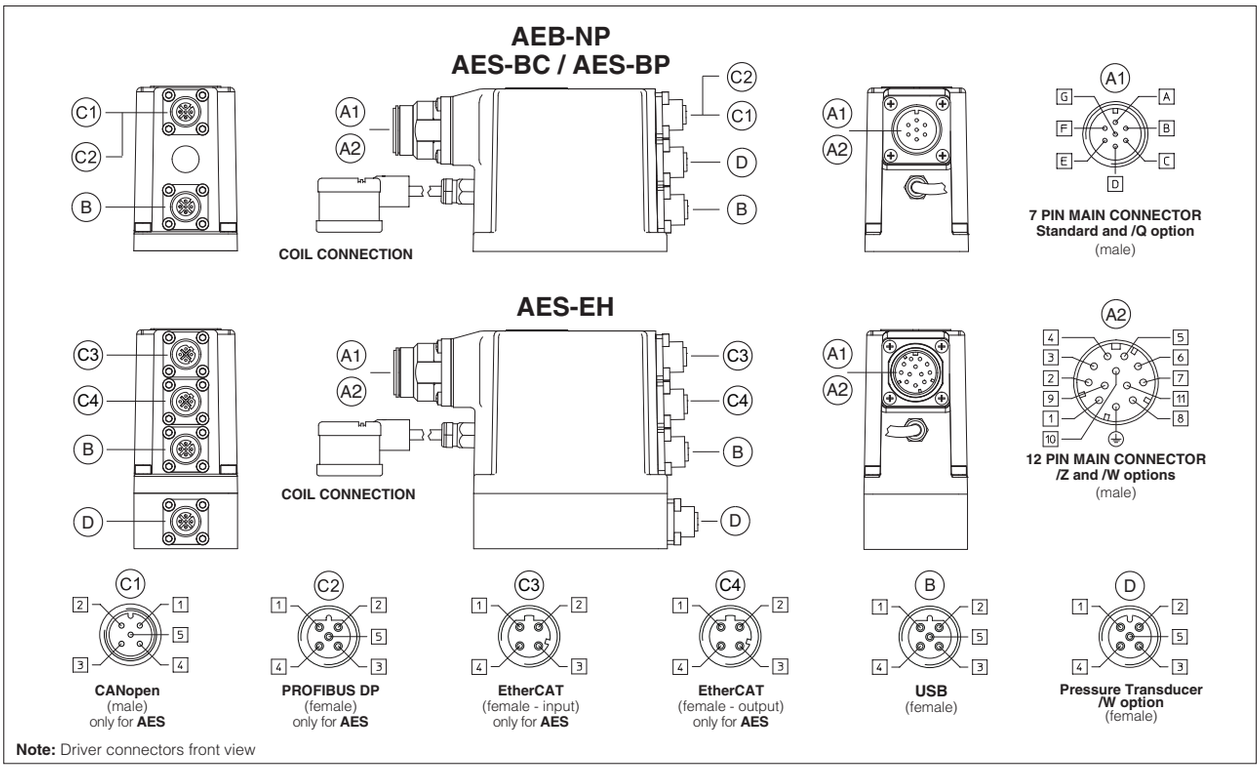
12.4 Pressure transducer connector - **M12 - 5 pin** - only for **/W** option (D)

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	/	/

12.5 Solenoid connection - only for **A**

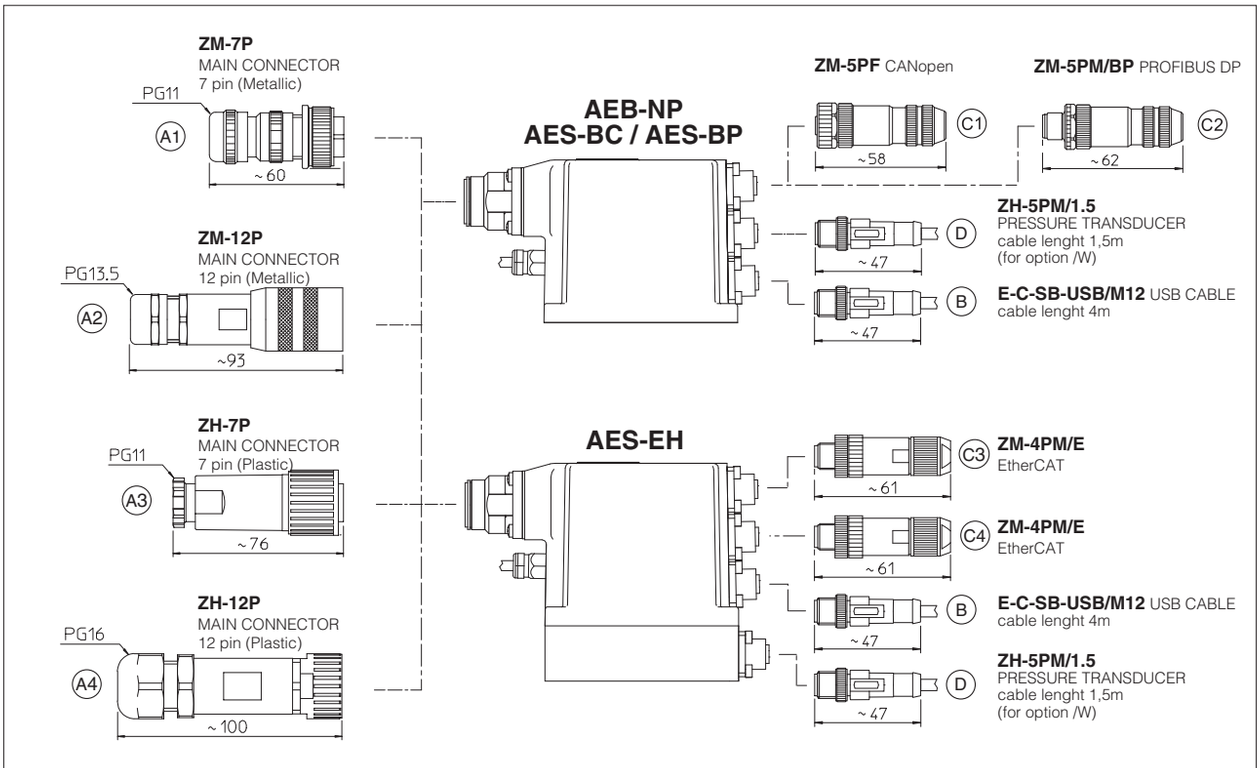
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

12.6 Connections layout - only for **AEB** and **AES**



Note: Driver connectors front view

13 CONNECTORS



Note: use of metallic connectors is strongly recommended in order to fulfill EMC requirements

14 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	A (1)	AEB, AES std and /Q	AEB, AES /Z and /W	AEB, AES /W	BC - CANopen	BP - PROFIBUS DP	EH - EtherCAT
CONNECTOR CODE	666	ZM-7P (A1)	ZM-12P (A2)	ZH-5PM/1.5 (D)	ZM-5PF (C1)	ZM-5PM/BP (C2)	ZM-4PM/E (C3)
		ZH-7P (A3)	ZH-12P (A4)				ZM-4PM/E (C4)
PROTECTION DEGREE	IP67	IP67					
DATA SHEET	K500	GS115, K500					

(1) Connector supplied with the valve

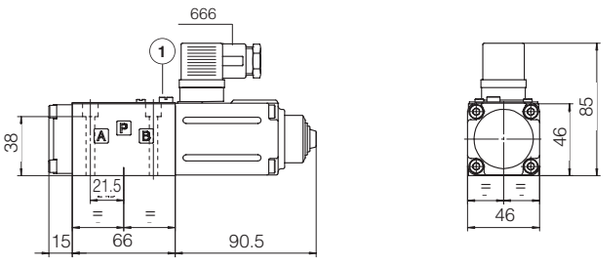
only for **AES**

15 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)

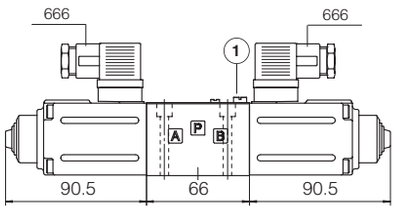
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108; 1 OR 2025
Diameter of ports A, B, P, T: Ø 7,5 mm (max)
Diameter of port Y: Ø = 3,2 mm (only for /Y option)

DHZO-A-05



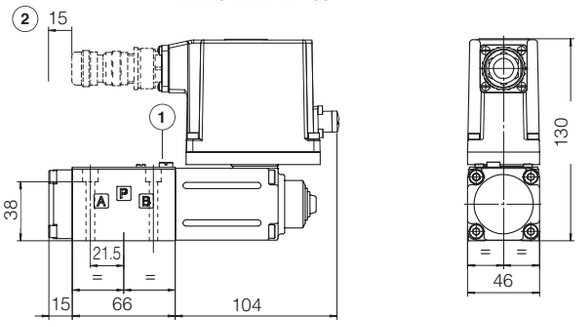
Mass: 1,9 kg

DHZO-A-07



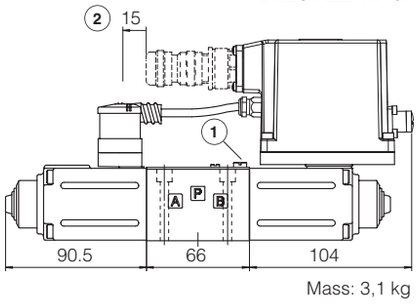
Mass: 2,6 kg

DHZO-AEB-NP-05



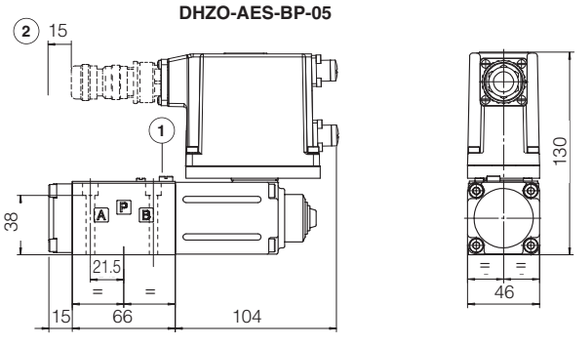
Mass: 2,3 kg

DHZO-AEB-NP-07



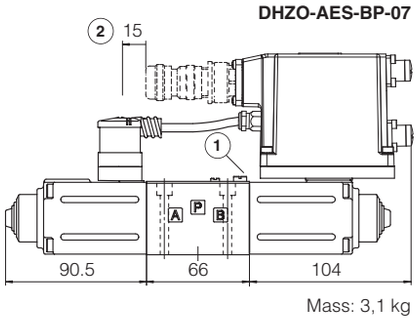
Mass: 3,1 kg

DHZO-AES-BC-05
DHZO-AES-BP-05



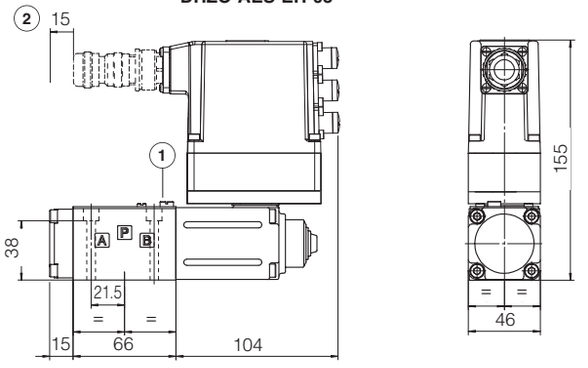
Mass: 2,3 kg

DHZO-AES-BC-07
DHZO-AES-BP-07



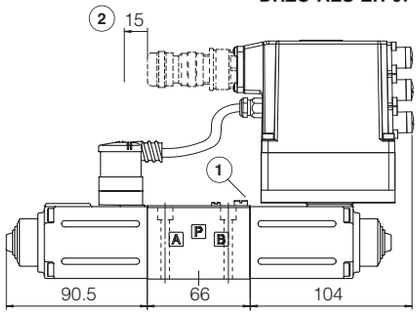
Mass: 3,1 kg

DHZO-AES-EH-05



Mass: 2,4 kg

DHZO-AES-EH-07



Mass: 3,2 kg

(1) = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw (1)

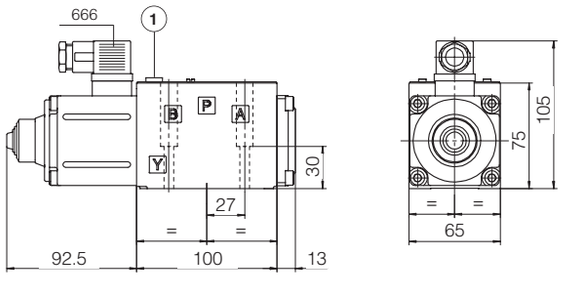
(2) = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 13, 14

16 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)

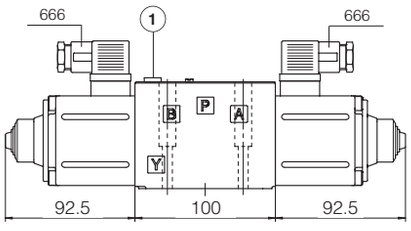
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 1 OR 108
Diameter of ports A, B, P, T: Ø 11,2 mm (max)
Diameter of port Y: Ø = 5 mm (only for /Y option)

DKZOR-A-15



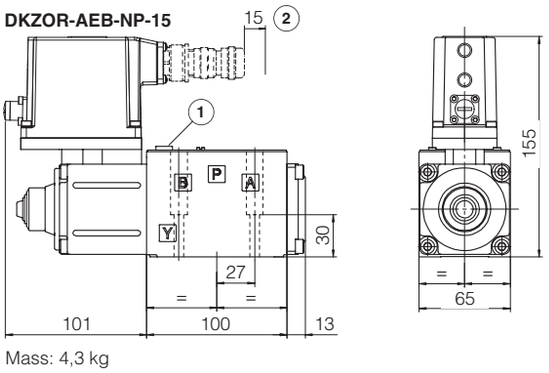
Mass: 3,8 kg

DKZOR-A-17



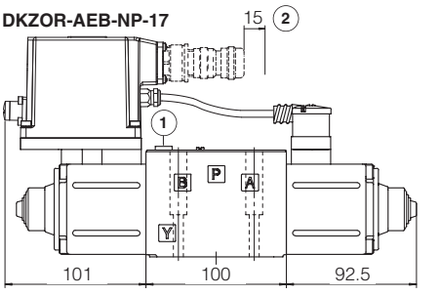
Mass: 4,5 kg

DKZOR-AEB-NP-15



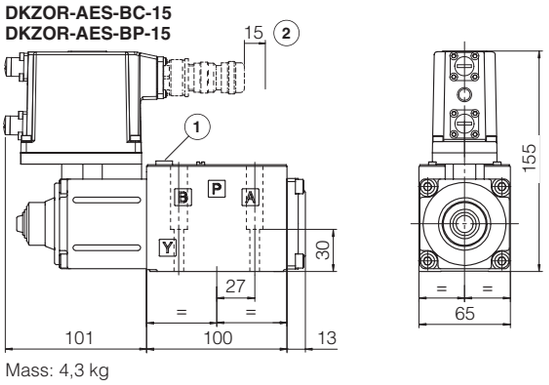
Mass: 4,3 kg

DKZOR-AEB-NP-17



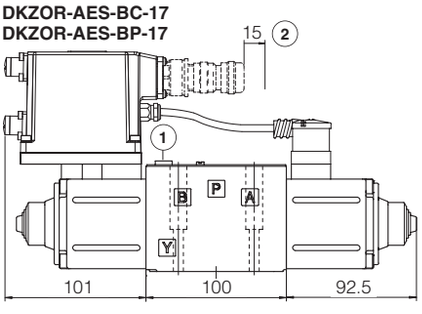
Mass: 5,0 kg

DKZOR-AES-BC-15
DKZOR-AES-BP-15



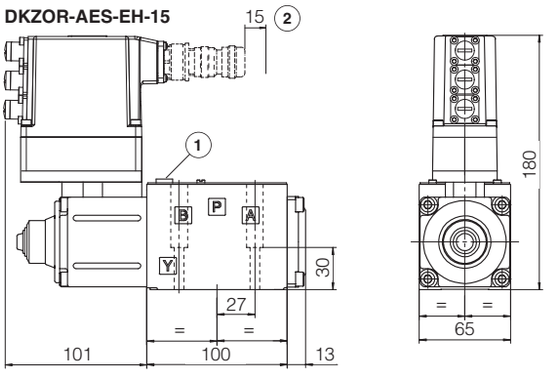
Mass: 4,3 kg

DKZOR-AES-BC-17
DKZOR-AES-BP-17



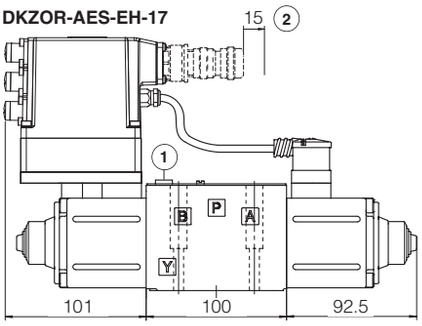
Mass: 5,0 kg

DKZOR-AES-EH-15



Mass: 4,4 kg

DKZOR-AES-EH-17



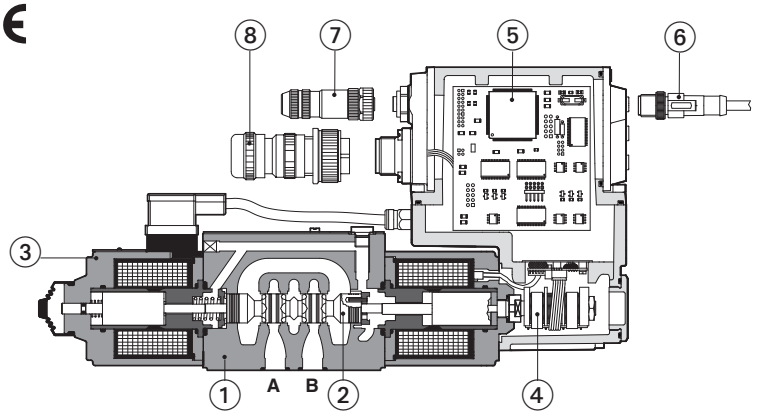
Mass: 5,1 kg

(1) = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw (1)

(2) = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 13, 14

Proportional directional valves high performance

digital, direct operated, with position transducer and **positive spool overlap**, rugged design



DKZOR-TES-SN-BC-171

① Valve body
② Spool
③ Proportional solenoid
④ Position transducer
⑤ Integral electronics
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector

DHZO-TEB, DHZO-TES
DKZOR-TEB, DKZOR-TES

High performance direct operated digital proportional valves 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.
The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting.
High performances valves are available in TEB basic execution with analog reference signals and USB port for software functional parameters setting or in 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: **06** and **10**
Max flow: up to **80** and **170 l/min**
Max pressure: **350 bar** (DHZO)
315 bar (DKZOR)

1 MODEL CODE for STANDARD SPOOLS

DHZO	-	T	ES	-	SN	-	NP	-	0	71	-	L	5	/	*	*	/	*

DHZO = size 06
DKZOR = size 10

T = closed-loop
one LVDT transducer

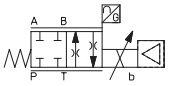
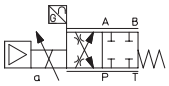
Integral digital drivers:
EB = basic **(1)**
ES = full

Alternated P/Q controls, see section 6:
SN = none **(1)**
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:
NP = Not present **(1)**
BC = CANopen
BP = PROFIBUS DP
EW= POWERLINK
EH = EtherCAT
EI = EtherNet/IP
EP = PROFINET IRT

Valve size, ISO 4401: **0** = 06 **1** = 10

Configuration: **Standard** Option **/B**

51 =



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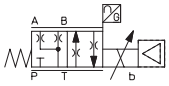
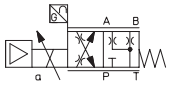

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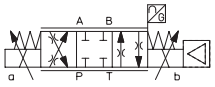
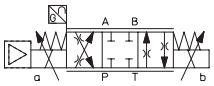
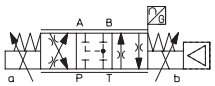
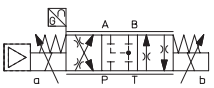
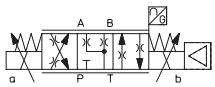
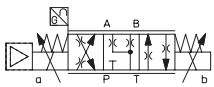



72 = **(2)**


(2)

73 =



(1) TEB available only in version **SN-NP**

(2) 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.

Seals material, see sect. 9, 10:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options, see section 14:
B = solenoid with integral electronics and position transducer at side of port A **(3)**
Y = external drain

Electronic options, see section 15 :
Note: **F, Q, Z** options are standard for **SP, SF, SL**
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) only **TES-SP, SF, SL**
F = fault signal - only **TEB** and **TES-SN**
I = current reference input and monitor 4÷20mA (omit for standard ±10VDC)
Q = enable signal - only **TEB** and **TES-SN**
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(4)**

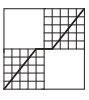
Safety option TUV certified - only **TES**:
U = safe double power supply
See section 8 and tech table **FY100**

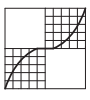
SAFETY CERTIFIED

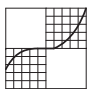
Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZO =	1	4,5	8	17	28
DKZOR =	-	-	-	45	75

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:

L = linear


S = progressive


D = differential-progressive

P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(3) In standard configuration the solenoid with integral electronics and position transducer are at side of port B

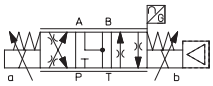
(4) double power supply only for **TES**

2 MODEL CODE for OPTIONAL SPOOLS - refer to section 1 for valve model code and options

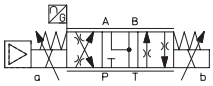
DHZO	-	TES	-	SP	-	NP	-	0	73 - V9	/	*	/	*	/	*

Configuration, spool type and size:

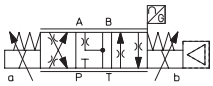
73-Q5



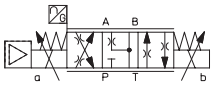
73-Q5/B



73-V9



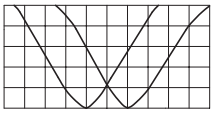
73-V9/B



Spool size:		Q5	V9
DHZO	=	30	30
DKZOR	=	75	75

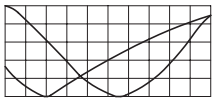
Nominal flow (l/min) at Δp 10 bar P-T

Q5



For alternate P/Q control see section 13, diagram 16

V9



For alternate P/Q control of injection cycle in plastic machinery see section 13, 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 **F003** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS001

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. 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 main setting of valve's functional parameters and configurations are:

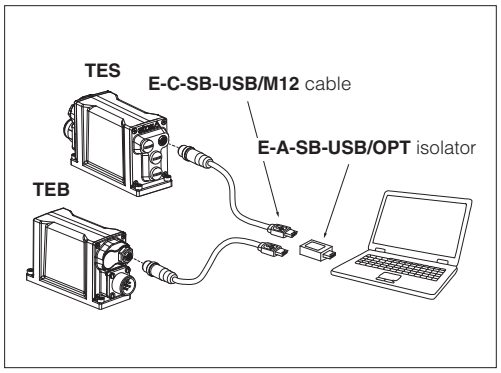
- bias, scale, ramps, dither
- linearization function for the hydraulic regulation
- setting of PID gains
- selection of analog IN / OUT range
- complete diagnostics of driver status
- internal oscilloscope function
- in field firmware update through USB port

The software is available in different versions according to the driver's options:

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!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

USB connection



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 GS002

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 AXIS CONTROLLER - see tech. table FS230

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.

8 SAFETY OPTION - only for TES, see tech. table FY100

Atos range of proportional directional valves, provides functional safety option **/U**, designed to accomplish a safety function, intended to reduce the risk in process control systems.

It is **TUV 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

SAFETY CERTIFIED

9 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		
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	

10 GENERAL CHARACTERISTICS

Assembly position	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, see technical table P007
Ambient temperature range	**standard** = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C

11 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		**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**	**Q5,V9**	**L3,S3,D3**	**L5,S5,D5**	**Q5,V9**
Nominal flow [l/min] **(1)**	Δp= 10 bar	1	4,5	8	18	28	30	45	75	75
Δp P-T	Δp= 30 bar	1,7	8	14	30	50	52	80	130	130
max	Δp= 70 bar	2,6	12	21	45	75	80	120	170	170
permissible flow **(2)**		4	18	30	50	80	80	130	180	180
Response time [ms] (0-100% step signal)		15						20		
Leakage [cm³]		<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (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								

Notes: (1) For different Δp, the max flow is in accordance to the diagrams in section 13.2
(2) See detailed diagrams in section 13.2

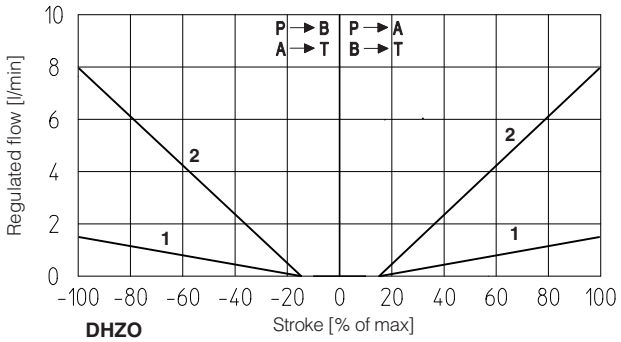
12 ELECTRIC CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Reference input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
Max. solenoid current	**DHZO** = 2,6 A **DKZOR** = 3 A			
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 100 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			
Format	Sealed box on the valve; IP66 / IP67 protection degree with mating connectors			
Tropicalization	Tropical coating on electronics PCB			
Operating temperature	-40 ÷ +60 °C (storage -40 ÷ +70 °C)			
Mass (driver only)	Approx. 490 g			
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 61000-2; Emission: EN 61000-3)			
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			

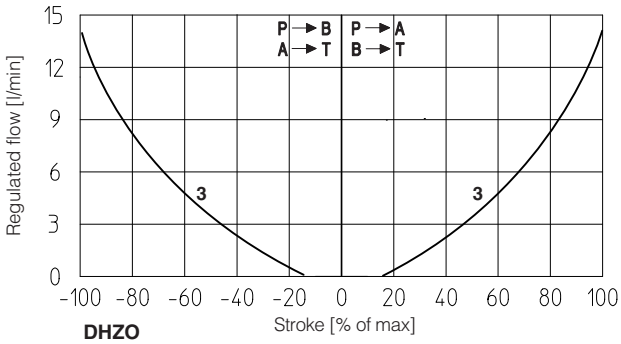
Note: a minimum booting time between 400 and 800 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero

13 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

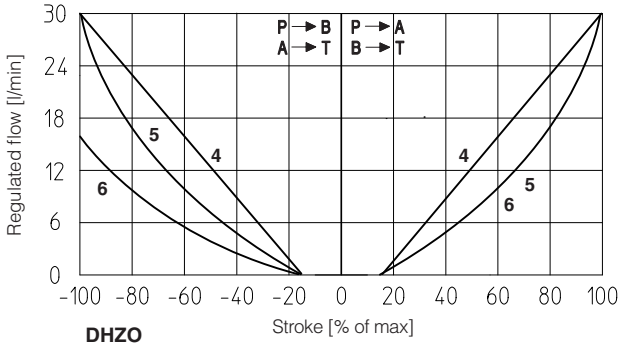
13.1 Regulation diagrams - values measure at Δp 30 bar P-T



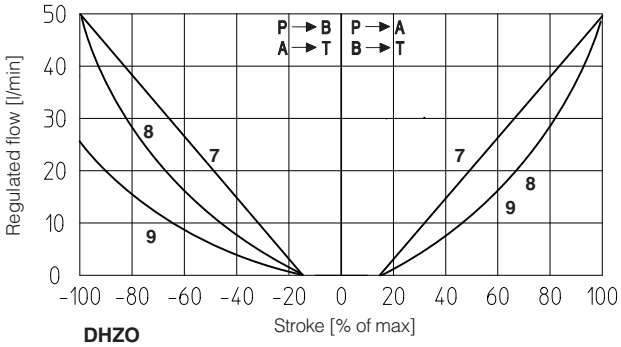
DHZO
1 = L14 **2** = L1



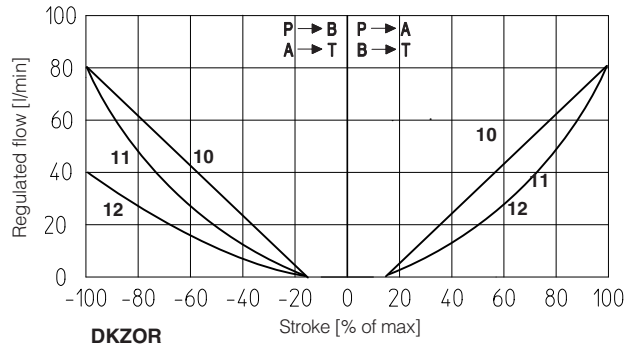
DHZO
3 = S2



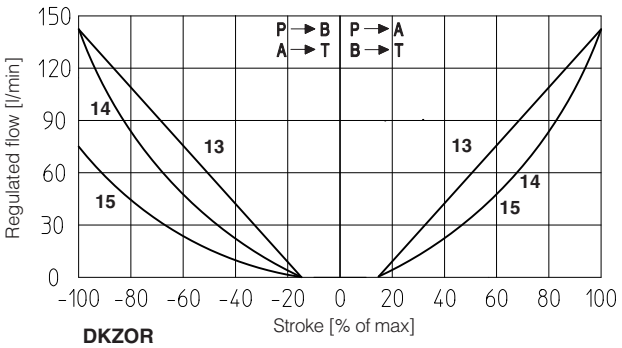
DHZO
4 = L3 **5** = S3 **6** = D3



DHZO
7 = L5 **8** = S5 **9** = D5



DKZOR
10 = L3 **11** = S3 **12** = D3



DKZOR
13 = L5 **14** = S5 **15** = D5

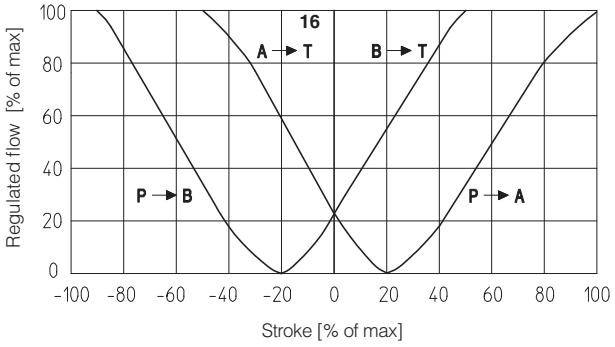
Note:
Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

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

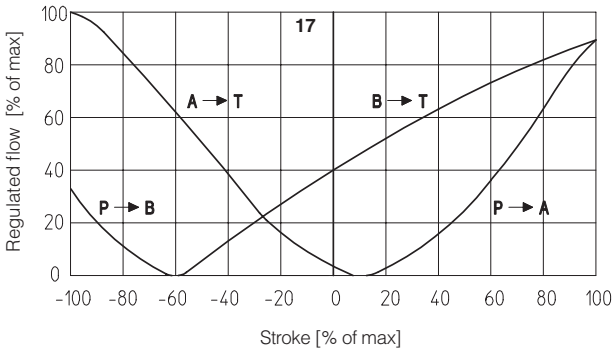
16 = linear spool **Q5**

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **GS212**).
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 **GS212**) or Z-ME-KZ/GI axis card (see tech table **G345**).
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



13.2 Flow /Dp diagrams

stated at 100% of valve stroke

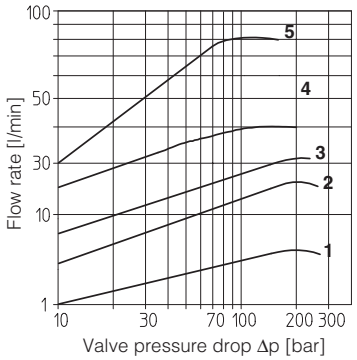
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9

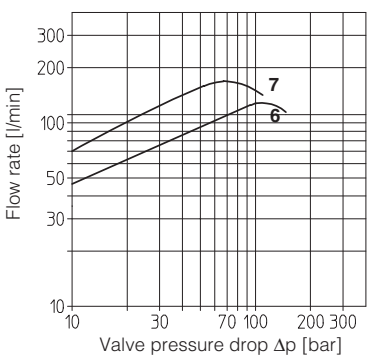
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO



DKZOR



13.3 Operating limits

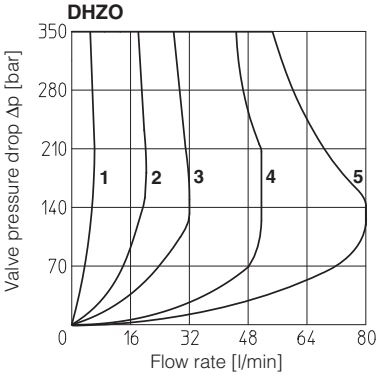
DHZO

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5, V9

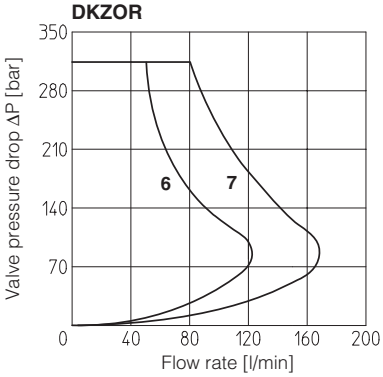
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO



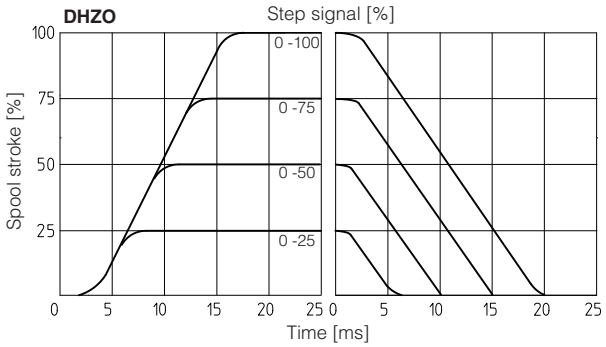
DKZOR



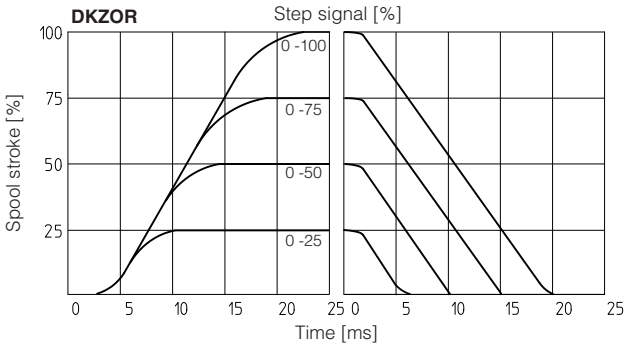
13.4 Response time

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.

DHZO



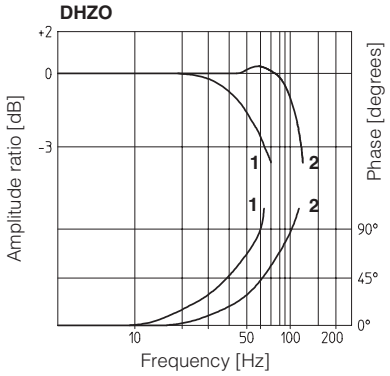
DKZOR



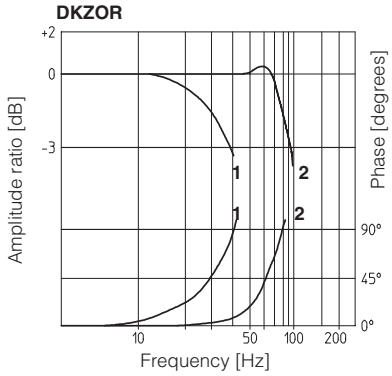
13.5 Bode diagrams

1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke

DHZO

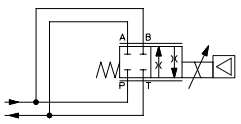


DKZOR



13.6 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= 30bar [l/min]	SPOOL TYPE				
	L14	**L1**	**S2**	**L3 S3**	**L5 S5**
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	260

14 HYDRAULIC OPTIONS

14.1 Option /B

Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 13.1

14.2 Option /Y

Option /Y is mandatory if the pressure in port T exceeds 210 bar.

15 ELECTRONIC OPTIONS

15.1 Option /F (for **TEB** and **TES-SN**; standard for **TES-SP, SF, SL** with fieldbus)

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.

15.2 Option /I (for all version)

It 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.

15.3 Option /Q (for **TEB** and **TES-SN**; standard for **TES-SP, SF, SL** with fieldbus)

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.

15.4 Option /Z (for **TEB** and **TES-SN**; standard for **TES-SP, SF, SL** with fieldbus)

It 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**

Power supply for driver's logics and communication - only for **TES**

Separate power supply (pin 9,10) allows to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, USB and fieldbus communication.

A safety fuse is required in series to each driver power supply: 500 mA fast fuse.

15.5 Options /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:

Standard versions:	Safety certified versions:
For SN: **/FI, /IQ, /IZ**	For SN: **/IU**
For SP, SF, SL: **/CI**	For SP, SF, SL: **/CU, IU, CIU**

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). For certified safety options /U see tech. table **FY100**.

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 GS002).

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) - only for standard, **/Q**, **/Z** and **TES-SP, SF, SL**

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) - only for **/Q**, **/Z** and **TES-SP, SF, SL**

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) - only for **/F**, **/Z** and **TES-SP, SF, SL**

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.
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 GS002).

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 - analog 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	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

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**	

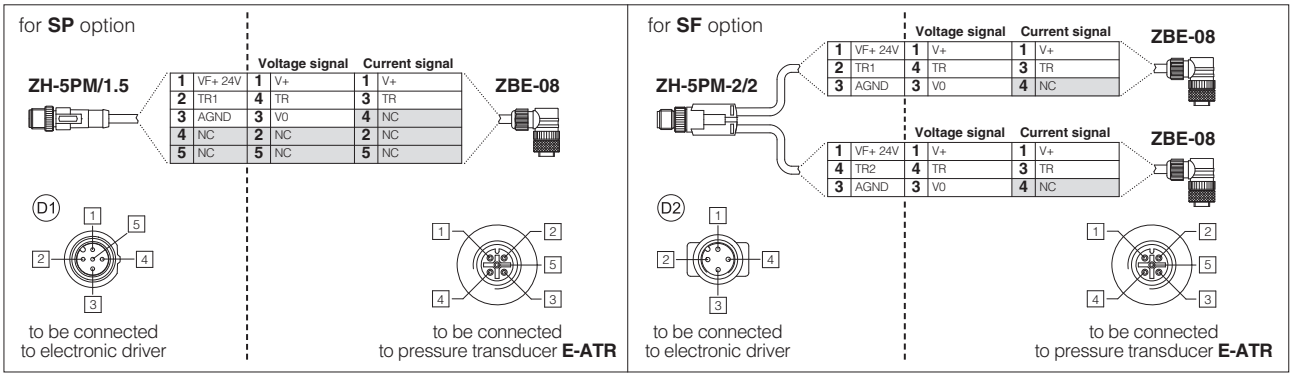
Notes: (1) shield connection on connector's housing is recommended **(2)** pin 2 can be fed with external +5V supply of CAN interface

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		/	/	/	/

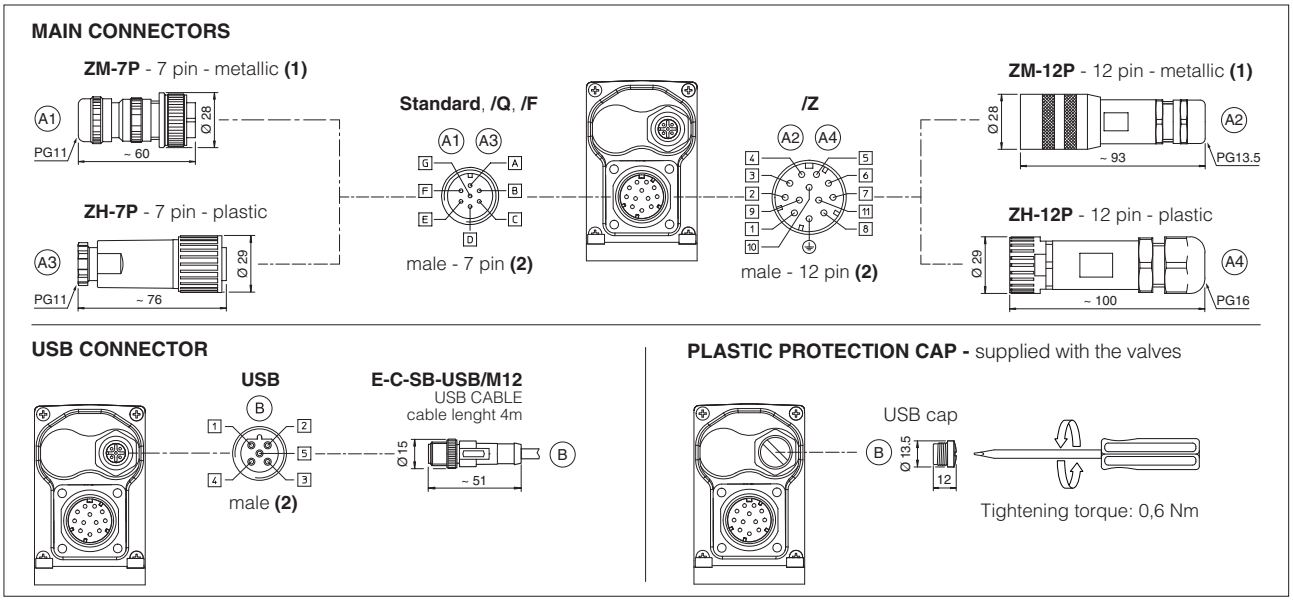
Note: (1) single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

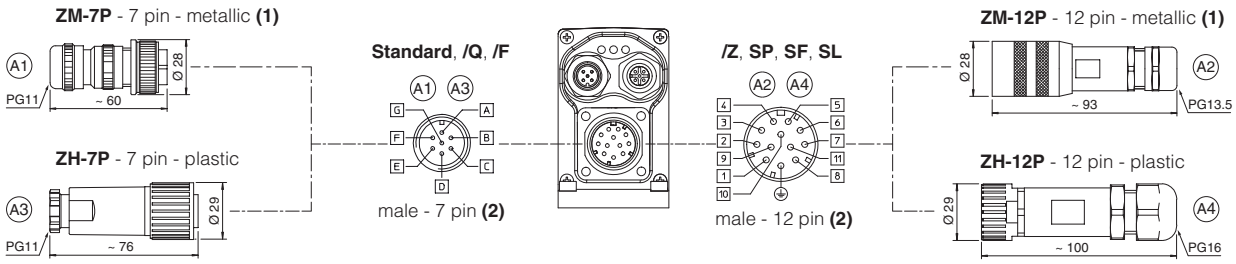
18.5 TEB connections layout



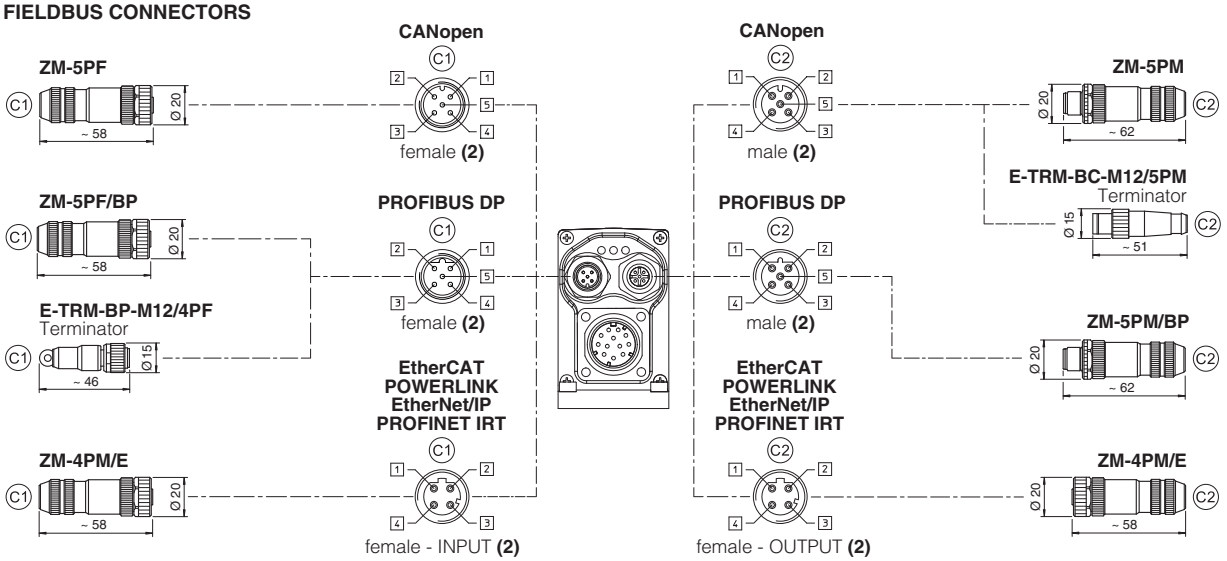
Notes: (1) use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** pin layout always referred to driver's view

18.6 TES connections layout

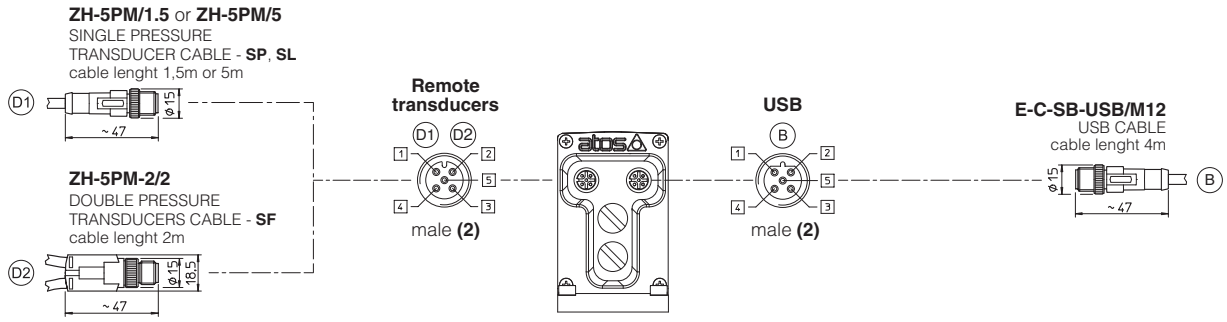
MAIN CONNECTORS



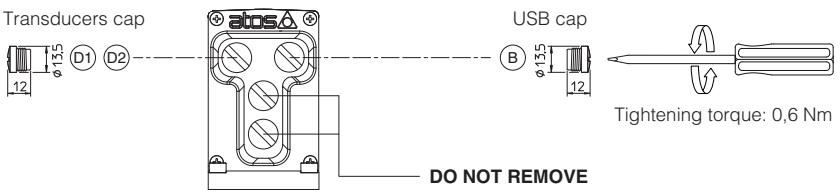
FIELDBUS CONNECTORS



TRANSDUCERS AND USB CONNECTORS



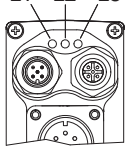
PLASTIC PROTECTION CAPS - supplied with the valves



Notes: (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**

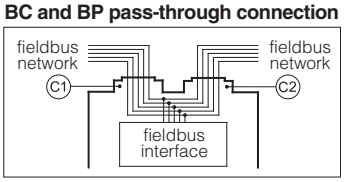
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET IRT	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

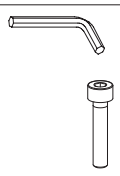
CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A2 ZM-12P	A4 ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power 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 IRT (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

Notes: (1) E-TRM-** terminators can be ordered separately - see tech table **GS500** **(2)** Internally terminated

21 FASTENING BOLTS AND SEALS

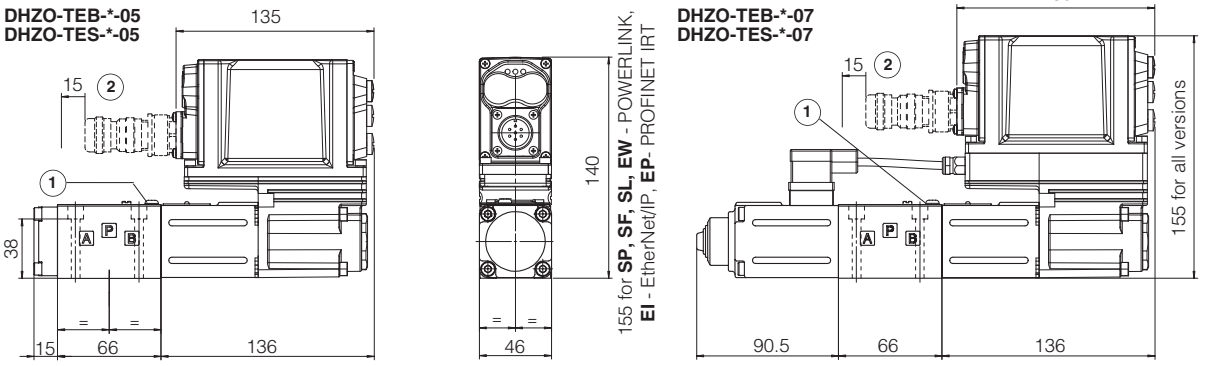
	DHZO	DKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y 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: 2000
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108; 1 OR 2025
Diameter of ports A, B, P, T: Ø 7,5 mm (max)
Diameter of port Y: Ø = 3,2 mm (only for /Y option)



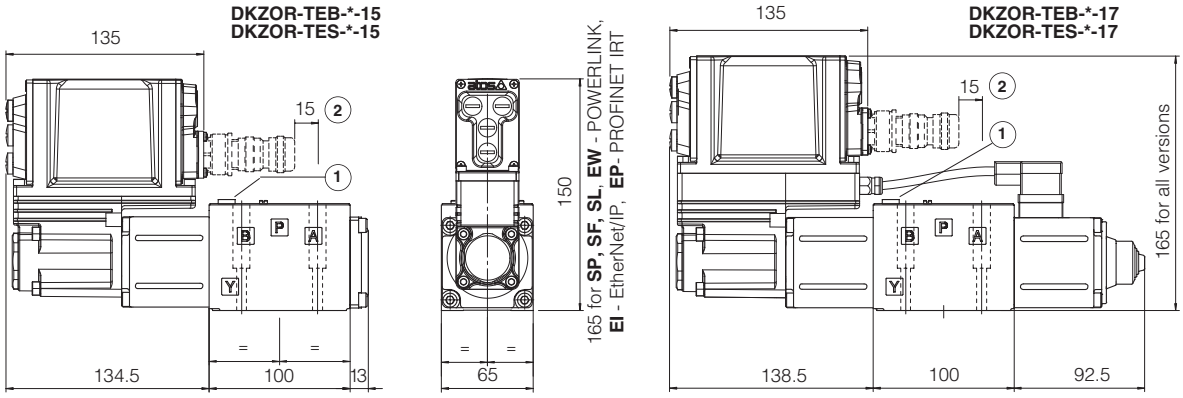
Mass: 2,3 kg

Mass: 3,1 kg

DKZOR-TEB, DKZOR-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)

Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 1 OR 108
Diameter of ports A, B, P, T: Ø 11,2 mm (max)
Diameter of port Y: Ø = 5 mm (only for /Y option)



Mass: 4,3 kg

Mass: 5,0 kg

(1) = Air bleed off

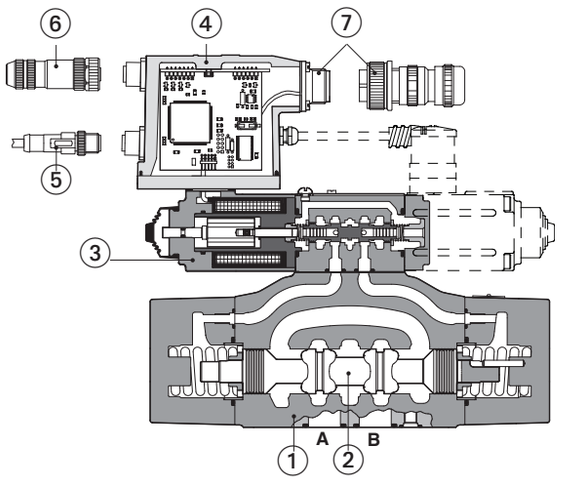
(2) = Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 13, 14

23 RELATED DOCUMENTATION

F002	Basics for digital electrohydraulics
F003	Commissioning and troubleshooting
FS230	Digital proportional valves with integral axis controller
FY100	Safety digital valves
GS001	Basics for digital proportionals
GS002	Basics for digital proportionals with P/Q control
GS003	Settings for digital proportionals
GS500	Programming tools
GS510	Fieldbus
K500	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB300	Quickstart for TEB valves commissioning
QF300	Quickstart for TES valves commissioning

Two stage proportional directional valves

digital, pilot operated, open loop, with **positive spool overlap**



① Valve body
② Main stage Spool
③ Pilot valve
④ Integral electronics
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

Pilot operated digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

Executions:

- **A** without integral driver, to be coupled with separated drivers, see section 2
- **AEB** with basic integral digital electronic driver, analog reference signals and USB port for software functional parameters setting
- **AES** with full integral digital electronic driver and fieldbus interface for functional parameters setting, reference signals and real-time diagnostics

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting.

Size: **10** to **32**
Max flow: **180** to **1500 l/min**
Max pressure: **350 bar**

1 MODEL CODE for STANDARD SPOOLS

DPZO	-	A	ES	-	BP	-	2	71	-	L	5	/	*	/	*	*	/	*

DPZO: Two stage proportional directional valve

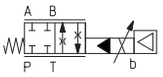
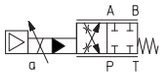
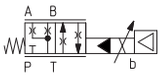
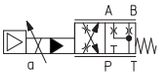
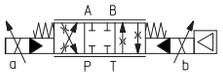
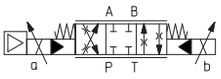
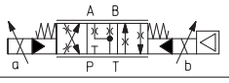
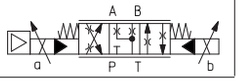
A = open loop

- = omit for execution with separated driver see section 2
EB = basic integral driver
ES = full integral driver

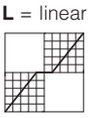
Fieldbus interfaces - USB port always present **(1)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

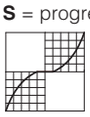
Valve size - ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

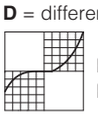
Configuration (2):

	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 sect. 5, 6:
- = NBR
PE = FKM
BT = HNBR

Series number

Coil voltage only for **A** - see sect. 9:
see section 8:
- = standard coil for 24V$_{DC}$ Atos drivers
6 = optional coil for 12V$_{DC}$ Atos drivers
18 = optional coil for low current drivers

Hydraulic options, see sect. 8:
B = solenoid and integral electronics at side of port B of the main stage (side A of pilot valve) **(3)**
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronic options, only for **AEB** and **AES** - see sect. 10
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 V)
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) Omit for **A** execution; **AEB** available only in version **NP**; **AES** available only in version **BC**, **BP**, **EH**
(2) Hydraulic symbols are represented with integral digital driver
(3) In standard configuration the solenoid (config. 51 and 53) and the integral electronics (AEB, AES) are at side A of the main stage (side B of pilot valve)

2 ELECTRONIC DRIVERS

Valve model	A										AEB	AES
Drivers model	E-MI-AC-01F		E-BM-AC-01F		E-ME-AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	E-RI-AEB	E-RI-AES
Type	Analog					Digital						
Voltage supply (V_{DC})	12	24	12	24	24	12	24	12	24	24	24	
Valve coil option	/6	std	/6	std	std	/6	std	/6	std	std	std	
Format	plug-in to solenoid		DIN 43700 UNDECAL		EUROCARD	plug-in to solenoid		DIN-rail panel			Integral to valve	
Data sheet	G010		G025		G035	G020		G030		GS050	GS115	

Note: for main and communication connector see sections 12 , 13

3 GENERAL NOTES

DPZO-A* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

4 FIELDBUS - only for AES

Fieldbus allows the direct communication of the proportional valve 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**.

5 MAIN CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Assembly position	Any position			
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)			
MTTFd valves according to EN ISO 13849	75 years, see technical table P007			
Ambient temperature range	**A**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +60°C **AEB, AES**: **standard** = -20°C ÷ +60°C, **/BT** option = -40°C ÷ +60°C			
Storage temperature range	**A**: **standard** = -20°C ÷ +80°C, **/BT** option = -40°C ÷ +70°C **AEB, AES**: **standard** = -20°C ÷ +70°C, **/BT** option = -40°C ÷ +70°C			
Coil code	standard		option /6	option /18
Coil resistance R at 20°C	3 ÷ 3,3 Ω		2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Max. solenoid current	2,2 A		2,75 A	1 A
Max. power	**A** = 30W **AEB, AES** = 50W			
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	IP66/67 with mating connectors			
Tropicalization	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

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		**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**		
Nominal flow	[l/min]					
(1)	Δp = 10 bar	100	160	250	480	640
Δp P-T	Δp = 30 bar	160	270	430	830	1100
Max permissible flow	[l/min]	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)**	Main stage [l/min]	0,15/0,5	0,2/0,6		0,3/1,0	1,0/3,0
Response time **(4)** (0-100% step signal and pilot pressure 100 bar)	[ms]	< 80	< 100		< 120	< 180
Hysteresis		≤ 5 [% of max regulation]				
Repeatability		± 1 [% of max regulation]				

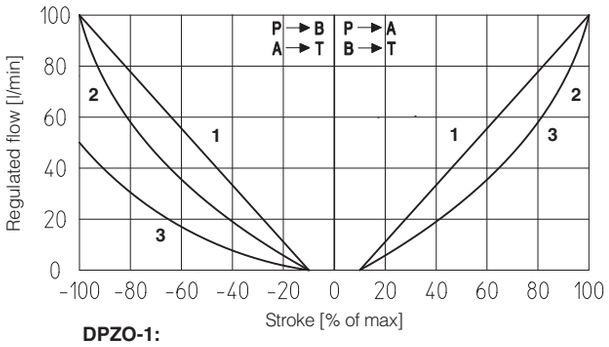
Notes: above performance data refer to valves coupled with Atos electronic drivers, see section 2.
(1) for different Δp, see section 7.2 **(2)** with step reference input signal 0 ÷100 %
(3) at p = 100/350 bar **(4)** see detailed diagrams in section 7.3

6 **SEALS AND HYDRAULIC FLUID** - for other fluids not included in below table, consult our technical office

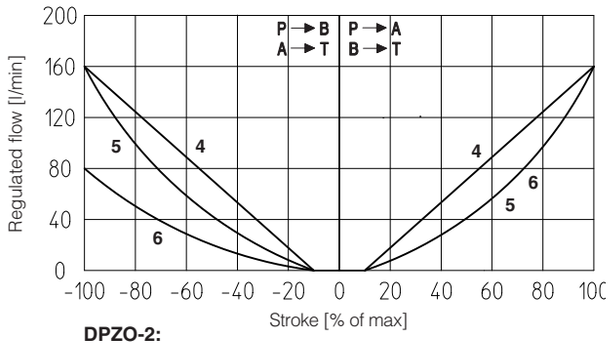
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
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	

7 **DIAGRAMS** (based on mineral oil ISO VG 46 at 50 °C)

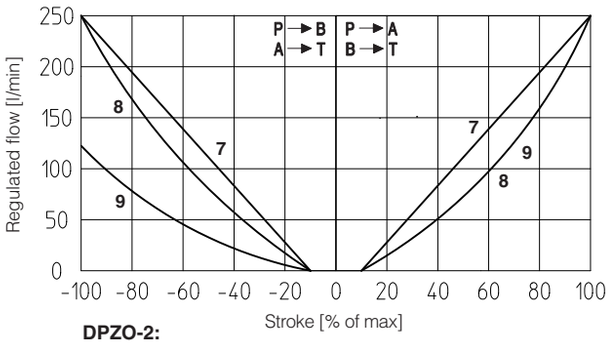
7.1 **Regulation diagrams** (values measure at Δp 10 bar P-T)



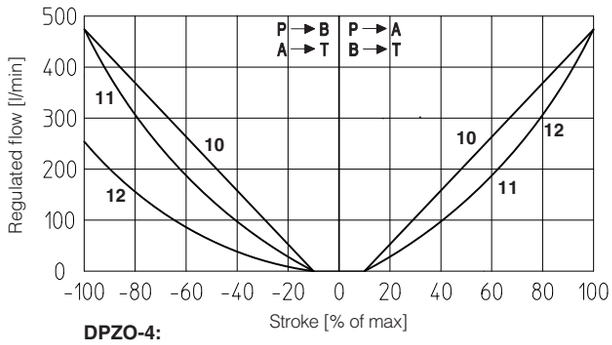
DPZO-1:
1 = L5 **2** = S5 **3** = D5



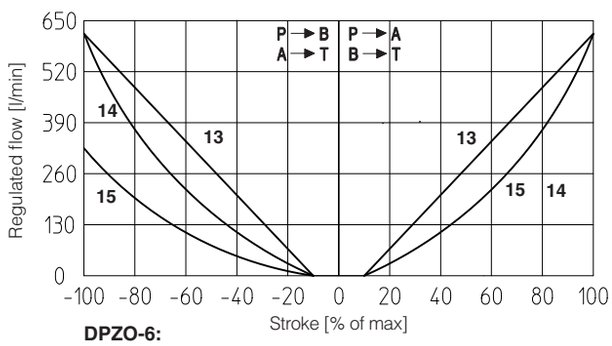
DPZO-2:
4 = L3 **5** = S3 **6** = D3



DPZO-2:
7 = L5 **8** = S5 **9** = D5



DPZO-4:
10 = L5 **11** = S5 **12** = D5



DPZO-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

7.2 Flow /Δp diagram

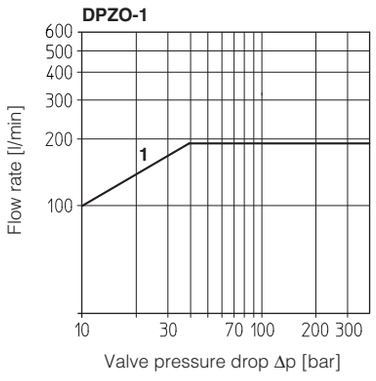
stated at 100% of spool stroke

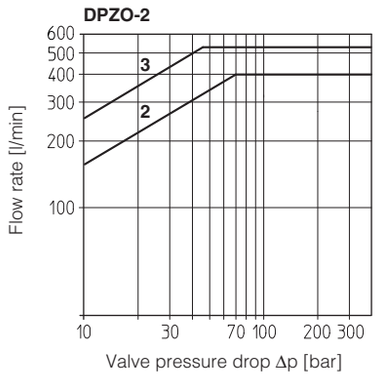
DPZO-1:
1 = spools L5, S5, D5

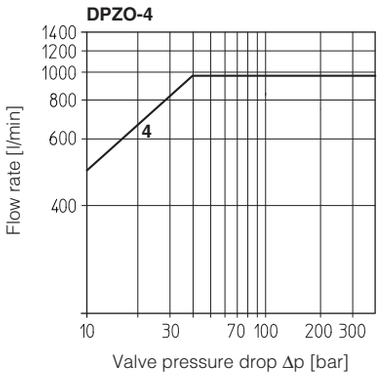
DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5

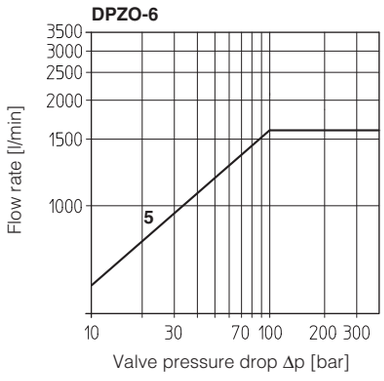
DPZO-4:
4 = spools L5, S5, D5

DPZO-6:
5 = spools L5, S5, D5



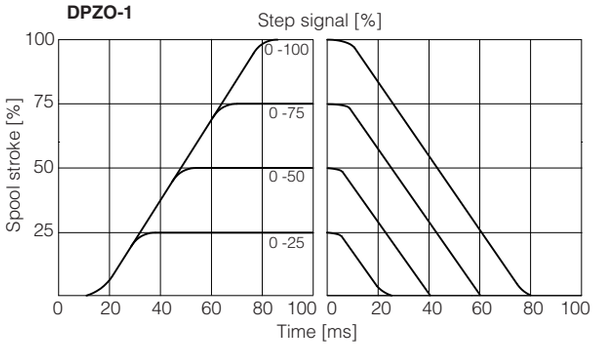


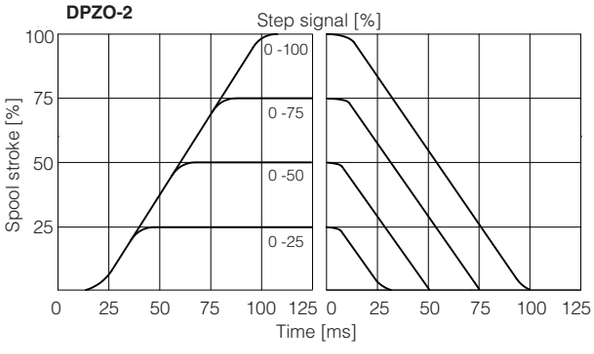


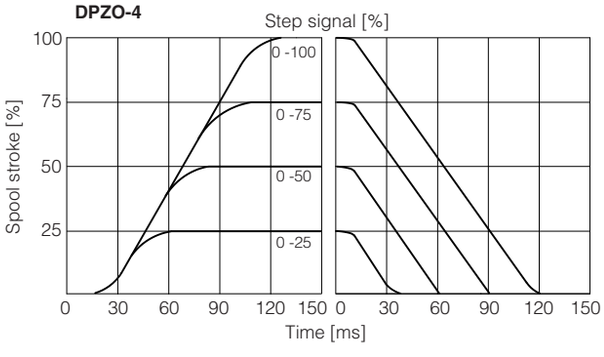


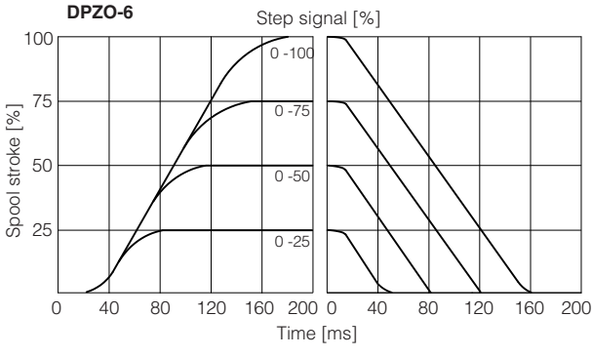
7.3 Response time (measured at pilot pressure = 100 bar)

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.



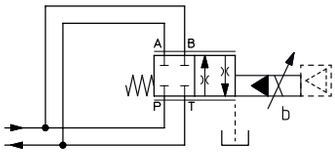






7.4 Operation as throttle valve

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 = 30 bar	320	850	1400	2000

8 HYDRAULIC OPTIONS

8.1 Option /B

DPZO-*-*5 = solenoid and integral electronics at side of port B of the main stage.

DPZO-*-*7 = integral electronics at side of port B of the main stage.

8.2 Options /E and /D

Pilot and drain configuration can be modified as shown in section 15
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:

Option /E External pilot (through port X).

Option /D Internal drain.

8.3 Option /G

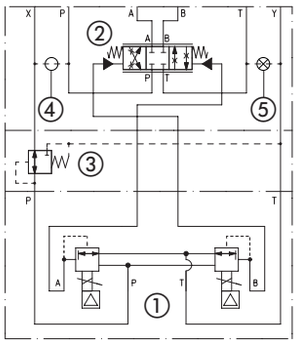
Pressure reducing valve installed between pilot valve and main body with fixed setting:

DPZO-1 and -2 = 40 bar

DPZO-4 and -6 = 100 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

9 OPTIONS for -A

9.1 Coil voltage

Option /6 optional coil to be used with Atos drivers with power supply 12 VDC

Option /18 optional coil to be used with electronic drivers not supplied by Atos

10 ELECTRONIC OPTIONS for AEB and AES

Standard driver execution provides on the 7 pin main connector:

Power supply - 24 VDC must be appropriately stabilized or rectified and filtered; **2,5 A** fuse time lag is required in series to each driver power supply Apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10 VDC nominal range (pin D, E), proportional to desired coil current

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Note: a minimum booting time of 500 ms has be considered from the driver energizing with the 24 VDC power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero.

10.1 Option /I

It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 V.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V 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.

10.2 Option /Q

To enable the driver, supply 24 VDC on pin C referred to pin B: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

10.3 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 VDC on pin 3 referred to pin 2: 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 communication and the other driver functions when the valve has to be disabled. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication

Separate power supply (pin 9,10) allow to cut solenoid power supply (pin 1, 2) while maintaining active diagnostics, USB and fieldbus communication.

A safety fuse is required in series to each driver power supply: 500 mA fast fuse.

10.4 Option /W - only for valves coupled with pressure compensator type KC-011 or JPC-2m (see tab. D150).

It provides, on the 12 pin main connector, the above option /Z features plus 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:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}}\ ;\ \text{Flow Reference [INPUT+]}\right)$$

For detailed information on hydraulic power limitation, see tab. GS115

10.5 Option /C - only in combination with option /W

Option /C is available to connect pressure transducer with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10V .

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V or ±20 mA.

10.6 Possible combined options: /IQ, /IZ, /IW, /CW and /CWI

11 ELECTRONIC CONNECTIONS

11.1 Main connector signals - 7 pin - **standard** and **/Q** options - **DPZO-AEB** and **DPZO-AES** (A1)

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	**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	

11.2 Main connector signals - 12 pin - **/Z** and **/W** options - **DPZO-AEB** and **DPZO-AES** (A2)

PIN	/Z	/W	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 V0	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
7	**NC**		Do not connect	
8	**NC**		Do not connect	
		MONITOR2	2nd monitor output signal: ±5 VDC maximum range, 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 V0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

11.3 Communication connectors - **DPZO-AEB** (B) and **DPZO-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)**

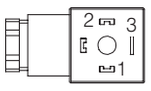
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

Notes: (1) shield connection on connector's housing is recommended **(2)** only for **AES** execution

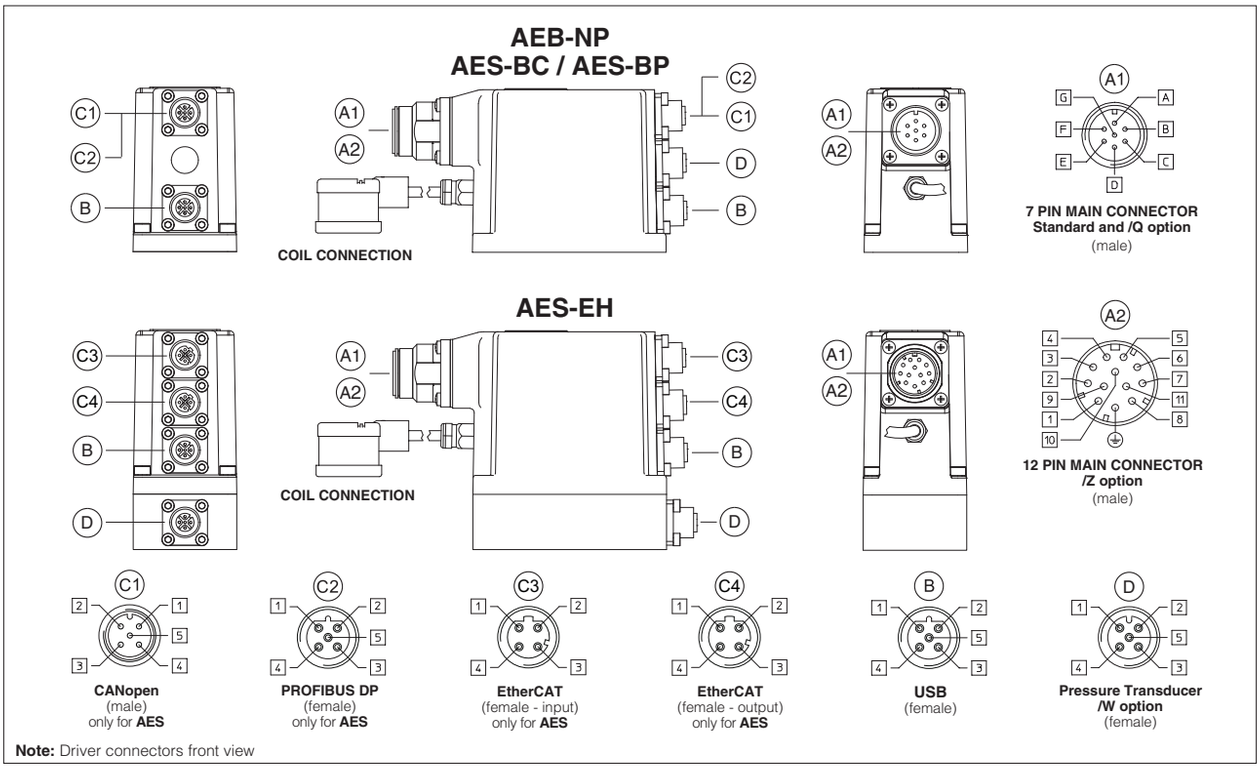
11.4 Pressure transducer connector - **M12 - 5 pin** - only for **/W** option (D)

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	/	/

11.5 Solenoid connection - only for **DPZO-A**

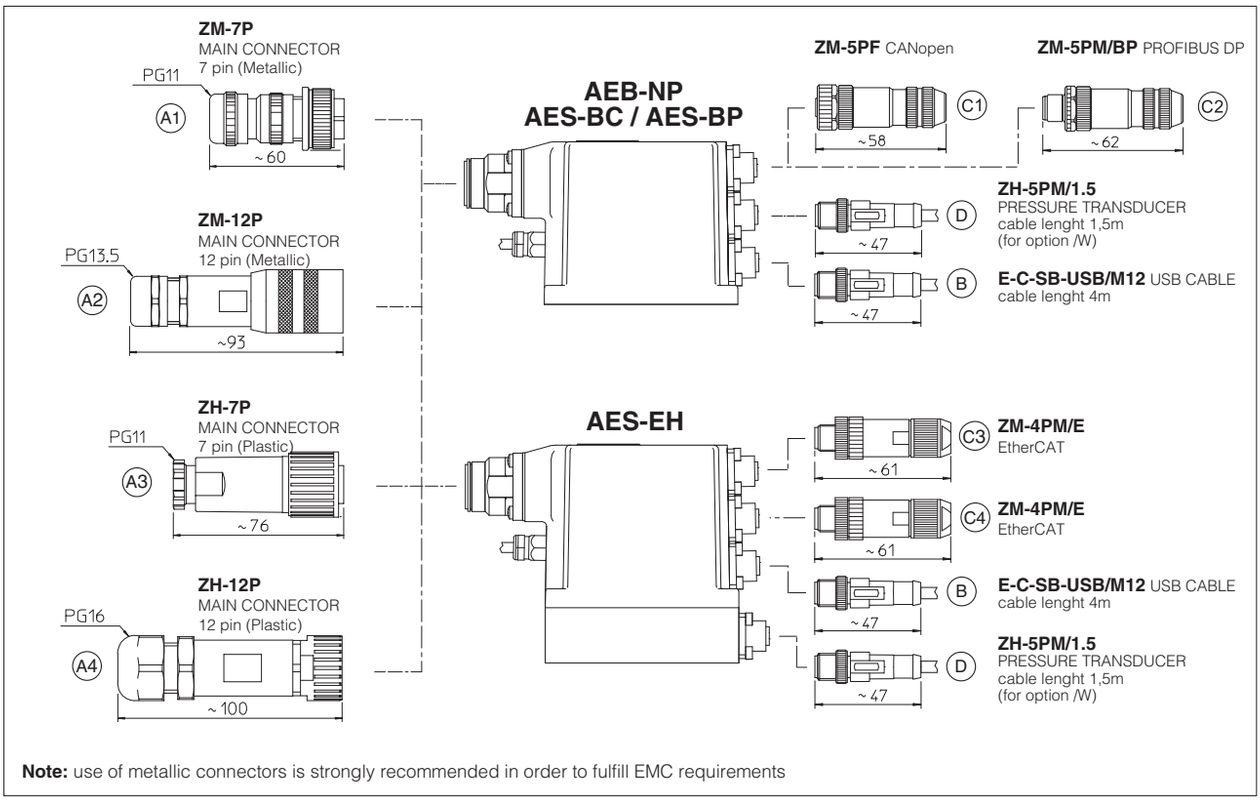
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

11.6 Connections layout - only for **AEB** and **AES**



Note: Driver connectors front view

12 CONNECTORS



Note: use of metallic connectors is strongly recommended in order to fulfill EMC requirements

13 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	A (1)	AEB, AES std and /Q	AEB, AES /Z and /W	AEB, AES /W	BC - CANopen	BP - PROFIBUS DP	EH - EtherCAT
CONNECTOR CODE	666	ZM-7P (A1)	ZM-12P (A2)	ZH-5PM/1.5 (D)	ZM-5PF (C1)	ZM-5PM/BP (C2)	ZM-4PM/E (C3)
		ZH-7P (A3)	ZH-12P (A4)				ZM-4PM/E (C4)
PROTECTION DEGREE	IP67	IP67					
DATA SHEET	K500	GS115, K500					

(1) Connector supplied with the valve

only for **AES**

14 PROGRAMMING TOOLS - see tech table **GS500**

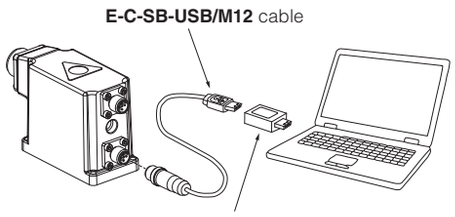
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver. For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options

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)	
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated!
The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

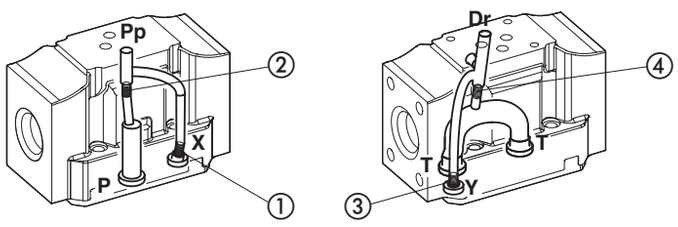
USB connection



15 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

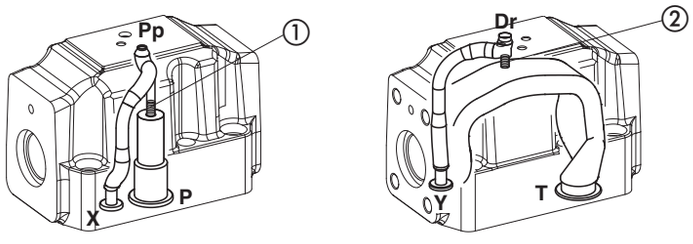
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZO-1 Pilot channels / Drain channels



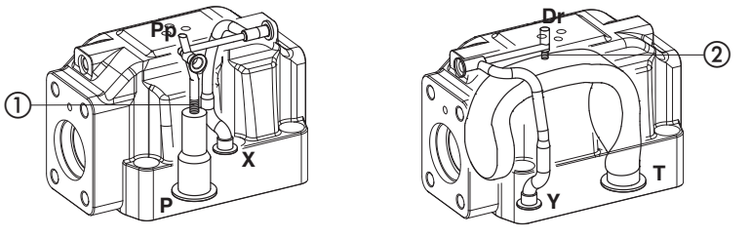
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels / Drain channels



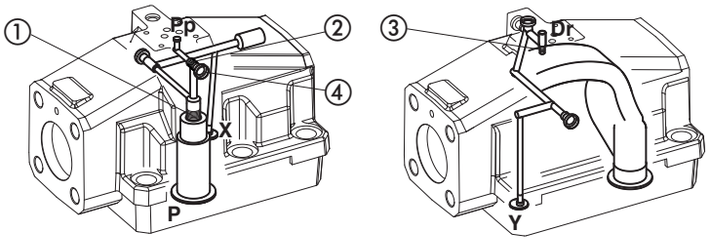
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

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"

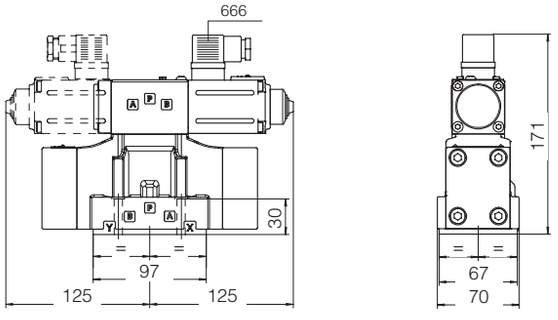
16 INSTALLATION DIMENSIONS FOR DPZO-1 [mm]

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
Seals: 5 OR 2050; 2 OR 108
Diameter of ports A, B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;

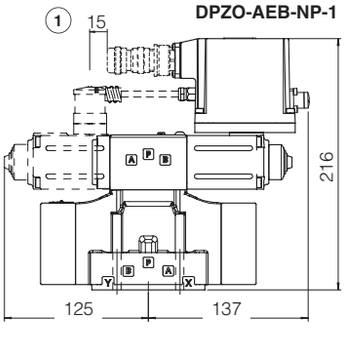
Mass [kg]

	A	AEB, AES	AES-EH
DPZO-*-15*	7,7	8,1	8,2
DPZO-*-17*	8,6	9	9,1
Option /G	+0,9		

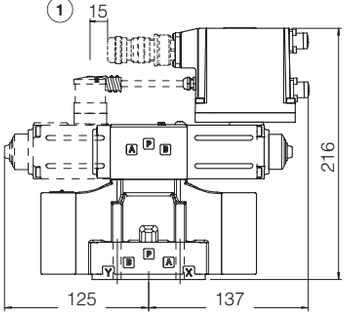
DPZO-A-1



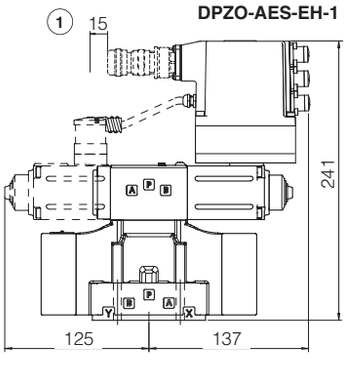
DPZO-AEB-NP-1



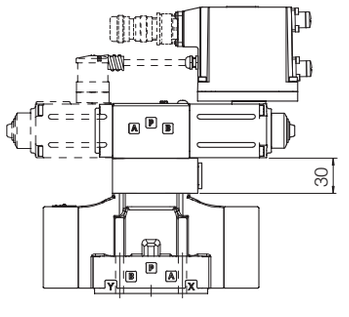
DPZO-AES-BC-1
DPZO-AES-BP-1



DPZO-AES-EH-1



option /G



Dotted line = double solenoid version

(1) = Space to remove the 7 or 12 pin main connector. For main and communication connector see section 12 , 13